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QuarryScapes Report
Risk Assessment and Monitoring of Ancient Egyptian Quarry Landscapes
Work Package 5, Deliverable No. 6

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Quarry Scapes

Conservation of Ancient Stone Quarry Landscapes in the Eastern Mediterranean

Risk Assessment and Monitoring of Ancient Egyptian Quarry Landscapes

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The QuarryScapes project

Conservation of Ancient Stone Quarry Landscapes in the Eastern Mediterranean

QuarryScapes is the first project of its kind for addressing the importance of ancient quarry landscapes and raising the awareness of the urgent needs for protecting such sites. QuarryScapes will develop scientific and practical methodologies for documentation, characterisation and conservation of ancient quarry landscapes, raise the awareness of their significance and vulnerability and contribute to legal protection measures and sustainable management. 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. The project is subdivided in ten work packages.

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Cover photo:
The Naq el-Fugani Nubian sandstone quarry (steep cliffs) on the West Bank of the Nile close to Aswan. Construction of New Aswan City is taking place in the foreground. In the background the new Aswan Bridge can be seen. The Ptolemaic-Roman quarry, which was on the verge of destruction by the new city, has recently been designated for protection by the Supreme Council of Antiquities (SCA) in cooperation with the New Aswan City Authorities. Photo: Per Storemyr 2005

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Although this report forms a coherent whole, upon preparation care has been taken so that each chapter can be read as a stand-alone contribution. Cross-references to other chapters are given when considered necessary. The contents of the contributions are the responsibility of the authors.

Per Storemyr, Elizabeth Bloxam and Tom Heldal
Zurich, London and Trondheim
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Abstract

Egypt's cultural heritage includes a large amount of ancient stone quarries ranging from the Palaeolithic to the Islamic period, with the most prodigious and numerous ones dating to Pharaonic and Graeco-Roman times (c. 3,000 BC – AD 395). From these, often extremely extensive quarry landscapes, covering up to dozens of square kilometres of land, stone was procured to an extent unrivalled in the ancient world. This unique heritage is at immense risk from damage and destruction by modern development projects, a situation that has given the impetus for the present work. Egypt is experiencing very rapid population growth and now desert areas bordering the Nile Valley have been put in use for relieving population pressure. Such areas are also used for increasing quarrying and mining, as well as agricultural development. These are regions where large proportions of ancient quarries are located.

By the use of a variety of tools ranging from in-depth case studies and field work, field checks, archive and literature research, interpretation of satellite images, topographic maps and development plans, and contact with authorities and developers, the work has analysed the condition and legal status of the known ancient quarries in the country and the threats facing them. Through reflections on the character of this heritage as related to conservation, the work has also aimed at proposing methods for monitoring and measures to mitigate risks.

The tentative analysis of 193 quarries of Pharaonic to Islamic date shows that 9% are entirely or largely destroyed, 20% are partially destroyed and 38% are largely intact, whereas 25% are still in good condition. The main reason for destruction is modern quarrying and mining, to which c. 40% have been subjected. About 11% have been or are influenced by urban and rural development, agricultural development accounting for 2%. However, the latter is a main risk for Prehistoric quarries (pre-3,000 BC). For 45% threat has not been specified, but the immediate risk of destruction is considered rather low. The main risk in the near future is clearly modern quarrying and mining, also in areas that have not previously been influenced by such activities. This is because the Egyptian quarrying and mining industry is developing fast. Also risks associated with the development of new cities and villages are increasing, especially in greater Cairo, Minya and Aswan. Natural hazards (rainstorms, flash flood) are a noteworthy factor in the Eastern Desert, whereas deep gallery quarries can be at risk from partial collapse.

Based on available official protection decrees, only 5% of the ancient quarries have a secured legal status as owned or supervised by the Supreme Council of Antiquities (SCA), but perhaps 50% may be known to regional SCA inspectorates. One quarry (the Unfinished Obelisk in Aswan) is part of a World Heritage Site (WHS) because of its value as an ancient production site, whereas a few are coincidentally part of other WHS. About 10% are coincidentally part of existing or proposed nature protectorates. Apparently, only three quarries are promoted to the public. Such quarries are probably the only receiving regular management. The figures presented can be regarded as a tentative baseline for nation-wide, long term monitoring. Refinement and update of figures can be done using the site records built in the QuarryScapes project, which are now the official ones in the Egyptian cultural heritage system. Detailed analysis of the development in four case study areas, going back to 1965 and looking ahead, has also been undertaken; the associated maps may serve as baselines for local monitoring.

In 2006 SCA recognised the regrettable situation for the country's ancient quarries by establishing a special department for their conservation. Located in Aswan, it will draw on assigned personnel in the regional SCA offices, these being responsible for their respective governorates. In addition to educating personnel, a crucial task for the new department is to

conduct rescue surveys in high-risk areas, attempting at constructive cooperation with developers and quarrying companies in order to stop, relocate or otherwise mitigate damaging activity in ancient quarries, a strategy that has been tried with success in Aswan.

However, given the current pace of development, there is a need to simultaneously work on several fronts in order to safeguard the ancient quarries, also those that are still in good condition. Although in theory the Antiquities Law (117/1983) restricts modern development in all areas with archaeological remains, *legal protection is clearly considered the best form of risk preparedness*, thus proposals are given in this report for a range of ancient quarries that should be considered protected as soon as possible. Three other central issues can be put forward for consideration for the cultural heritage sector:

- Cooperation with authorities in the sectors of quarrying/mining, urban development and agriculture/irrigation to place ancient quarries on land-use agendas. Ancient quarries cover large tracts of land and conservation often conflicts with other legitimate interests.
- Cooperation with environmental authorities in order to pool resources in monitoring and management of natural protectorates, in which many quarries are or will be located.
- Furthering of the planned centre for knowledge and education related to ancient quarries in the Unfinished Obelisk Quarry Museum in Aswan. This could become a "hub" supporting the protection and conservation of ancient quarry landscapes in general.

Most other types of cultural heritage enjoy vastly better protection than Egypt's spectacular ancient quarries – the foundation on which Pharaonic Egypt was built. QuarryScapes has contributed to placing such sites on the conservation agenda.

Contents at a glance

Chapter 1

Introduction

Per Storemyr, Elizabeth Bloxam and Tom Heldal

The flanks of almost the entire Nile Valley could be characterised as a continuous ancient quarry landscape (Figure 1). The same can be said about large parts of the Eastern Desert (Figure 2) and some regions of the Western Desert (Figure 3). From these ancient quarries stone tools, stone vessels, grinding stone, ornamental stone and building stone were procured to an extent unrivalled in the ancient world. If counting only those used for vessels, and ornamental and building stone, about 200 individual quarry areas dating from the Early Dynastic (early 3rd millennium BC) to the Islamic period are known, frequently showing multiple phases of exploitation. Sometimes covering 100 square kilometres or more of land, most remain legally unregistered as cultural heritage. This world-class heritage is at immense risk from modern development activities such as quarrying, mining, urban expansion, land reclamation for agriculture, as well as tourism with associated looting and vandalism (Storemyr & Heldal in press, Storemyr *et al*. in press).

Visualising where the quarries of Egypt are located, assessing their legal status, their current condition and the threats facing them, as well as reflecting on what can be done in terms of protection, conservation and monitoring, this report addresses the ancient quarry landscapes of the entire country. It also describes cases studies of select places to gain in-depth information about the character and significance of quarry landscapes and what has happened to these particular places over the last 40-50 years – a period in which Egypt has experienced massive population growth and unprecedented changes in land use affecting the cultural heritage at large. This report is written with Egyptian heritage authorities in mind. They are ultimately responsible for protection and conservation of the ancient quarries in the country. However, it is hoped that the report can be of value for a broader audience, ranging from international cultural heritage organisations to researchers and people with a general interest in ancient quarries.

Archaeological character and significance of ancient quarries

Some aspects of the significance of Egyptian quarry landscapes are obvious: they give unique insights into ancient technologies of stone working and transportation, and some represent markers in the history of development of craft techniques, as seen from a global perspective. At many places high quarry faces and immense spoil heaps have profoundly altered the landscape we see today and thus they form very visible historical landmarks. Many much less visible, but extremely extensive quarries, have also thoroughly modified the natural landscape

Figure 1: Limestone open-cut and gallery quarries in the hills by Qau el-Kebir in Middle Egypt. This is a fairly typical quarry landscape along the Nile (photo: James Harrell)

through thousands or tens of thousands of small pits and ditches (for the Egyptian context, see overviews of quarries and stone working technology in e.g. Lucas & Harris 1999 [1962]; Arnold 1991; De Putter & Karlshausen 1992; Klemm & Klemm 1993; Aston 1994; Aston *et al*. 2000; Stocks 2003; Goyon *et al*. 2004, and the many works of James Harrell[1]). Less obvious is their significance in terms of their social context: quarry landscapes not only feature primary extraction places and secondary work areas, but also structures ranging from fortified settlements to simple ephemeral shelters, transportation and access roads, ramps, causeways and harbours, and, not least, places of ritual and religious practice, along with ceramics and epigraphic data. Hence, quarry landscapes can offer fresh insights not only into social life but also trade and exchange networks in antiquity, an aspect often forgotten in terms of archaeological research in Egypt (e.g. Peacock 1992; Bloxam 2003, Bloxam & Heldal 2007).

Quarry landscapes often have aspects of significance and value far beyond those related to their ancient primary purpose. For example, today they may be landmarks imbued with special meanings for local populations (for the Eastern Desert, see Hobbs 2002). Some also have economic value as tourist destinations (e.g. the Unfinished Obelisk in Aswan). Moreover, when in operation millennia ago, they were sometimes key places of ceremonial and ritual practice, a feature of particular importance for prehistoric quarries (e.g. Bloxam 2007). As such they are as important as the grand Pharaonic temples littering the Nile Valley.

Of course, the ancient quarry landscapes of Egypt, as anywhere in the world, are part of much more extensive cultural landscapes (e.g. Heldal *et al*. in press; Bloxam & Heldal 2007, Bloxam 2007). The quarries may be spatially and temporally connected to the places the stone was used, such as settlements and towns, or temples and other places of worship (e.g. quarries at the Giza plateau); they may be elements of larger industrial landscapes featuring, for

[1] See overview at: www.eeescience.utoledo.edu/faculty/harrell/Egypt/AGRG_Home.html

Figure 2: Part of the quarry landscape at Mons Porphyrites in the mountainous Eastern Desert. The photos shows the Lycabettos quarries and the slipway down towards the central settlement (photo: Per Storemyr 2002)

example, ancient mines (e.g. many places in the Eastern Desert); or they may belong to long-lived landscapes of subsistence-related activities, such as hunting, gathering and pastoralism (e.g. Bloxam *et al*. 2007, Bloxam 2007)

A vulnerable World Heritage

Although cultural heritage globally is at high risk from modern development activities,[2] through the QuarryScapes work it has become clear that ancient production sites, such as quarries, are some of the most vulnerable elements of cultural landscapes. Although many are recorded and described in scientific works, unlike monumental architecture and settlements, they are rarely officially listed, seldom shown on maps and they usually lack basic management, as this report will show. Hence, they are practically non-existent from the modern developer's perspective, a status which is reinforced by the often limited knowledge of their location and significance among heritage managers, except in cases where their size and monumentality cannot be overlooked (such as in the case of the Unfinished Obelisk Quarry in Aswan).

Due to the nature of development in Egypt, the threats facing these vulnerable ancient quarry landscapes have dramatically increased over the last few decades. Whereas habitation, agriculture and industry were usually confined to the Nile Valley, since the 1970s this started to include more remote desert areas. Such expansion into adjacent desert regions is essentially

[2] For the Eastern Mediterranean, see e.g. Palumbo & Teutonico (2002); for Egypt, see overviews at the website of the Egyptian Cultural Heritage Organisation (www.e-c-h-o.org/background.htm) and in the management report for the Valley of the Kings in Luxor by Weeks *et al*. (2006). See also Amin (2002)

Figure 3: Chephren's Quarry with extraction area and loading ramp in the southern Western Desert. Pristine land until a decade ago, it is now severely threatened by the Toshka mega-scale land reclamation project (photo: Per Storemyr 2007)

to relieve population pressure,[3] reclaim new land (e.g. Meyer 1998) and procure stone, minerals and ores for buildings, infrastructure and industrial purposes (e.g. Ciccu *et al*. 2005; Kandil & Selim undated). Many such areas are precisely the ones in which ancient quarries are located (e.g. Storemyr & Heldal in press; Storemyr *et al*. in press). Formerly being victims of occasional looting, vandalism and small-scale artisan quarrying, the key threats are now rather related to bulldozers and dynamite.

Given the massive use of stone for multiple purposes in Ancient Egypt, and also that the country features the first true architectural stone buildings, it comes as no surprise that many of its quarry landscapes would qualify for inclusion on the World Heritage List in terms of criteria such as "outstanding universal value" "authenticity" and "integrity" (Storemyr *et al*. 2003; Bloxam & Heldal 2007; Bloxam 2007). However, as will be shown in this report, there is one vital set of criteria that practically none of the quarries fulfils; namely those criteria related to "legal protection", "boundaries", "buffer zones" and "management systems".[4] These are central issues for the Egyptian cultural heritage at large, whether the sites qualify as World Heritage or are significant in a national, regional or local context. Such issues are being increasingly addressed by the SCA (Supreme Council of Antiquities), not least through EAIS (Egyptian Antiquities Information System)[5], both of which are partners in the QuarryScapes project. This report addresses these and related issues in several chapters.

[3] The expansion of Cairo into the adjacent deserts is one example, but throughout Egypt many new cities and villages are being built adjacent to the Nile Valley; see e.g. the website of the "New Urban Communities Authorities" (http://www.urban-comm.gov.eg/english/index.asp)

[4] See the "Operational Guidelines for the Implementation of the World Heritage Convention", http://whc.unesco.org/archive/opguide05-en.pdf

[5] http://eais.org.eg. See also Amin (2002). A particular useful example of site management in Egypt can be found in Weeks *et al.* 2006

Figure 4: The Wadi el-Garawi ancient travertine (Egyptian alabaster) quarries in the Eastern Desert close to Cairo. Ancient workings can be seen along the vein on the picture (photo: James Harrell)

Objectives and contents of this report

As worked out in the project description of QuarryScapes, the main objectives in Work Package (WP) 5 "Egypt Risk and Monitoring" are to develop practical tools for (1) analysis of human threats, natural hazards and weathering applicable to ancient quarry landscapes; and (2) long-term systematic monitoring based development of indicators, and through field checks and satellite imagery. However, in the course of the QuarryScapes project, there has been a fortunate turn of events in that risk assessment and monitoring, applicable to ancient quarries of Egypt, have recently been placed within the country's official legal-administrative cultural heritage framework. This outcome, as described below, has made it necessary to modify these objectives. The modified objectives are:

- Establishment of a tentative, nation-wide overview of the current status of ancient quarries. This includes legal aspects, condition and overall assessment of threat (Chapters 2 and 5)
- Discussion of ancient quarries as seen from a landscape perspective, which is highly relevant for assessment of risks and protection measures (Chapter 3)
- Overview and in-depth analyses of human threats and natural hazards (Chapters 4, 5, 6, 7 and 8)
- Reflections on monitoring and protection measures, including rescue surveys in high-risk areas, as well as proposals for monitoring tools (Chapter 9)

The background for the modification of the objectives is first that EAIS, providing the official record with details of the entire Egyptian cultural heritage for SCA, has agreed to incorporate all known ancient quarries of the country in their comprehensive databases and GIS

(Geographical Information System). This work, undertaken in Work Package (WP) 7 of QuarryScapes, is based on existing scientific records of the quarries. It is a massive task, which will continue after QuarryScapes. It has partially been undertaken in cooperation with WP5. Although comprehensive results cannot be expected yet, the databases and GIS are planned to become the key official/administrative tool for the status, monitoring, protection and conservation of the country's heritage, to be used by heritage managers, developers and researchers.[6] However, the work on inclusion of the quarries in the EAIS-system has enabled us to work out a *tentative* overview of the current status (legal, condition, threats etc.) of the ancient quarries in the entire country. This overview will be presented in this report (Chapters 2 and 5). Moreover, since the EAIS databases and GIS represent the official Egyptian monitoring tools (on a national level), less weight will be placed on the development of such tools in this report. However, Chapter 9 includes basic guidelines for selection of indicators for long-term monitoring.

Second, in the course of the QuarryScapes project, SCA has established a new department for conservation of ancient quarries and mines. Still in its establishment phase, this department will incorporate officially assigned persons from each regional SCA-office who will be responsible for survey, monitoring, protection and conservation of the ancient quarries and mines in their respective governorates. Moreover, education of appointed personnel, as well as working out forms for detailed inspection and monitoring of quarry sites forms part of these initial phases of development. This implies that such work will be undertaken by people with a knowledge of the local circumstances and thus it should be largely up to them to find efficient forms of tackling the daily work (field checks etc.). An account of the department's and related work, especially as related to rescue surveys in high-risk areas and ongoing protection work, is presented in Chapter 9 of this report.

The case study areas that were selected for work on risk assessment and monitoring include Chephren's Quarry (Southern Western Desert), Aswan (especially the West Bank) and Widan el-Faras (Northern Faiyum).[7] For these areas, especially the West Bank of Aswan, a multitude of data has been collected, relating to both archaeology and modern development over the last 40-50 years. This means that we can now visualise the development that has destroyed or otherwise influenced parts of the quarries as key to assessing the risks facing these areas today and in the future. Such "retrospective monitoring" is presented in Chapter 4. Importantly, this methodology can be transportable to other quarry areas in Egypt.

As mentioned above, ancient quarries may cover extensive areas with a range of material culture, often with multiple layers of significance. As seen from various landscape perspectives and according to the general aims of QuarryScapes, the case study areas have also been used to discuss and formulate the implications of these aspects, in terms of protection and conservation. Obvious practical implications include the setting of borders and buffer zones in an extended quarry landscape that is not only the sum of its extraction sites alone. A discussion of such perspectives and issues surrounding the conceptualisation of quarry landscapes is attempted in Chapter 3. As a prerequisite for any type of protection and conservation, the legal cultural heritage system influencing the protection of ancient quarries in Egypt are briefly presented in Chapter 2.

[6] See http://eais.org.eg and Amin (2002)

[7] Sagalassos in Turkey (WP3) was also considered for inclusion in this work. However, the results of the risk assessment in this case study is presented the main report from the study (due in autumn 2007). Instead, another Egyptian quarry, Gebel Ahmar in Cairo, is included as a case study

It is out of the scope of this report to cover the many laws that govern land-use and large-scale development in Egypt and also the socio-political forces behind the current development of, for example, desert areas in the country. Hence, we can only refer to some of the actual projects and programmes that have destroyed or are impacting on ancient quarry areas, primarily in the case study areas (Chapter 4). However, since modern quarrying and mining is a special type of risk, particularly relevant for ancient quarries, it will be discussed in more detail in Chapter 6, also from a legal and international market perspective. Some aspects of modern quarrying and mining, which represent a major risk in the Aswan area, will, moreover, be described in Chapter 9.

Ancient quarries have been looted, vandalised and re-used since the time of the Pharaohs.[8] Contrary to modern development projects, some of these activities have not eradicated the quarries, but have transformed them adding other layers of significance, in particular those that have been re-used for tombs and monasteries. Such transformations from looting and re-use in antiquity into the modern era of desert tourists, will be reviewed in Chapter 7.

Ancient Egyptian quarries have not only been influenced by human transformations, but also by natural hazards, weathering and erosion. Especially rainstorms and flash-flood have had a severe impact on ancient quarry infrastructure, such as settlements, in the mountainous Eastern Desert. These and other relevant actions of weather and climate will be discussed in Chapter 8.

Chapter 9 reflects on monitoring and protection measures, including rescue surveys in high-risk areas, as well as proposals for monitoring tools. Examples from recent work in Aswan are presented.

Limitations

It would have been natural and highly relevant to include other types of ancient production sites, such as mines, in this report. They suffer very much the same fate as the ancient quarries of Egypt. Some gemstone mining sites are included in the discussions, such as emerald and turquoise mines in the Eastern Desert and Sinai, respectively, but it has not been possible to include the enormous amounts of mining sites for gold and other metals. It has neither been possible to incorporate often extremely extensive ancient mining areas for minerals such as ochre and various types of salt (e.g. halite, trona and alum) (see overviews in e.g. Lucas & Harris 1999 [1962]; Nicholson & Shaw 2000; Klemm *et al*. 2001). Due to the lack of data, it has also been difficult to take account of prehistoric tool quarries (and mines), but some of the few preserved and many of those destroyed are mentioned.

Terminology

This report addresses central issues within *cultural heritage management* (CHM)[9], which some prefer to call *cultural resources management* (CRH). Whatever term is preferred, it is hard to define (e.g. McManamon & Hatton 2000). One possible definition would be "professional or traditional, targeted and coordinated actions taken to preserve and promote

[8] cf. Fagan 2004 on looting of ancient Egyptian sites in general; and Klemm & Klemm 1993 on examples of re-use

[9] Terms preferred in this report are written in italics and underlined.

cultural heritage". Such actions include dealing with the risks affecting cultural heritage, as well as monitoring its condition or what otherwise happen to it. Since these are the key issues being dealt with they need to be more thoroughly elucidated.

The following thesaurus might be helpful in understanding the differences between key concepts related to risk, and how they are used in this report:[10]

- *Vulnerability* is the susceptibility to physical harm. The susceptibility may be related to:
  - visibility (ancient quarries are often not easily visible for non-experts);
  - physical condition (heavily deteriorated quarry faces and quarry infrastructure are more susceptible than their well-preserved counterparts);
  - knowledge/awareness (in a given area, well-known quarries are less likely to be destroyed than virtually unknown ones)
  - legal status (a listed quarry will usually be less vulnerable to damage than a quarry that is not legally protected).
- *Hazard* is a situation which could cause harm (deterioration, decay, destruction) or that poses a level of threat. For ancient quarries a typical *natural hazard* is flash flood; a typical *man-made hazard* is modern mining. One may differentiate between potential hazards (those that in the future may become active) and active hazards (those that are currently destroying or otherwise affecting the quarries).
- *Threat* is often used as a synonym to hazard, especially those caused by man (*man-made threat*).
- *Risk* is the probability that a certain kind of harm is realised; e.g. the probability that flash flood or modern mining will destroy ancient quarry infrastructure. This is also dependent on the vulnerability of the features in question. The risk is typically expressed as high, medium or low, or as a function of time (within 1 year, 5 years etc.). Sometimes it may be very difficult to make such assessments or prognoses. For example, detailed knowledge of official or less official land-use plans is needed for sound evaluation. The effects of natural hazards may be easier to evaluate than man-made threats (man is not particularly predictable!). Risk is sometimes used as a synonym to hazard and threat, but in this report an attempt has been made to avoid this.
- *Risk assessment* or *risk analysis* is the activity of determining vulnerability, identifying hazards (or threats) and assessing the probability of different forms of harm.
- *Risk management* is the professional, targeted and coordinated decision making process following on from risk assessment, undertaken in order to prevent or mitigate risk. This is essentially the same as preventive, sometimes also called "indirect conservation" (as opposed to "direct conservation", which primarily deals with repairing damage or strengthening the object to make it more robust to further damage).

Concepts and definitions of monitoring vary widely according to geographical level, type of cultural heritage and purpose (e.g. Storemyr *et al*. 2004; Ward 1995). A very general definition, which will be elaborated further in Chapter 10, might be as follows:

> Monitoring is the regular recording, evaluation and reporting of cultural heritage. This is done in order to assess its changing condition and identify the threats and hazards that have led to this condition (*reactive* or *systematic monitoring*). It is also done in order to gain an understanding of the nature of potential and active threats and hazards for the purpose of risk assessment and risk management (*proactive* or diagnostic monitoring).

[10] Reworked from Ball & Watt (2001), Storemyr *et al*. (2004) and Wikipedia (http://en.wikipedia.org/wiki/Hazard; http://en.wikipedia.org/wiki/Vulnerability)

The relationship between risk and proactive monitoring may be further elucidated by inferring that risk assessment implies making prognoses or hypotheses: in order to verify or falsify the hypotheses there is a need for monitoring of the development. If the monitoring can confirm the hypotheses, then things are fine (or bad!), if not, there is a need for re-assessment.

Terminology related to ancient quarries and their archaeology has been presented in another QuarryScapes report (Bloxam *et al*. 2007: 6f). Here we will briefly review some of the key terms:

- *The difference between quarry and mine:* A *quarry* is used for extraction and production of rock where the whole rock is valuable and not just the components within it. This includes blocks for purposes such as building stone, statues and stone tools. A *mine* is a production site for specific minerals that need to be extracted from the rock, including metallic ore, industrial minerals, flint and gemstone. In this report, however, flint mine and flint quarry are both used.
- A *quarry* is a stone production unit, limited and connected in space (but not necessarily in time), or a group of overlapping or closely spaced units, which cannot be separated. A *quarry* consists of e.g. extraction places (where the stone has been removed from an outcrop, bedrock or boulder), work areas (where secondary production took place), spoil heaps (debitage from quarrying) and other features directly related to the stone production.
- A *quarry area* is a limited geographic area containing a group of *quarries*, connected either through their geographical location or other aspects, such as chronology.
- A *quarry site* is often used in the same meaning as *quarry area*, but, depending on context, it may also be used for a *quarry* or a *quarry landscape*.
- *Quarry landscape:* ambiguity still surrounds this term, but for the purposes of this report this may be defined as a cultural landscape shaped by stone quarrying, consisting of groups of quarries/quarry areas, but also associated infrastructure and other elements of material culture, e.g. related to the exploitation of natural resources. These remains are culturally bounded and extending over a large area.

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Chapter 2

Location and tentative legal status of ancient Egyptian quarries

Per Storemyr, James Harrell, Rawda Yousri and El Shaimaa Fathy

Introduction

This chapter gives an overview of the location of known ancient quarries in Egypt, as well as a tentative assessment of their legal status. The most complete record of locational information and general characteristics of quarries have been assembled by James Harrell on the basis of field trips under the auspices of EMRA (formerly EGSMA)[11] and literature research since 1989.[12] This record includes quarries for ornamental stone, building stone, gemstone and utilitarian stone of Early Dynastic (early 3rd millennium BC) to Islamic date. It currently counts more than 190 individual quarries, most of which can be described as large quarry areas. More than 140 of these quarries have been visited by Harrell. Supplemented with literature on the location of other quarries, Harrell's record forms the basis for this chapter, which also gives a very brief review of prehistoric quarries (pre c. 3000 BC), mainly used for tools.

In order to extract relevant information from Harrell's record and enable visualisation of the quarry distribution (Figure 5), the summary has been converted into a Microsoft Access database (see extract in Appendix 1), which is coupled with ESRI ArcGIS software. In the database the centre coordinates of each quarry or quarry area, as well as information such as stone type and age – and also condition, man-made threats and risks are incorporated, where possible. Moreover, for each quarry there is a link to its position in Google Earth. Since the whole of the Egyptian Nile Valley and substantial parts of the adjacent deserts are covered by high-resolution satellite images in Google Earth,[13] this has been a essential tool for both correction/modification of centre coordinates and rough assessment of condition and threats (see chapter 5). The legal status of the ancient quarries is a work-in-progress by EAIS, in WP7 of QuarryScapes. Since Egypt does not yet have a comprehensive digital national register of cultural heritage sites, here we can only present a tentative overview. As will be described below, in addition to occasionally being officially registered by the SCA, quite a few quarries, whether registered with SCA or not, are situated within protected areas, such as other archaeological sites protected or supervised by SCA, World Heritage Sites and nature protectorates.

[11] Egyptian Mineral Resources Authority and Egyptian Geological Survey and Mining Authority, respectively
[12] Summary can be found in Aston *et al*. (2000) and at www.eeescience.utoledo.edu/faculty/harrell/Egypt/AGRG_Home.html. See also a wealth of references in these works to studies of individual quarries and quarry areas.
[13] QuickBird, 0.6 m resolution, generally shot between 2002 and 2006. See http://earth.google.com

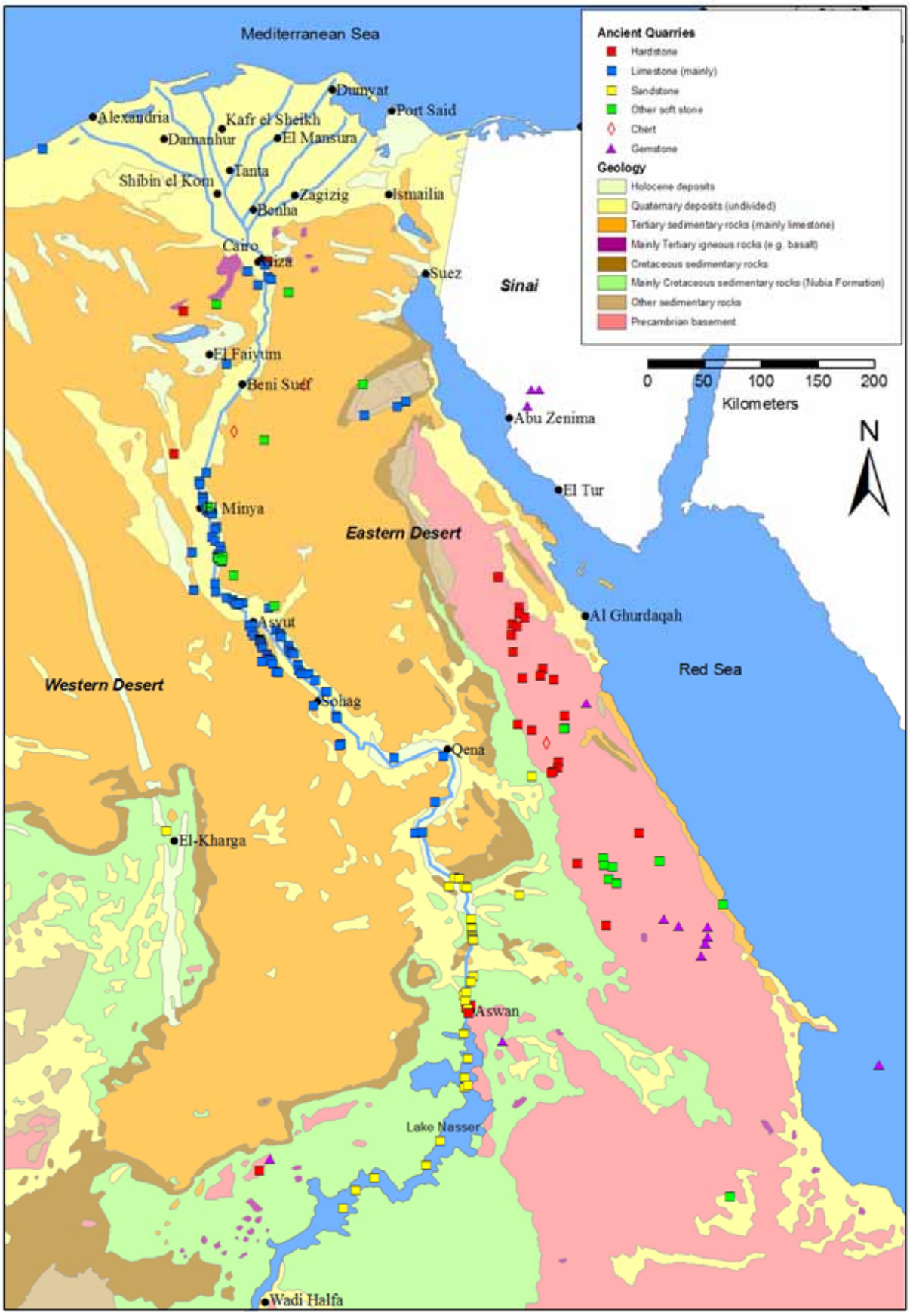

Figure 5: Overview of ancient Egyptian quarries from the record of James Harrell (see description in text). Simplified geological background map provided from the ACACIA-project (ESRI GIS shapefiles downloaded from www.uni-koeln.de/sfb389/e/e1/index.htm). Note that the geological boundaries are approximate. Map by QuarryScapes/Per Storemyr

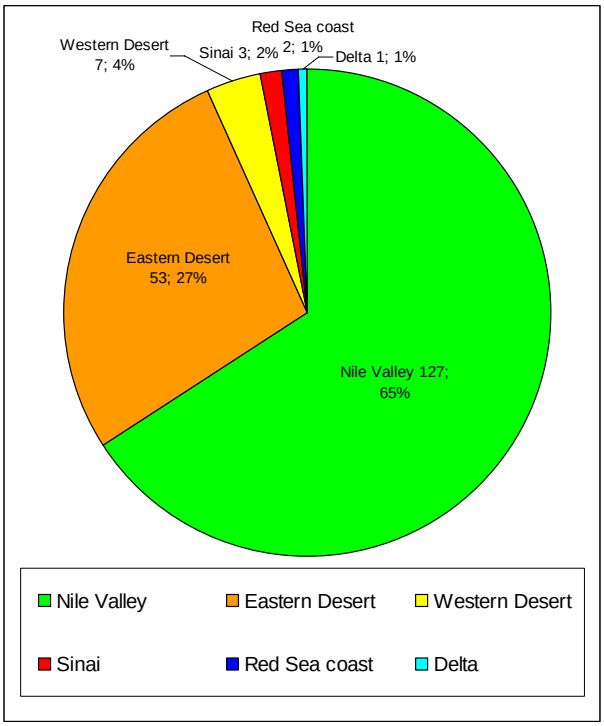

Figure 6: Regional distribution of quarries in Harrell's record (see text for explanation)

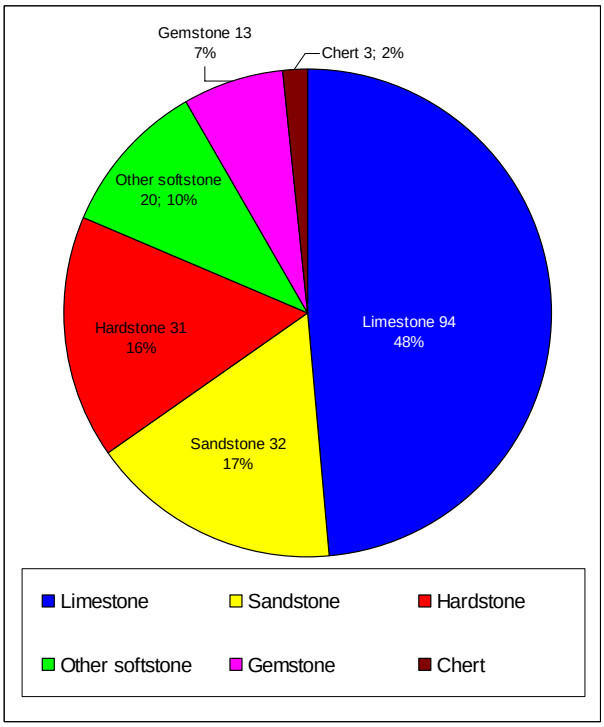

Figure 7: Groups of stone quarried (from Harrell's record; see text for explanation)

Brief overview of Pharaonic and later quarries

The work of James Harrell (see above) is the most complete, but not the only overview of ancient quarries in Egypt. Klemm & Klemm (1993) also provide a very extensive outline of the ancient quarries in the country, describing their geology, petrography, age and use, as well extraction technology and quarry infrastructure. This review vitally supplements Harrell's record. It concentrates on Pharaonic quarries, but mention is made of many Islamic and early modern limestone quarries used for building the cities of Egypt. Other, more limited overviews can be found, for example, in Lucas & Harris (1999) [1962]; Arnold (1991); De Putter & Karlshausen (1992); Aston (1994) and Goyon *et al*. (2004). All these works draw on a rich collection of individual studies of quarries and stone in Egypt, going back to some of the first investigations by the expedition of Napoleon's *savants* around 1800.

A common feature of most of these reviews is that fieldwork has been undertaken in the form of rather brief visits and short-term surveys. Very few long-term, extensive and intensive surveys and excavations of continuous quarry landscapes have been undertaken – and even fewer studies that consider aspects of the quarries and quarry areas other than those related to the primary purpose of the sites: extraction and use of stone (but see e.g. Peacock & Maxfield 1997 and Maxfield & Peacock 2001, as well as Chapter 3 of this report). Although maps are available for many quarry areas, this implies that the existing records for the whole country typically consider single quarries and quarry areas, but not quarry landscapes (cf. Chapter 3).

We know that there are many more ancient quarries than those mentioned in the records and reviews above. For example, in the Northern Faiyum two ornamental stone quarries are

described in the literature (Widan el-Faras and Umm es-Sawan), whereas recent QuarryScapes survey has shown that there are perhaps as many as ten additional quarries, mostly rather small and for utilitarian uses (grinding stone and tools). Not mentioned in the above reviews are also the extremely extensive grinding stone quarries and several ornamental and building stone quarries at the West Bank of Aswan, also surveyed by QuarryScapes recently (see Chapters 3 and 4).

In the following a very brief outline of the quarries is provided, as seen from a geological and topographical perspective. The outline has been modified from "Stone in Ancient Egypt" by James Harrell.[14] Figure 5, Figure 6 and Figure 7 show overviews of the quarries in terms of regional distribution and groups of stone extracted. See also Appendix 1 for an overview.

Sedimentary rocks

The sedimentary stones used in Ancient Egypt include the following:

Softstone:
- Limestone (from biogenic marine sediments)
- Sandstone (from continental sediments and, in part, shallow nearshore marine sediments)
- Travertine (also called Egyptian Alabaster; from secondary mineralization of limestone)
- Rock gypsum (also called alabaster) and rock anhydrite (both from evaporative marine sediments)

Hardstone:
- Silicified (quartz-cemented) sandstone (also called quartzite)

Chert:
- Derived from secondary mineralization of limestone

Nearly all the ancient quarries for limestone, travertine and chert are located in the hills and cliffs bordering the Nile River valley between Cairo in the north and Isna in the south. Quarries in the Nile Valley from Isna southward into northern Sudan supplied the sandstone ("Nubian sandstone"). Silicified sandstone mainly came from two areas – at the West Bank of Aswan and Gebel Ahmar in Cairo. Rock gypsum and rock anhydrite were obtained from Egypt's Red Sea coast, but the most famous gypsum quarries are located in the Northern Faiyum (Umm es-Sawan).

Partially excluding silicified sandstone, all these are bedrock quarries (as opposed to quarrying of e.g. boulders). Whereas a quarry like Umm es-Sawan contains shallow pits hardly visible to the untrained eye, a large proportion of the limestone and sandstone quarries are huge, with high quarry faces, deep underground galleries and massive spoil heaps (Figure 8). Travertine quarries may come as diggings along extensive veins, but also as underground workings, whereas chert quarries (for tools) are normally characterised as extensive areas of small pits (e.g. Wadi el-Sheikh, Figure 9).

[14] Published at: www.eeescience.utoledo.edu/Faculty/Harrell/Egypt/Stone%20Use/Harrell_Stones_text.htm. This review also gives an outline of the use of stone in ancient Egypt.

Figure 8: The largest individual quarry at Gebel el-Silsila is left as a deep scar in the landscape. Compare with Figure 9. Satellite image from Google Earth (scale bar: 156 m).

Figure 9: As compared to the large quarry in Figure 8, the chert mines in Wadi el-Sheikh come as thousands of small pits, here on a plateau bordering the wadi. Satellite image from Google Earth (scale bar: 157 m).

Igneous rocks

The igneous rocks used in Ancient Egypt are all characterised as hardstone and include the following:

- Granite, granodiorite, quartz diorite, diorite, and pyroxenite (plutonic intrusives)
- Andesite and dolerite porphyries as well as other porphyritic rocks (volcanic dikes and lava flows)
- Basalt (lava flows)
- Tuff and related rocks (volcanic pyroclastics; may be characterised as *semi-hardstone*)

Apart from the famous granite and granodiorite quarried at Aswan, the igneous rocks came from the Faiyum (basalt) and the mountains of the Eastern Desert. They were mainly used for ornamental purposes. The early quarrying in Aswan (especially Old Kingdom) focused on quarrying of smaller and larger boulders, but nearly all the rest of the quarries provided stone from bedrock. None of them are as large as the most extensive limestone and sandstone quarries (c.f. Figure 10), but they often show a large amount of individual workings and a prolific quarry infrastructure, thus forming extensive quarry landscapes, e.g. Mons Porphyrites and environs in the Eastern Desert. Most of the quarries in the Eastern Desert are Roman, but there are some exceptions, e.g. Gebel Manzal el-Seyl and Gebel Umm Naqqat, which were used for stone vessels in the Early Dynastic and Predynastic periods, respectively.

Figure 10: Not all quarries are extensive. This is the small Rod el-Gamra quarry in the Eastern Desert. It is a compact quarry, showing both an extraction (red) and a small habitation (blue) area. Satellite image from Google Earth (scale bar: 72 m).

Metamorphic rocks

Metamorphic rocks include both hardstone and softstone:

Hardstone:
- Anorthosite gneiss and tonalite gneiss, metagabbro and serpentinite (derived from igneous rocks)
- Metaconglomerate and metagraywacke (derived from sedimentary rocks),

Softstone:
- Marble
- Soapstone (or steatite)

The anorthosite gneiss (or "Chephren gneiss") comes from the Nubian Desert west of Lake Nasser (the 100 square kilometre large Chephren's Quarry from mainly the Old Kingdom), but all the other rocks were quarried in the mountains of the Eastern Desert. Whereas in Chephren's Quarry boulders were used as the raw material resource, all the other stones were quarried from bedrock. Most of the quarries have the same characteristics as those in igneous rocks, with one notable exception: The soapstone quarries, particularly in use in the Islamic period, are spread mainly over a 400 square kilometre large area in the central Eastern Desert, in the form of thousands of small extraction sites in hillsides.

Figure 11: The main settlement in the Wadi Sikait emerald mining area. Satellite image from Google Earth (scale bar: 108 m).

Gemstone

The other stones employed by the ancient Egyptians are minerals found mostly within the plutonic and metamorphic rocks. These are the gemstones used for jewellery and include:

- Amazonite, a variety of microcline feldspar
- Emerald, a variety of beryl
- Garnet
- Peridot, a variety of olivine
- Numerous varieties of quartz (agate, amethyst, carnelian and other coloured chalcedonies, jasper, milky quartz, and rock crystal)
- Turquoise

These minerals were quarried in the Sinai (turquoise), St. John's Island in the Red Sea (peridot), the Nubian Desert west of Lake Nasser (Stele Ridge; agate, carnelian and other chalcedonies); and the mountains of the Eastern Desert (all the rest). Many of the mining sites are extensive, with prolific ancient infrastructure (e.g. Sikait, see Figure 11).

Prehistoric quarries

There are numerous prehistoric quarries used for tools throughout Egypt, some of which where also employed in the Predynastic and Pharaonic period, e.g. the extensive Wadi el-Sheikh flint quarries (Seton Carr 1898; Weisgerber 1987) and "Flint City" by Hierakonpolis (Friedman & Youngblood 1999). Moreover, there are quarries for grinding stone and stone vessels. The records of prehistoric quarries are fragmentary and to our knowledge no review exists.

Some of the earliest tool quarries, of Acheulean and early Middle Palaeolithic date, are those in silicified and ferruginous sandstone in the Second Cataract region (Marks 1968a; 1968b; Guichard & Guichard 1968). However, these appear all to be under Lake Nasser now. There are also documented early quarries in silicified sandstone, probably preserved until today, in the Western Desert oases, e.g. Dunqul (Hester & Hobler 1969: 21f), and recently similar quarries have been found by the QuarryScapes team at the West Bank of Aswan (Heldal & Storemyr 2007; see also chapter 3).

Otherwise, the surveyed and/or excavated quarries are for chert (or flint) exploitation and are mainly found in the Nile Valley. The "Belgian Middle Egypt Prehistoric Project" has documented the following mainly Middle and Late Palaeolithic quarry sites (Vermeersch 1990, Veermeersch 2002, Veermeersch et al. 2005), all on the West Bank of the Nile (Figure 12):

- Nazlet Khater by Thata, 50 km south of Asiyut
- Beit Allam between Sohag and Nag Hammadi
- Nazlet Safaha between Nag Hammadi and Qena
- Taramsa and Tiwayrat close to Qena

Neolithic flint/chert extraction sites are known from Kharga (Refuf Pass; Caton-Thompson 1952: 187f) and some of the small sites in the Northern Faiyum might perhaps also be dated

to this period (Caton-Thompson & Gardner 1934).[15] In addition to extraction sites, some intensive collection sites for flint pebbles on the ground are also known, for example at the Faiyum-Nile Valley divide (Sandford & Arkell 1929).

Several Early Dynastic quarries for vessel procurement are known (e.g. Chephren's Quarry, Umm es-Sawan and Gebel Manzal el-Seyl), but of their Predynastic counterparts only two sites have been positively identified (Chephren's Quarry and Gebel Umm Naqqat in the Eastern Desert; for the latter, see Harrell 2004). Other Pharaonic and later quarrying sites might have their origin in the extensive Predynastic vessel procurement, but traces of production are thus far lacking (cf. Aston 1994).

Prehistoric grinding stone quarries are as of yet only known from the Aswan West Bank (Roubet 1989; Heldal *et al*. 2005; Bloxam & Storemyr 2005; Heldal & Storemyr 2007). However, it is highly probably that, as with tool quarries, there are many more scattered along the flanks of the Nile Valley and adjacent deserts.

Figure 12: Middle/Late Palaeolitic flint quarrying sites in the Nile Valley (circles) projected on satellite image from Google Earth (scale bar: 44 km). See text for references.

[15] Several small flint quarries in the Northern Faiyum have been revisited or discovered in the QuarryScapes project, but the findings have not yet been published.

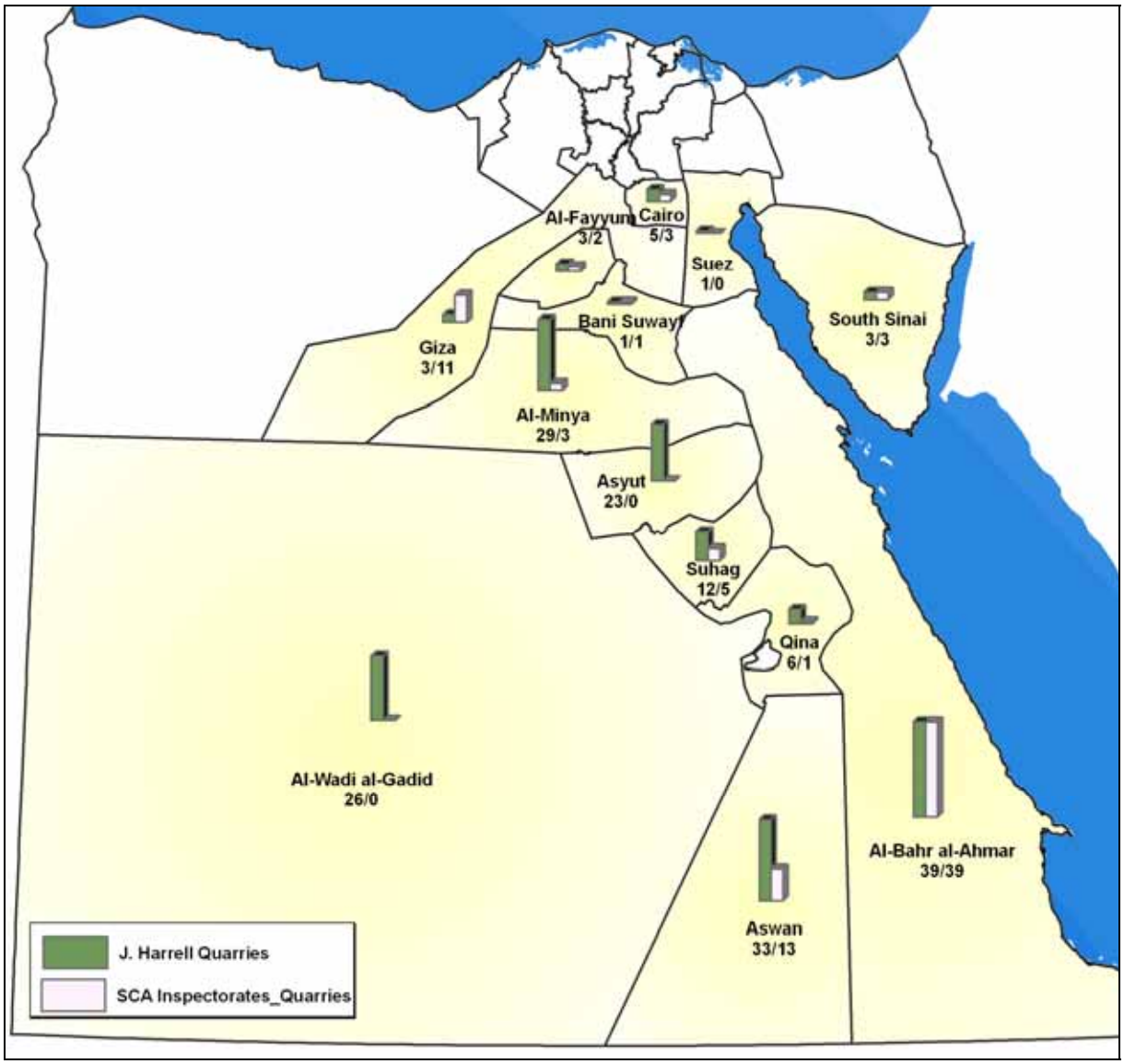

Figure 13: Map of governorates in Egypt. The bars show the number of quarries recorded by James Harrell (green) and those *known* by the respective SCA inspectorates (white). Note that the white bars also include quarries that are protected (owned or supervised) by SCA. Map by EAIS/Rawda Yousri/ElShaimaa Fathy

Tentative legal status of ancient Egyptian quarries

Research on the legal status of ancient Egyptian quarries is carried out by EAIS, taking Harrell's record described above as a point of departure. It is a difficult work, especially since, in practice, knowledge of the location and legal status of ancient quarries appears to be mainly with the regional SCA offices or inspectorates in each of Egypt's 27 governorates.[16] To date, EAIS has approached 13 governorates that have known ancient quarries within their borders. The result of these inquiries can be seen in Figure 13 In order to make use of the available information in this report, it has been provisionally incorporated into the Access database mentioned in the introduction to this chapter, but the aim is to link this database with the EAIS central database and GIS-system in order to ensure full compatibility in the end.

[16] The central Amlaak registers of SCA also provide locational and legal information. See also general description of EAIS work procedures in Amin (2002) and at www.eais.org.eg/index.pl/gis_center. See also description of EAIS work within QuarryScapes at: http://www.eais.org.eg/index.pl/quarryscapes

There are several types of legal status known in the SCA system:[17]

- Property of SCA: This means that SCA owns and controls the site by decree of the Prime Minister.
- Supervision by SCA: This implies that SCA supervises the site by decree of the Minister of Culture.
- Registration process: The site is under request for legal protection (ownership or supervision) and the request is currently being processed.

It should be noted that in the Egyptian Antiquities Law (no. 117/1983) cultural property is defined as all types of sites older than 100 years.[18] This implies that all ancient quarries are defined as cultural property and thus have the potential of becoming legally protected (owned or supervised by SCA). However, in practice it is of course impossible to enforce regulations[19] to sites that are not known or neglected by the national or regional heritage authorities. Although the EAIS research has shown that quite a few ancient quarry sites not legally protected are known by inspectorates (see below), the lack of knowledge of quarries in general is a crucial problem facing such sites.

Despite its wealth of world-class archaeological sites, Egypt features comparatively few World Heritage Sites.[20] Three of these sites include ancient quarries. Since this status potentially gives the quarries "extra" protection, the sites will be described in more detail below. Moreover, Egypt has many nature protectorates, several of which include ancient quarries. Although inclusion in a nature protectorate does not automatically imply any change in the legal status of the quarries, it may in some cases aid the preservation of such sites. Such issues will also be commented upon below.

Ancient quarries legally protected with SCA

According to the latest information available (November 2007), the following ancient quarries recorded by James Harrell are protected or in the process of being protected. They may be protected by virtue of their significance as ancient quarries or being part of other archaeological sites (see also Figure 14 and Figure 15). Note that for several quarries no official decree has been found stating their legal status; these quarries are only mentioned by the respective inspectorates as being legally protected.

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[17] Based on information from EAIS

[18] See e.g. Nahkla et al. (undated)

[19] Such regulations include e.g. those defined by article 20 of the Antiquities Law (no. 117/1983):

- "No license can be granted for construction in archaeological sites and lands."
- "Other parties shall be prohibited from establishing foundations or cemeteries or digging canals or constructing roads or cultivating in the same or in the public-service facilities set for antiquities or lands lying within the authorized beautifying lines."
- "Implanting trees or the cutting of such or carrying rubble or taking soil or fertilizers or sand or the execution any such work which result in changing the characteristics said sites and lands shall be prohibited except with a license from the SCA and its supervision."
- "This article can be applied on lands which are detected through SCA studies of a probability of antiquities presence. Also is applied on desert lands and licensed lands for stone quarries."

[20] There are currently 7 sites inscribed on the list, see http://whc.unesco.org/en/statesparties/eg

Property of SCA:

Limestone and travertine	• Giza Pyramids (Lower Egypt) (official decree available) • Wadi Nahkla (south of Minya, Middle Egypt, part of ancient tombs)[21] (official decree available) • Wadi el-Barshawi (Middle Egypt, travertine) (official decree) • Wadi el-Muluk (Thebes, Upper Egypt). Protected within the Thebes archaeological area (official decree available)
Sandstone	• St. Simeon's monastery (Aswan, Upper Egypt). This quarry is not listed by James Harrell. The monastery is built on top of an ancient quarry (official decree available)
Hardstone	• Mons Porphyrites (Eastern Desert) (as quoted by the Red Sea inspectorate) • Mons Claudianus (Eastern Desert) (as quoted by the Red Sea inspectorate) • Wadi Hammamat (Eastern Desert) (as quoted by the Red Sea inspectorate) • Bir Umm Fawakhir (Eastern Desert) (as quoted by the Red Sea inspectorate) • Unfinished Obelisk Aswan (official decree available)
Gemstone	• Serabit el-Khadim (Sinai) (official decree available) • Wadi Maghara (Sinai) (official decree available)

The following quarries are probably the property of SCA, but there are uncertainties as to location and/or site borders:

- Saqqara pyramids (limestone, Lower Egypt)
- el-Lahun pyramids (limestone, Lower Egypt)
- Gebel el-Teir (sandstone, Kharga Oasis)

Four additional archaeological sites appear to include quarries. However, these are not mentioned in the literature by James Harrell and others, so their status remains unknown. In summary, available information shows that there are a minimum of 12 and a maximum of 19 quarries protected as the property of SCA, *but only for 8 quarries official decrees stating the legal status have been positively identified.*

Supervision by SCA

- Bir Nasib (Sinai, gemstone) (official decree available)

One additional archaeological site appears to include quarries. Again, this is not mentioned in the literature and its status remains unknown. Thus, there are a minimum of 1 and a maximum of 2 quarries supervised by SCA

SCA registration process

- Hatnub (travertine, Middle Egypt) (as quoted by the Minya inspectorate)
- Chephren's Quarry (gneiss, Upper Egypt)[22]

[21] See recent investigation in the quarries and tombs at www.arts.kuleuven.be/bersha

- Gebel Qubbet el-Hawa (sandstone, Upper Egypt; within of Tombs of the Nobles and Deir Mari Girgis monastery, Aswan) (official process)

Also here are some possible quarries (3) that are not mentioned in the literature, implying that there are a minimum of 3 and a maximum of 6 quarries currently being processed.

It is very likely that quite a few more quarries mentioned by Harrell and other authors are coincidentally part of other important archaeological sites, but not known or neglected by the heritage authorities. Such quarries may include some of those on which Coptic monasteries have been built (cf. St. Simeon's monastery mentioned above), for example Deir el-Ganadla, Deir Deronqa and Deir Amir Tadros in Middle Egypt (cf. Klemm & Klemm 1993: 273). Also ancient tombs (cf. Wadi Nahkla mentioned above) are in this respect good candidates, for example Beni Hassan in Middle Egypt (cf. Klemm & Klemm 1993:101ff). An estimate would be that there are at least 10 additional ancient quarries that have some kind of legal status as part of other archaeological sites.

In total, there are thus about 15 quarries that quite certainly are or will soon be legally protected (though in four cases official decrees are unavailable), as well as an additional perhaps more than 20 quarries that might be registered. Taking Harrell's record of 193 quarries, plus some unknown, in sum c. 200 quarries, as a basis, 7-8% of these are quite certainly protected (or will be), but this figure *might* be as high as 15-20% when accounting for the unknowns. However, a secured status can only be justified for c. 5%.

Although in some regions ancient quarries may be unknown or neglected, in other areas also those legally unregistered are known by the inspectorates. As Figure 13 indicates, a total of approximately 65 non-listed quarries (c. 30%) have been quoted as known by the responsible inspectorate. One example is the Eastern Desert, where the Red Sea Governorate inspectorate in fact has noted that it knows all 39 ancient quarries within the borders of the governorate. Furthermore, it has specifically listed 12 quarries as unregistered in this vast area, implying that they enjoy a certain protection, given that – ideally – modern developers have to consult the inspectorates before development commences. In practice, such consultation is often not taking place, as has been demonstrated in Aswan (see Chapter 4). It should be underlined that the summary above does not include prehistoric quarries, such as those previously described. It is, however, unlikely that any of these are registered as archaeological sites with SCA.

Ancient quarries as part of World Heritage Sites

Three Egyptian World Heritage Sites (WHS) include ancient quarries. One is the Wadi el-Muluk ("King's Wadi") New Kingdom limestone quarry near the entrance to the Valley of the Kings on the West Bank at Luxor (Klemm & Klemm 1993:183ff) (Figure 16, Figure 17). Although visits in 1999 and 2001 showed that part of the quarry was used as a garbage dump and may have been subject to modern exploitation, it is a reasonably well-preserved site. However, the so-called "New Qurna" (or "New el-Taref") town has now been constructed immediately to the east of the ancient quarry area. This disputed project (e.g. van der Spek 2003) has aimed at relocating the inhabitants of Old Qurna away from world-famous tombs in the Theban Necropolis. Although within a WHS, the quarry is leading a lonely life at the

[22] Latest update (November 2007): On further research by EAIS, it has been found that Chephren's Quarry was first requested for protection back in 2000, but was then "lost" in the SCA bureaucracy. This is a fairly typical problem and it is mentioned here in order to show the tentative nature of the figures given in this section of the report. The request for protection will now be followed up and the process started over again.

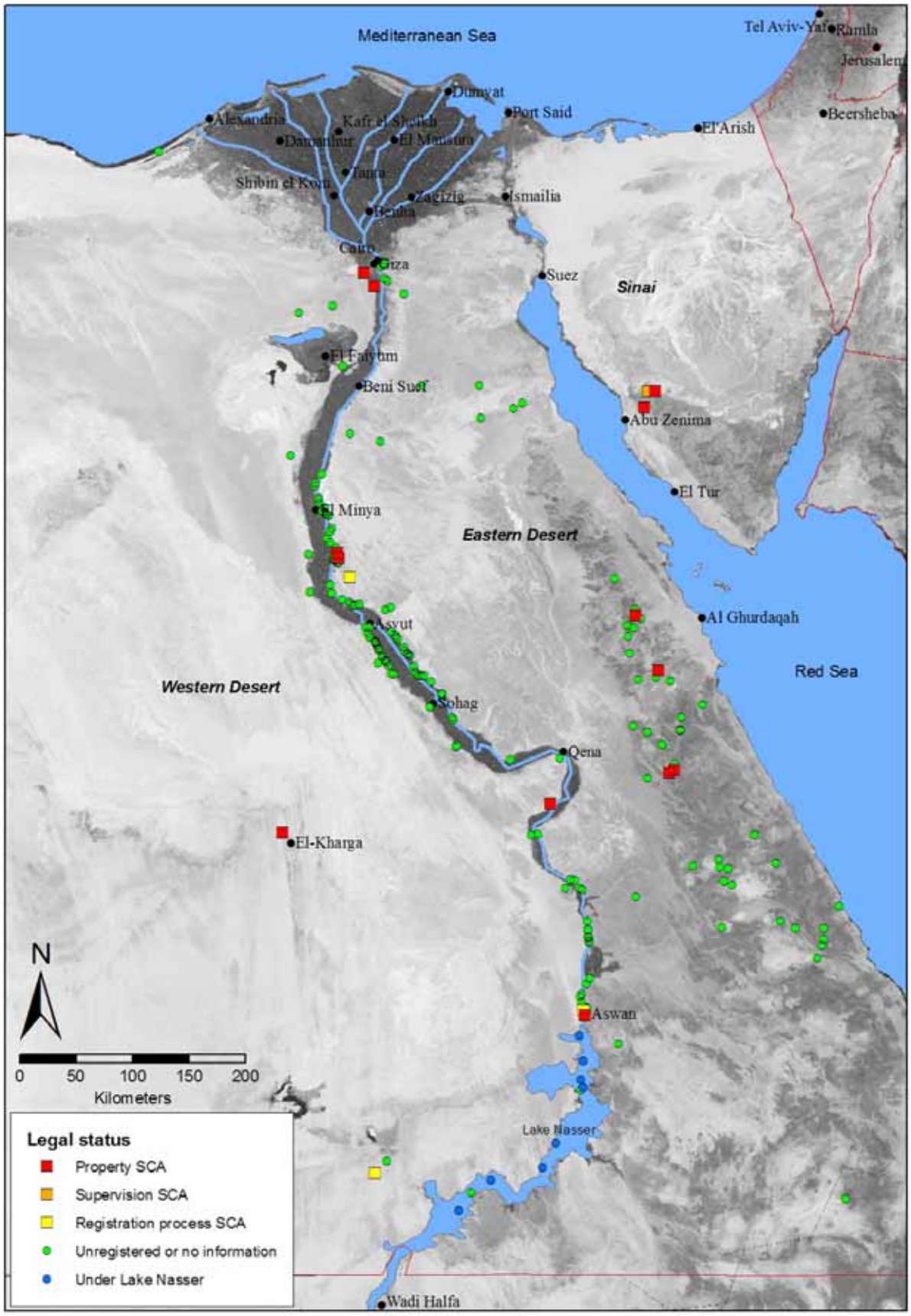

Figure 14: Distribution of quarries recorded by James Harrell and their legal status. Only quarries with a quite secure legal status have been included. Note that for the 4 quarries in the Eastern Desert reported to be owned by SCA no official decree of their status has been positively identified. See text for explanation. Map by QuarryScapes/Per Storemyr

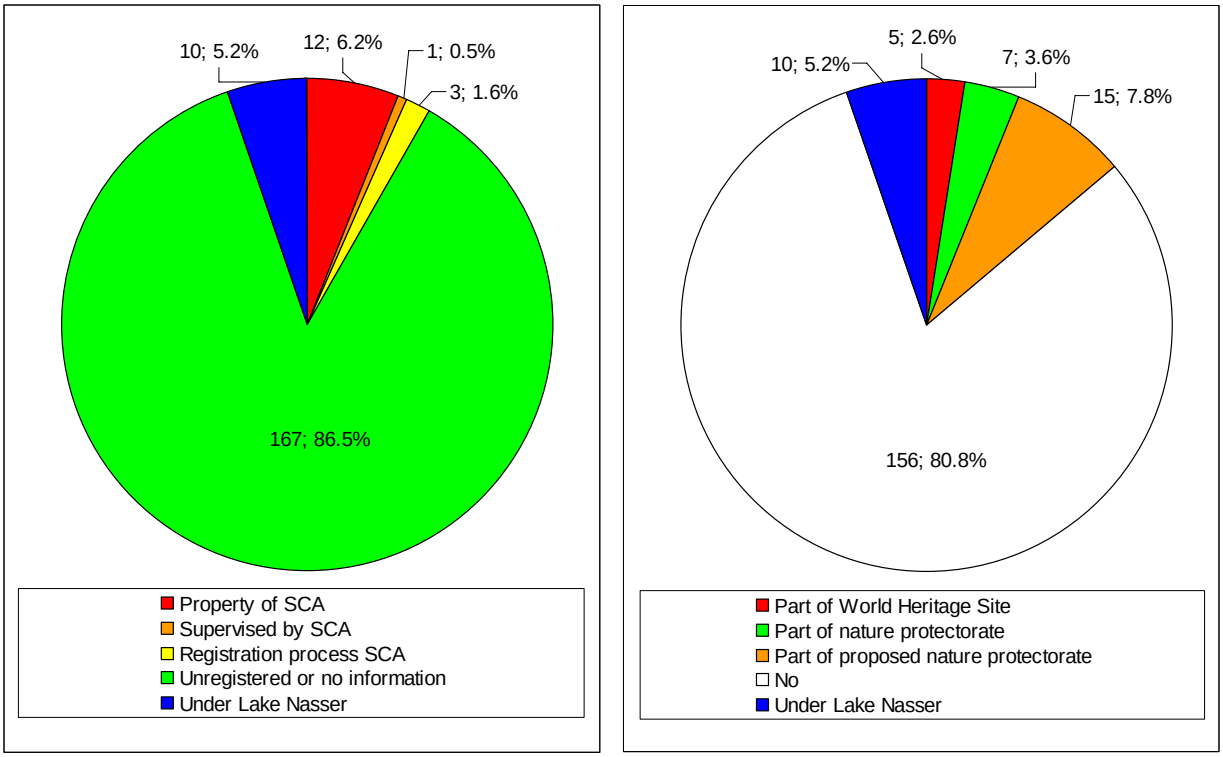

Figure 15: Graphic representation of the legal status of ancient quarries recorded by Harrell. Only quarries that have a quite secure legal status are included in the presentation. *It is very important to note that of the 167 quarries that are unregistered or that lack information approximately 65 are quoted as known by the respective SCA inspectorates*. See Figure 13 and text for further explanation of this issue.

periphery of its world-famous archaeological neighbours. It has been subject to limited, rather recent archaeological investigations (e.g. Nishimoto *et al.* 2002), but it is definitely not a "famous" quarry promoted to tourists; it is hardly marked on maps of the region and probably enjoys next to zero management. In the recently published site management masterplan for the Valley of the Kings by the Theban Mapping Project (Weeks *et al.* 2006)[23] the quarry is not mentioned.

The second quarry area rather coincidentally protected as part of a WHS is located at the Giza Plateau, in the shadow of the mighty pyramids (cf. Klemm & Klemm 1993: 53ff) (Figure 18, Figure 19).[24] These quarries are not leading a lonely life, as thousands of people pass them every day, though most likely without knowing what they are looking at (Storemyr 2006). The quarries are not promoted to tourists, but it is unknown whether they receive some kind of management.

The Wadi el-Muluk and especially the Giza quarries are large, almost "monumental", but both are completely overshadowed by their neighbouring monuments. In a sense this is true for almost the whole of the Nile Valley, with world-famous monuments receiving the scholarly and public, and administrative and management interest in favour of "mundane" quarries.

[23] See also www.thebanmappingproject.com
[24] See also The Giza Plateau Mapping Project and description of Khufu's quarry at www.aeraweb.org/khufu_quarry.asp. It must be noted that also the quarries by the Sakkara pyramids are part of the WHS

Figure 16: Part of the Wadi el-Muluk quarry (photo: Per Storemyr)

Figure 17: The Theban Necropolis on the West Bank of the Nile at Luxor. The outline of the Wadi el-Muluk quarry is marked with blue. The border of the World Heritage Site (red) has been adopted from Weeks *et al.* (2006:32). Satellite image from Google Earth. Width of picture c. 6 km

Figure 18: Limestone quarry to the southeast of the pyramid of Chephren (photo: Per Storemyr)

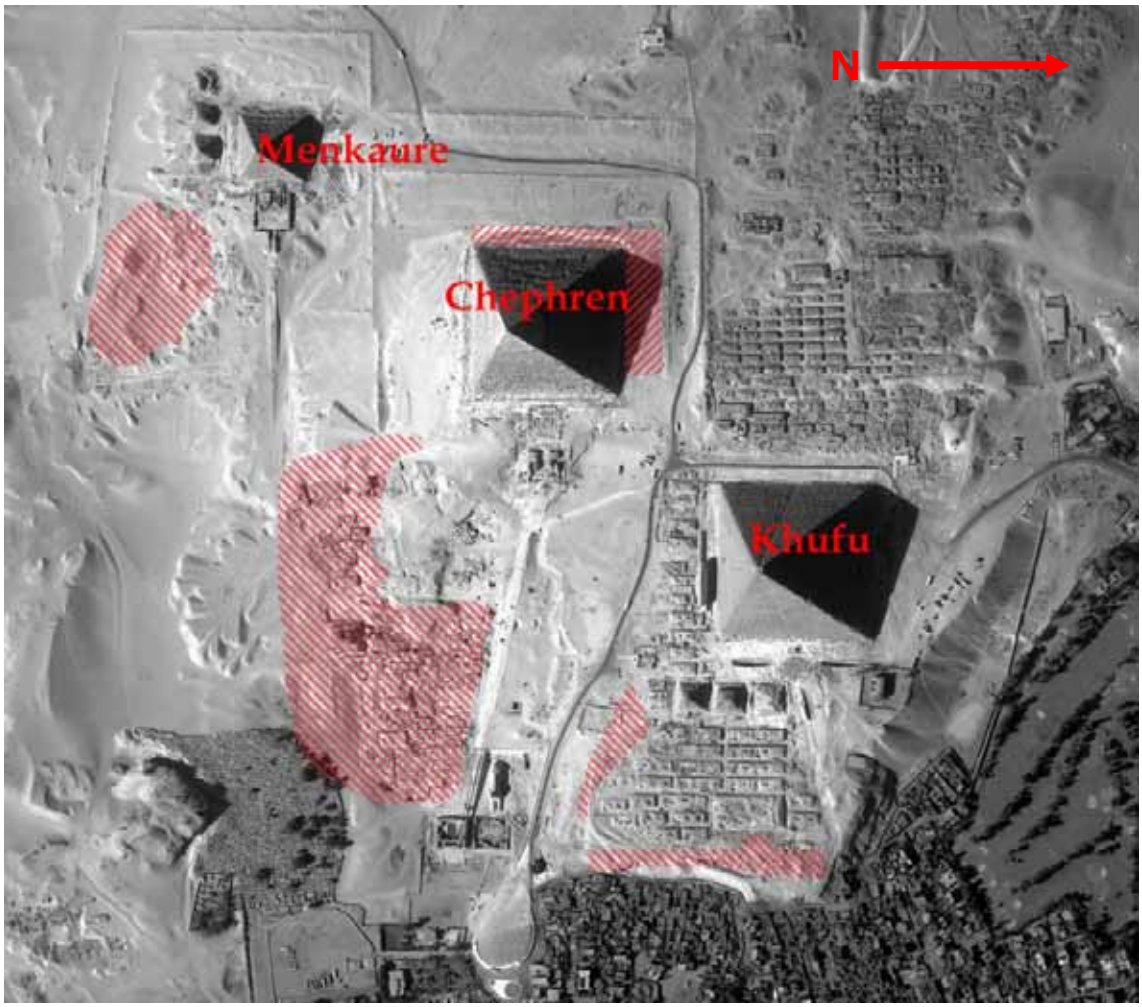

Figure 19: Quarries for construction of the pyramids at the Giza Plateau (hatched areas). After Klemm & Klemm (1993:54). Background: Ikonos satellite image (1999) from www.spaceimaging.com

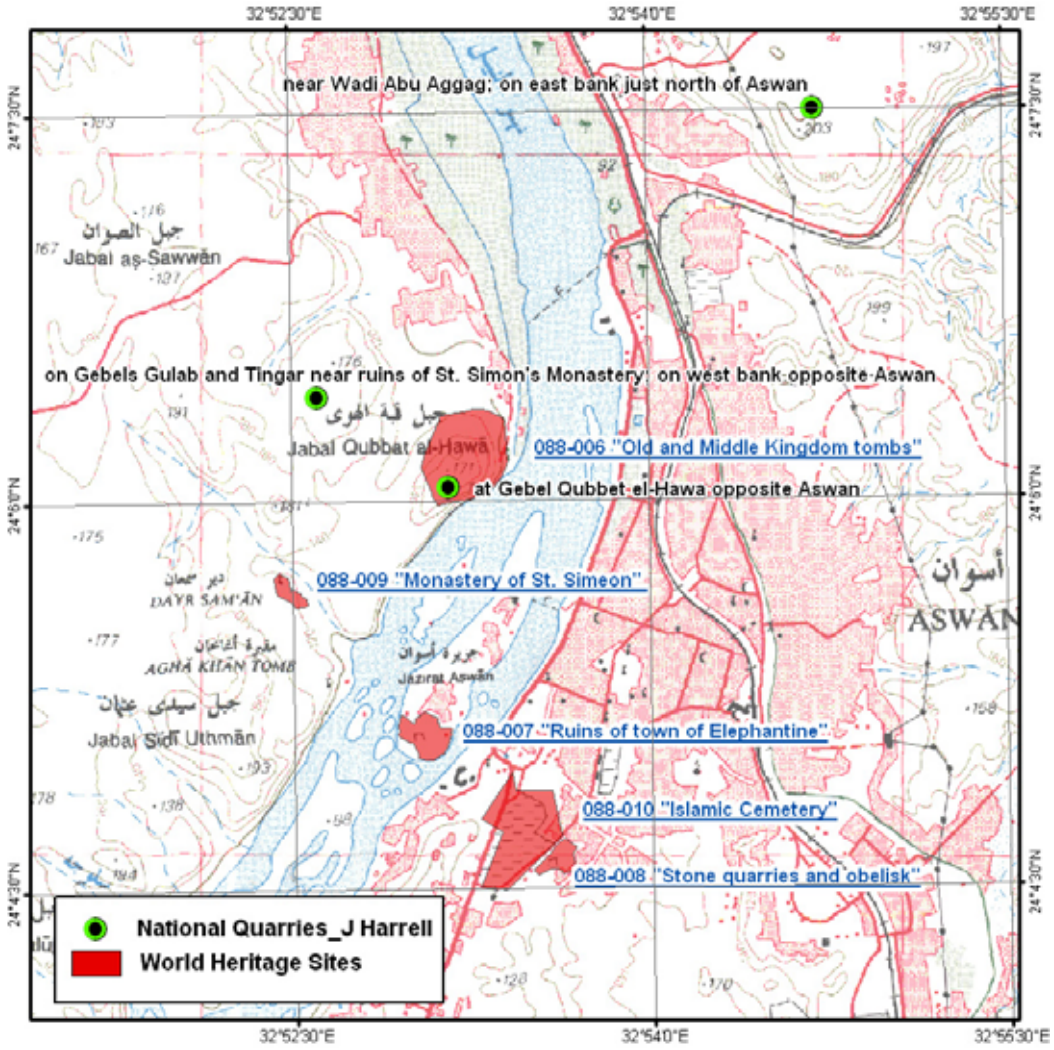

Figure 20: World Heritage Sites in Aswan which are part of "Nubian Monuments from Abu Simbel to Philae". Ancient quarries recorded by James Harrell are also shown. Note that St. Simeon's monastery also features an ancient sandstone quarry and that the Gebel Gulab/Tingar site is covering more than 50 square kilometres on the West Bank (Chapter 3). Map by EAIS/Rawda Yousri/ElShaimaa Fathy

Recently, EAIS, on request from UNESCO, has reviewed the borders of several Egyptian World Heritage Sites. Perhaps surprisingly, within the "Nubian Monuments from Abu Simbel to Philae"[25] many sites in Aswan are officially included (see Figure 20). This implies that there are in fact three quarries in Aswan with World Heritage status – a status which until now has hardly been known to anyone. The Unfinished Obelisk granite quarry is by far the most prominent extraction site registered as a WHS. In the "Advisory Body Evaluation" of the site in 1979, it is stated that *"To these must be added the astonishing granite quarries of Aswan, exploited by the pharaohs from early antiquity, where colossal unfinished obelisque, like monuments have been discovered"*.[26] Although not specifically mentioned, the sandstone quarries which form part of the tombs at Gebel Gubbet el-Hawa and those within St. Simeon's Monastery also (coincidentally) have a WHS status.

Although the World Heritage status of the Aswan sites is at present largely unknown, it might become an important factor in future attempts at protecting, managing and promoting the larger Aswan quarry landscape (cf. Chapters 3, 4 and 9).

[25] See description of this WHS site at http://whc.unesco.org/en/list/88
[26] See http://whc.unesco.org/archive/advisory_body_evaluation/088.pdf,

Figure 21: Mons Claudianus Roman quarry landscape in the Eastern Desert. The fort can be seen in the wadi, whereas small quarries are located across the low hills (photo: Per Storemyr)

Ancient quarries as part of nature protectorates

There are currently 25 nature protectorates in Egypt, covering more than 10% of the country's area (Egypt State of the Environment 2004). Seven known ancient quarries or gemstone mines are located within such protectorates; these are mainly emerald mines in the Eastern Desert (within Wadi Gemal protectorate). In addition, Widan el-Faras (and several other small quarries, see above) in the Northern Faiyum is located within Lake Qarun protectorate. 15 new protectorates have been proposed (ibid.), two of which include many ancient quarries. Of particular interest is the proposed Shayeb el-Banat protectorate in the Eastern Desert, which, if established, will include the prominent Roman quarry landscape from Mons Porphyrites (Gebel Dokhan) to Mons Claudianus (Figure 21). Moreover, the proposed El-Galala Qebleya protectorate includes several ancient limestone quarries, whereas the Kurkur and Dunqul protectorate features prehistoric tool quarries (Figure 22).

Theoretically, ancient quarries, whether legally registered with SCA or not, should enjoy better protection within a nature reserve than outside its borders, as the law on nature protectorates (no. 102/1983) puts severe restrictions on modern development within such areas. However, in practice the enforcement of the law is dependent on the management regime established for each protectorate. For example, due to the lack of interest, knowledge and resources, the Northern Faiyum desert in the Lake Qarun protectorate has until now hardly enjoyed active management, implying that the ancient basalt quarries at Widan el-Faras have been seriously destroyed by modern quarrying (see Chapters 3 and 4, and Storemyr *et al*. 2003; in press). The situation is different is the remoter Wadi Gemal protectorate in the Eastern Desert, where simple management practices are established and the emerald mines (see description in Sidebotham *et al*. 2004) are at least partially promoted for the limited tourism taking place in the area (cf. Storemyr 2006). Despite current problems with management of nature protectorates, the fact that they usually cover large tracts of land, and potentially may prevent large-scale modern development from destroying natural and cultural remains, is highly significant also for the preservation of ancient quarries, especially when considering these in a landscape perspective (cf. discussion in Chapter 3).

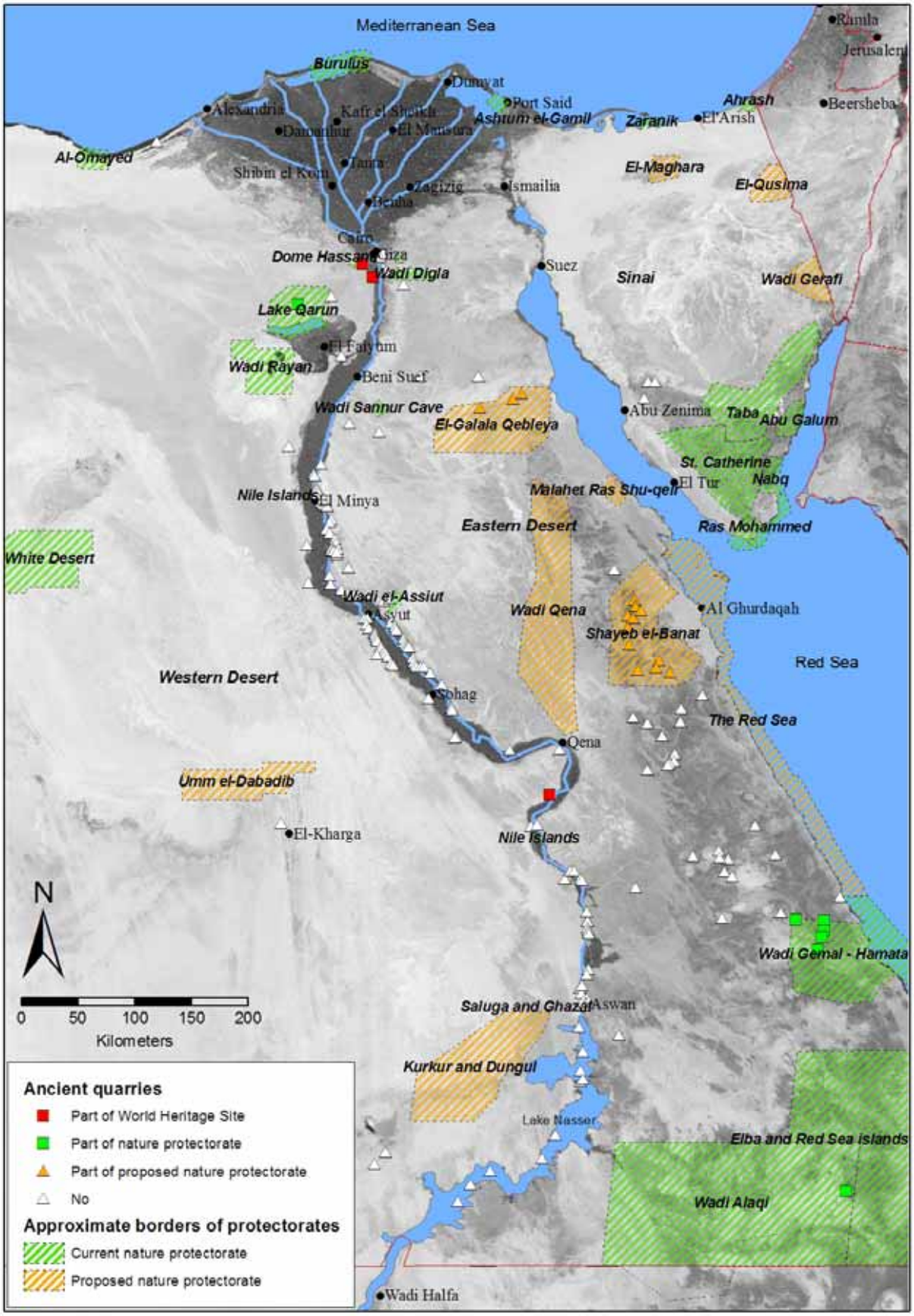

Figure 22: Current and proposed nature protectorates in Egypt. Adopted from Egypt State of the Environment (2004:73). Note that the Wadi Sannur Karst Cave also features an ancient travertine quarry (see Chapter 6), which is not marked on the map. Map by QuarryScapes/Per Storemyr. Very recently, the Red Sea Islands by Hurghada were also declared a protectorate (see www.eeaa.gov.eg/English/main/Protectorates.asp**)**

Figure 23: View of one of the large quarries at Gebel el-Silsila (photo: Per Storemyr)

Summary and concluding remarks

This chapter has given an introduction to the location and characteristics of known ancient quarries in Egypt. It has also reviewed the legal status of the quarries. Although at the moment this review is only tentative, it seems that, although only 5% have a secured legal status based on official decrees, 10-20% of the known quarries may enjoy legal protection within the SCA system, often as part of other, more "monumental" archaeological sites. In addition, three World Heritage Sites include ancient quarries. Most of these quarries (e.g. at Giza and by the Valley of the Kings in Luxor) are coincidentally part of the WHS, but the Unfinished Obelisk in Aswan is specifically listed within the WHS named "Nubian Monuments from Abu Simbel to Philae". Less than 5% are currently (coincidentally) within nature protectorates, but this figure may increase to more than 10% if proposed protectorates are established in the future. It should also be noted that in addition to these quarries, about 30% are reported to be known by regional cultural heritage authorities (inspectorates), implying that the authorities in theory can apply the antiquities law if threat occur. This is because archaeological sites older than 100 years are defined as cultural property. In summary, 40-50% of the quarries known to scholars may have an official legal status, be part of protected areas or be known to responsible authorities. Thus, these quarries are theoretically better protected than the remaining 50-60%. These figures do not include prehistoric quarries, which are probably little known and hardly enjoy any kind of official legal protection.

This overview has concentrated on the number of quarries with varying official status. Site borders, buffer zones and management regimes in most cases remain obscure. Usually, officially protected areas will probably be rather limited, not considering the sites in a landscape perspective (cf. Chapter 3). However, for a key, SCA-owned site such as the Serabit al-Khadim turquoise mines in Sinai the officially protected area is in the range of 20

square kilometres; there is a visitor's centre and pathways to the extraction areas.[27] Moreover, Gebel el-Silsila (Figure 23), its legal status not yet clarified, has recently undergone development facilitating tourism, especially related to Nile cruises. In addition to the Unfinished Obelisk Quarry and Museum in Aswan (see Chapters 4 and 9), these two quarry sites belong to the extremely few actively promoted and managed. For example, few other quarries have guards regularly present.

With exceptions such as Serabit el-Khadim, Gebel el-Silsila and the Unfinished Obelisk, there is no guarantee that an official legal status or knowledge by authorities will prevent destruction from taking place. As we shall see in Chapter 4, key quarries very well known by authorities have been destroyed in the recent past.

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[27] See www.touregypt.net/featurestories/serabit.htm. For borders, see www.eais.org.eg/index.pl/sarabit_al-khadim

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Chapter 3

From ancient quarry site to ancient quarry landscape

Elizabeth Bloxam

Introduction

The cultural heritage of ancient Egypt, in terms of World Heritage sites and the broader perception of its archaeological record, is largely linked to its monumental structures. Although the quarries from which the raw materials to build many of these structures, such as pyramids, obelisks and temples have been described and documented (see references in chapter 1) there has been the tendency to present them as static 'archaeological sites' rather than as dynamic landscapes where social, technological and cultural interactions linked to stone procurement were played out over time. The QuarryScapes project has aimed to present fresh approaches to documenting, characterising and articulating the significance and value of ancient quarry landscapes as recently presented in two reports to the Commission (Bloxam *et al* 2007 and Bloxam 2007) concerning the West Bank Aswan ancient quarry landscape. In essence, the objective has been to convey the significance and value of the largely non-monumental and often invisible material culture that constitutes the archaeology of ancient quarry landscapes.

The aim of this chapter is to present an overview of how the concept of a 'quarry landscape' as a dynamic 'cultural landscape' is an applicable model to articulate the significance and value of ancient quarries that comprise a complex range of material culture across large areas. Within the criteria of this risk report, the objective is to present a brief overview of the diverse archaeology of the three case study quarries: Northern Faiyum, West Bank Aswan and Chephren's Quarry and discuss models through which their significance can be articulated. Furthermore, the chapter will consider the transportability of such models to other quarry areas in Egypt.

Modelling the significance of ancient quarry landscapes

The material culture that comprises a recognised ancient quarry as an 'archaeological site' can comprise 'monumental' elements such as roads, large extraction sites, partially worked large objects still in-situ, such as obelisks and statues. However, they can also comprise less visible non-monumental elements such as scatters of ceramics, ephemeral shelters, workshops of scattered stone chips, object blanks of utilitarian products, inscriptions, rock art and often a transport infrastructure such as loading ramps and cleared tracks rather than paved roads.

Hence, ancient quarries can comprise a range of visible and less visible elements which to a greater or lesser extent transformed the landscape to create a cultural landscape or 'quarry landscape' whereby resource procurement was key. Given that an ancient quarry and its associated material culture can cover large areas, sometimes upwards of 100 km^2, one of the challenges has been to design composite models that can forward the totality of these sites in terms of their significance across a range of interests, i.e., from local and national cultural heritage authorities to international bodies such as UNESCO.

One approach to articulating the significance of a 'quarry landscape' as making up a 'cultural landscape' of often global significance has been to construct concepts in terms of the baseline criterion for World Heritage listing, that of 'outstanding universal value' (see Bloxam 2007; Bloxam and Heldal 2007). This criterion has been an important foundation to articulate the significance of quarry landscapes whereby all elements of its material culture are viewed in a more holistic manner and disposes of hierarchies of material culture. In essence, the natural landscape has provided the arena whereby its transformation by man is directly related to acquisition of specific raw material resources exploited over time, or a nature-culture continuum (von Droste 1995: 21; Cleere 1996: 231; Titchen 1996: 239). Although inscription of such landscapes are few, in fact less than 5% (Jokilehto 2005), the nomination documents of 'industrial' landscapes that have been inscribed as World Heritage Sites have provided valuable models to articulate the significance of quarry landscapes at a macro-level. In particular, they can be used to draw out the essence of the landscape transformed by raw material acquisition within a broader perspective of human endeavours through which achievements such as inventiveness, technological innovation were part of, or led to, profound social transformations of global significance (see Bloxam 2007; Bloxam and Heldal 2007).

Although such models are useful particularly in articulating significance to a larger audience and allow for less visible elements of a quarry landscape to become as important and significant as the monumental structures, such a model alone is not applicable in all cases. For instance, overcoming problems related to authenticity, another key criterion for World Heritage listing, given that quarry landscapes are dynamic and often multi-layered representing transformations over several thousands of millennia. Cross-cultural theoretical contributions from landscape archaeologies can provide useful frameworks for conceptualizing the authenticity of multi-layered cultural landscapes, which by their very nature are fragmented with multiple meanings across time (Ingold 1993: 152-3, 171-2; Barrett 1999; Knapp 1999; Thomas 2001: 166, 181; Cooney 1999; Edmonds 1999; Bradley 2000). Moreover, landscape archaeologies can aid in grappling with the problems of articulating the social construction of the landscape, particularly in the absence written records. In essence, 'quarry landscapes' comprise invisible borders that are socially constructed and hence human interaction with the landscape related to quarrying may extend beyond the confines of a closed 'archaeological site' – landscape archaeologies are thus important for grappling with such borderless sites. Such aspects crucially come to the fore in matters of risks and conservation of these sites.

Of course no model fits all, as ancient quarry landscapes comprise ranges of material culture, present in some, absent in others. Hence, the status of preservation, as discussed in Chapters 4 and 5 of this report, is a key consideration when designing models of significance. Moreover, some quarry landscapes may be significant not because they have global significance or provide insights into the social context of quarrying, but present aesthetically pleasing landscapes. The large quarries in the Nile Valley, such as Gebel el-Silsila, form exceptional vistas within a desert landscape. Although aesthetics are more subjective attributes, they are

equally valid considerations in terms of conservation given that this human intervention has transformed the geological landscape into what we see today.

The Northern Faiyum: two quarries, one quarry landscape

The ancient quarry landscape of the Northern Faiyum comprises material culture associated with basalt quarrying at Widan el-Faras and gypsum quarrying at Umm es-Sawan, both of Old Kingdom date (3rd millennium BC). Bounded to the south by Lake Qarun and to the north by the escarpment of Gebel Qatrani, the natural and cultural landscape of the Northern Faiyum Desert (within the Lake Qarun Protectorate) comprises an area of approximately 600 km^2 of largely hyper-arid desert (Figure 24). Although exploitation of both resources is more or less contemporary, between the 4th and 5th Dynasties, these sites exemplify the diversity of material culture that can be associated with ancient quarries. Such diversity may be attributed to factors such as the geological properties of material being extracted in relation to technologies of extraction and tools used, down to the construction of infrastructure relating to transportation of the material.

The quarries

The Widan el-Faras basalt quarries are located 350 m above sea level along the rim of the Gebel Qatrani escarpment, behind the two highly visible peaks of Widan el-Faras (translated as 'ears of the mare'). Visually, the actual extraction sites are hard to see and were not recognized until the work of Harrell and Bown (1995) in the mid 1990s as a series of shallow bench-like depressions into a 8-15 metre thick layer of Oligocene basalt which caps the sedimentary rocks of the escarpment. Although quarrying transformed the rim of the escarpment, this visually outstanding landscape of black scree cascading down the escarpment is actually a natural transformation of the landscape produced from weathering of the basalt (Figure 25). The gypsum quarries of Umm es-Sawan present the antithesis of Widan el-Faras. Hard to see and located almost on the desert floor 25 km north-east of Widan el-Faras, they present a network of shallow sand-filled sub-surface extractions within the upper part of the Eocene Qasr el Sagha Formation (Bown and Kraus 1988: 37). In fact the quarry landscape can be visualized more by the secondary workings, which form a series of workshop mounds situated 200 m above the quarries below the sandstone escarpment (Figure 26).

Both these resources were key production sites (or quarries) that were centre-stage in the transformation to large-scale stone quarrying associated with the 'Pyramid Age' of the Old Kingdom. Authenticating this connection comes not only from ceramic evidence of the 3rd – 5th Dynasty scattered in the quarries, but from the record of consumption. Faiyum basalt has a long history of consumption that ebbed and flowed since at least the Faiyum Neolithic (5th millennium BC), when it was used for axes (Lucas 1930: 203-5; Caton-Thompson and Gardner 1934: 25-6), into the Roman Period when it was used for small statuettes (Harrell and Bown 1995: 73; Empereur 2000: 11; Bloxam and Storemyr 2002: 28). Widan el-Faras was the source of the basalt used mainly for floors and walls in the Old Kingdom (4th and 5th Dynasty) mortuary temples of king's Khufu, Userkaf, Sahure and Nyuserra pyramid complexes (Harrell and Bown 1995: 74-5; Mallory-Greenough *et al.* 2000). Whereas Umm es-Sawan gypsum was used for the manufacture of small stone vessels and also as mortar for construction purposes, more or less contemporaneously between the 3rd – 5th Dynasties of the Old Kingdom (Caton-Thompson and Gardner 1934: 110-3; Aston 1994: 47-53; El Senussi 2006).

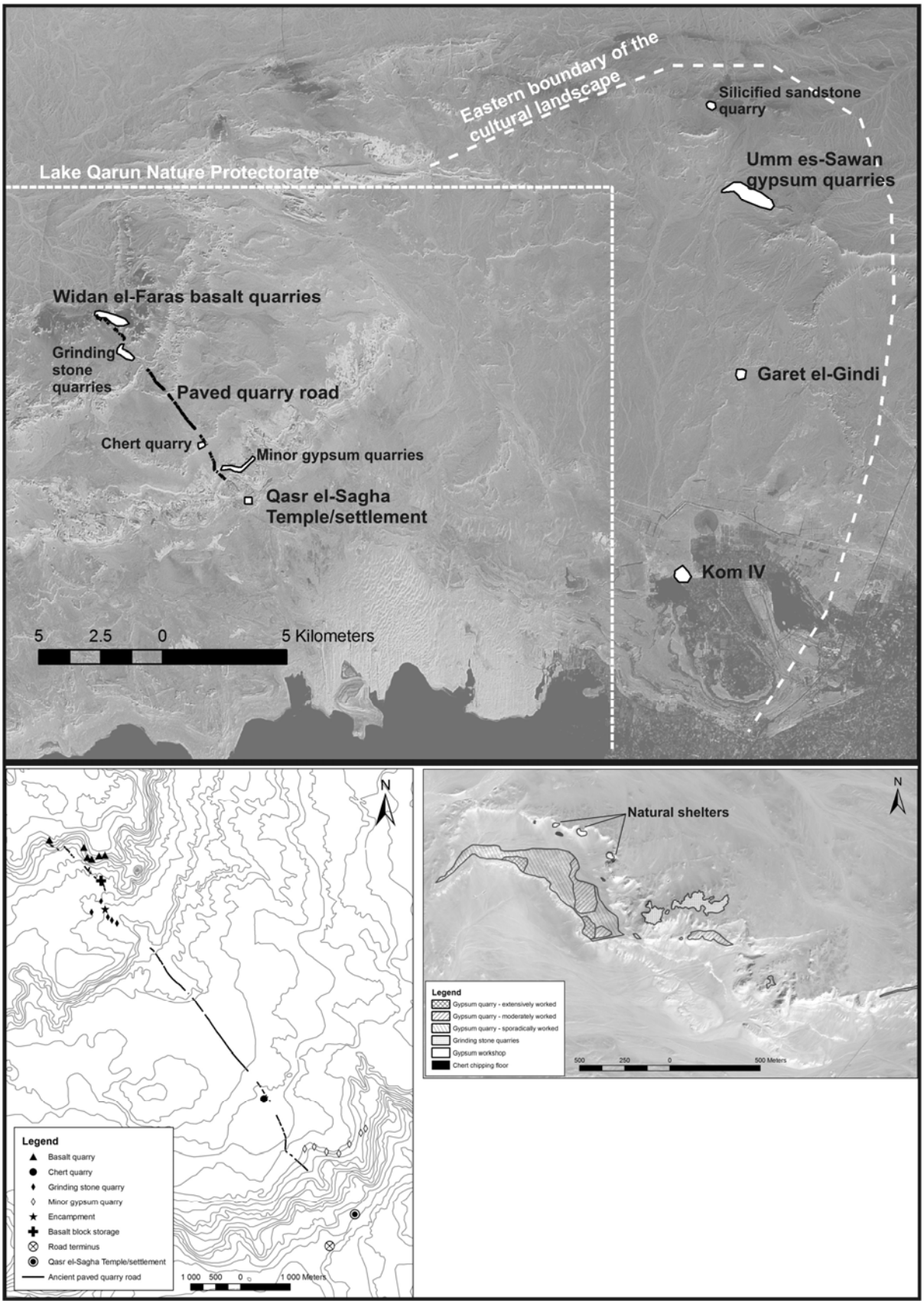

Figure 24: Map of the Northern Faiyum Desert showing extent of the ancient quarry landscape within the current Lake Qarun Protectorate and proposed extended boundary (map by QuarryScapes/Tom Heldal)

Figure 25: Widan el-Faras basalt quarries: foreground, basalt quarries along the rim of the Gebel Qatrani escarpment, background, the twin peaks of Widan el-Faras (photo: Elizabeth Bloxam)

Figure 26: Workshop mounds at Umm es-Sawan: foreground, clusters of vessel blanks or rough-outs; background, workshop debris below a natural rock shelter in the overhang (photo: Elizabeth Bloxam)

Given the differing properties of each stone type, basalt as a 'hard' igneous rock and gypsum at the other end of the spectrum as a 'soft' sedimentary rock, then as would be expected the stone tools used to extract the material differ. Large stone axes and pounders in the basalt quarries typify the assemblages, as opposed to finer rod-shaped pieces of fossilised wood associated with chert stone hammers in the gypsum quarries. Although viewed as mundane utilitarian products, the most significant feature of the stone tool assemblages are those made from non-local exotic stones, especially at Widan el-Faras where all the stone tools come from distant sources (Harrell 2002: 235). Notably, some are from sources up to 800 km away, such as the blue and visually distinctive Chephren Gneiss that has one source at Chephren's Quarry (as discussed below) near Abu Simbel (Engelbach 1938; Harrell and Brown 1994; Storemyr *et al.* 2002) and granodiorite from the Aswan region. At Umm es-Sawan these

stones are found shaped into tools, but also as small unworked blocks, and possible vessel 'blanks' or rough-outs. This evidence raises the significance of the Northern Faiyum quarry landscape to another level as constituting the highest concentrations of imported stones known in any ancient quarry in Egypt.

Similar to other ancient quarry sites in Egypt prior to the Roman Period, purpose-built large settlements associated with quarries are not usually attested. A small ephemeral encampment located 500 m south-west of the quarries at Widan el-Faras and utilization of some natural rock shelters at Umm es-Sawan, characterize the dwellings in immediate proximity to the quarries. Small amounts of ceramics attest to their connection with the period of most intensive exploitation of each resource between the 4th and 5th Dynasties (Caton-Thompson and Gardner 1934: 117-20; Bloxam and Storemyr 2002: 33-4; El-Senussi 2006). There are no known written records or indeed any inscribing of the landscape associated with these quarries.

From two quarries to an ancient quarry landscape

The material culture described above, although concentrated in close proximity to the quarries, is only part of the story of these places. Rather than conveniently constricted with a bordered 'archaeological site' where the material culture is most concentrated, the environs surrounding both sites have also been transformed. Transport infrastructure and exploitation of secondary resources for tools and other products have all played their part in transforming the landscape around these sites. This is demonstrated from the range of peripheral sources exploited. For instance, sources of silicified sandstone and grit for grinding stones, chert and fossilised wood for tools were simultaneously exploited in the environs of both quarries. Moreover, local sources of fossilised wood, sandstone and mudstone were all put to the most significant and innovative effect in the construction of one of world's first paved quarry roads (Harrell and Bown 1995; Bloxam and Storemyr 2002). Hence, the quarry landscape tends to take shape, as most clearly visualised by the 11 km quarry road that creates a uniform 2.1 m corridor delineating the shortest route to water from Widan el-Faras. The road terminates on an elevated promontory at the shoreline of ancient Lake Moeris at Qasr el-Sagha, on which weathered remains of large basalt blocks still remain (Wendorf and Schild 1976: 220; Arnold and Arnold 1979: 25; Harrell and Bown 1995: 86). A connection between high Nile floods during the 4th and 5th Dynasties (Hassan 1997; Said 1993: 134) coinciding with the peak in large-scale stone procurement, points to Lake Moeris as the crucial interface in the stone transportation process (Shafei 1960: 192-3; Harrell and Bown 1995: 83; Bloxam and Storemyr 2002: 34-5).

Although there is no paved road connecting Umm es-Sawan to Lake Moeris, according to observations made by Caton-Thompson and Gardner (1934: 103), a 20 km 'caravan' route heads south-west in the direction of the Old Kingdom settlement of Kom IV at Lake Moeris. On the way, the pyramidial hill of Garet el-Gindi forms a halfway point. There is also no visible road or pathway that laterally connects Umm es-Sawan with Widan el-Faras, yet material culture at both sites and at the lakeside settlement, specifically at Kom IV, suggests a connection. This is because the distinctive fabric of locally made pottery (containing dark particles, probably basalt) is attested at both Widan el-Faras and Umm es-Sawan (Caton-Thompson and Gardner 1934: 99-100; 110-6, pl.lxvi.30; Bloxam 2003: 267; El-Senussi 2006) and due to the presence of non-local exotic stones, usually found as tools. The connection between these places in making up the quarry landscape may also have a visual component

via the natural landmarks of the Widan el-Faras peaks, the pyramidal hill of Garet el-Gindi and the Qasr el-Sagha escarpment, which all share a significant inter-visibility.

'Outstanding universal value' and the Northern Faiyum quarry landscape

The significance of the ancient quarry landscape of the Northern Faiyum *could* be forwarded at a site-specific level, for instance, the ancient quarry road that connects Widan el-Faras to ancient Lake Moeris as a corner-stone in technological achievement. Significance also lies in the terminus of the quarry road at the ancient lake providing rare evidence of logistics and the pivotal role that water transport played in the large-scale stone transport of basalt from the Faiyum to the pyramid fields at Giza (Harrell and Bown 1995; Bloxam and Storemyr 2002). Moreover, such evidence has implications on hypotheses into the high levels of Lake Moeris during the Old Kingdom, which remains a contentious issue amongst scholars (see Wendorf and Schild 1976; Hassan 1986; Kozolowski and Ginter 1993). Umm es-Sawan is significantly the only known quarry to show evidence of a large importation of stones from 'exotic' and distance sources. Aesthetically, the peaks of Widan el-Faras and the black scree hills that surround them present a spectacular desert landscape. Yet, in the case of the Northern Faiyum, under risk from modern development such as agriculture at its southern borders and modern basalt quarrying in the north (as discussed in more detail in Chapter 4), isolating elements of the quarry landscape into site-specific and subjective views of significance would have disastrous consequences on its conservation and preservation and indeed its global significance as a World Heritage Site.

Such issues have come to the fore in the recent discussions on nomination of the Northern Faiyum as a World Heritage Site, under the criteria of a 'natural landscape'. Although the background to this is discussed elsewhere (Storemyr *et al.*, 2003 and Chapter 4 of this report) and forms the basis of a publication (see Bloxam and Heldal 2007), in essence the nomination document placed the ancient quarries firmly in the background. Moreover, Umm es-Sawan would not be included at all within the borders of a potential World Heritage Site (although it was suggested to extend the borders of the Lake Qarun Protectorate to include this site). Other associated problems led to the decision by the Egyptian State Party not to forward a nomination of the area as a World Heritage Site in 2007, but there are signals that the nomination will be submitted later (Samir Ghabbour, pers. comm. 2007).

As discussed above, it became important to model ways in which one can get from a quarry as an isolated 'archaeological site' to a 'quarry landscape' that is inclusive of not only other 'archaeological sites' but can be presented as a tangible entity for protection as a whole. Crucially, there was the need to articulate significance on as many levels as possible so that even the most mundane and almost invisible elements of the material culture could be considered. Moreover, the invisible social construction of the landscape, which is impossible to access in the absence of written records, needed to be addressed. In essence, the model aimed to characterise the Northern Faiyum as representing one of the world's oldest industrial landscapes related to ornamental stone quarrying. The model deployed key concepts from the nomination document for World Heritage listing of the Blaenavon industrial landscape, a landscape transformed by raw material procurement in the 18th and 19th centuries in South Wales, UK (Torfaen County Borough Council 1999), to access the broader picture of significance. In addition, was the utilisation of landscape archaeologies to access the social construction of the landscape in a holistic manner (see Heldal and Bloxam 2007).

In synthesis, the outcome of conceptualising material culture both site-specifically and across the environs of the Northern Faiyum was their representation as a series of transformations, contingent with a 'revolution' to large-scale exploitation of basalt and gypsum deposits, associated with pyramid construction in the early to mid 3rd millennium BC. The significance of this revolution in transforming the natural landscape of Northern Faiyum is how these primary industries set in motion a series of other interactions that produced the distinctive character and components of the cultural landscape that are visible today. The social construction of the landscape implies that the transformation to intensive exploitation of local resources was largely conducted within low-levels of social organization, perhaps related to local kin-groups. The selection and extraction of certain stone deposits are also congruent with technological innovation, particularly in constructing the paved quarry road. The global significance of the ancient industrial landscape of the Northern Faiyum as a 'combined work of nature and man' is its projection of the narrative of how stone was extracted, transported and finally crafted to produce elements of the pyramids – the world's most outstanding funerary monuments.

The Aswan West Bank ancient quarry landscape: time depth and complexity

The material culture relating to quarrying of silicified sandstone extends over an area of approximately 60 km^2 from Wadi Kubbaniya in the north, to the Old Aswan Dam in the south on the West Bank in Aswan. Detailed descriptions of the quarries and associated material are documented in a report to the European Commission (Bloxam *et al*., 2007) and so it is not the intention to cover this in detail here, but rather to point out the diversity of quarry landscapes and hence the different approaches needed to model their significance.

The quarries

The material culture of the Aswan West Bank, associated with quarrying of largely silicified sandstone, presents a different set of challenges in respect of modelling significance as opposed to the Northern Faiyum. Crucially, there are difficulties in defining authenticity of a quarry landscape transformed by quarrying over multiple periods, as opposed to that of the Northern Faiyum, which is largely of one historical epoch. At the West Bank Aswan we are confronted with material culture and quarrying not only in history but in prehistory, back to at least the Middle Palaeolithic. Hence, the landscape features evidence of over 150,000 years of quarrying. Simply put, the earliest phases of this exploitation relate specifically to silicified sandstone use for tools during the Middle Palaeolithic and peaking by the historical period of the 2nd millennium BC (New Kingdom) to its use for ornamental objects such as obelisks and monumental statues. Running parallel to its exploitation for elite objects is a continuous exploitation of the resource for grinding stones, commencing from the Late Palaeolithic and terminating at some point during the Roman Period. Yet, similar to the Northern Faiyum, other local resources in proximity were also exploited, such as iron and non-silicified sandstone, although not extensively before the Graeco-Roman period.

The monumental aspects of this material culture are the networks of quarry roads associated with New Kingdom ornamental stone quarrying, most concentrated in the environs of Gebel Gulab (Figure 27). The tip of an obelisk at Gebel Gulab and partially worked ornamental objects can be found concentrated at Khnum Quarries. Yet this period of ornamental quarrying accounts for only 11% of the total exploitation of silicified sandstone on the West

Bank (see Bloxam *et al*. 2007). Small amounts of ceramics and scatters of ephemeral shelters concentrated in the quarries typify the other elements of the material culture associated with the New Kingdom quarrying, along with some hieroglyphic inscriptions and graffiti.

Figure 27: Monumental aspects of the Aswan West Bank quarry landscape – New Kingdom causeway and obelisk top at Gebel Gulab (photos: Elizabeth Bloxam)

Figure 28: The 'invisible' quarries (foreground and background) comprising Prehistoric grinding stone quarries and Middle Palaeolithic tool workshops. Gebel es-Sawan North, West Bank, Aswan (photo: Elizabeth Bloxam)

Although the quarry roads are significant in themselves as presenting a rare example of some of the best preserved ancient quarry roads, such monumental aspects tend to pale, in terms of significance, against the monumental aspects associated with the 'Obelisk Quarry' across the Nile in the East Bank granite quarries. Moreover, what about the remaining 80+% of quarrying which is related to grinding stone production? Also the Middle Palaeolithic tool workshops, the rock art, desert routes and stone alignments that characterise the West Bank landscape? In terms of risk assessment, conservation and preservation of this cultural landscape we are presented with a similar situation as encountered in the Northern Faiyum, whereby significance lies in its conception as an extensive quarry landscape comprising a range of elements whereby the most highly visible may not necessarily be the most significant (Figure 28).

150,000 years of quarrying: the 'storied' landscape of the Aswan West Bank

Modelling significance of this complex material culture over multiple periods, in particular as a quarry landscape that has largely been transformed by utilitarian grinding stone production, required a modification of the conceptual approaches used for the Northern Faiyum. In essence, an emphasis on cross-cultural models drawn from landscape archaeologies and ethnographic models, particularly from Aboriginal culture in Australia, were a preferred framework to get at significance, particularly of grinding stone production (see Bloxam 2007). Moreover, the symbolism and ritual that might be attached not only to the properties of the stone, but as a way of examining the connection between quarrying and the prolific occurrences of prehistoric rock art, usually in proximity to the grinding stone quarries. The approach was to gather in as many elements of the material culture across the landscape as not only being interconnected, but having antecedents across time related to kinship and the social construction of the landscape. In essence, it was important to present the quarry landscape as a continuous transformation that tells the story of procurement of one specific source. The implications of this in global terms being that the West Bank is perhaps the only 'cultural landscape' or 'quarry landscape' whereby human endeavours to extract a single resource over a time depth of at least 150,000 years can be visualised (see Bloxam 2007).

Chephren's Quarry: visualising a lost quarry landscape

The quarries

Located 65 km north-west of Abu Simbel in Upper Egypt (Lower Nubia) Chephren's Quarry extends over an area of approximately 120 km^2 comprising over 600 individual extraction sites or quarries. Re-discovered by Engelbach and Murray in the early 1930s (Engelbach 1933, 1938; Murray 1939) this extensive quarry landscape is perhaps the hardest to visualise of the three case study areas (see map). The reason for its invisibility is the nature and occurrence of the deposit itself, as the metamorphic 'Chephren Gneiss' occurs as a patchwork of surface outcrops (boulders) within Precambrian granite/granitic gneiss bordered to the SE by the Cretaceous Nubia Sandstone formation and separated by sheets of aeolian sand (Storemyr *et al.* 2002; Klemm and Klemm 1993, 423-426; Harrell and Brown 1994). Hence visually, the environment would have resembled a landscape of boulders which during the 3rd millennium BC, 3rd – 5th Dynasties of the Old Kingdom, were extensively quarried. Today, the quarry landscape presents a low-lying crater-like surface of sand-filled depressions from where most of the boulders were removed, usually surrounded by spoil heaps consisting of

burnt (from fire-setting) and weathered stone chippings. This landscape was perhaps best described by Murray (1939: 105-7):

> *'...the first appearance of our landscape was a little disappointing. The cliffs of the scarp had disappeared below the northern horizon and we were left in a plain with only the slightest of features. There were neither hills nor definite quarry-faces to look at - only heaps of boulders emerged from the sand...quarries is almost too dignified a word for these Egyptian workings.'*

Figure 29: The ancient quarry landscape of Chephren's Quarry, Lower Nubia (photo: Elizabeth Bloxam)

Although today the Uweinat Road, which connects Abu Simbel with Uweinat in the Western Desert, passes almost through the centre of these 'Egyptian workings' such is their invisibility that most observers would have no idea that they were passing through the world's first known statue quarry. The distinctive blue colour of Chephren Gneiss was particularly sought after by the pharaoh's of the Old Kingdom for life-size statues, such as the centre-piece statue of Khafre in the Egyptian Museum in Cairo, where placements for 22 more were found in the Valley Temple of his pyramid complex (Lehner 1997: 126; Grzymski 1999: 53). Yet, the history of Chephren Gneiss use extends back at least to the Neolithic (Schild and Wendorf 2001: 16-7) and was also extensively used for small vessels, specifically between the 2nd and 3rd Dynasties (Reisner 1931; Firth and Quibell 1935).

The material culture associated with these quarries is scattered across an extensive area where boulder extractions were concentrated, these are marked on the map (see map in Chapter 4). These areas usually comprise small scatters of ceramics dating to the Old Kingdom (3rd – 5th Dynasties), ephemeral stone-built structures comprising low-level dry-stone walls around natural rock outcrops, object blanks of either vessels or in the larger boulder extraction areas, blanks of life-sized statues (Bloxam 2003; Storemyr *et al*. 2002). Stone tools such as pounders, hand-held axes and numerous broken large pounders, all from local sources, lie in varying concentrations in the production sites. In some instances groundwater wells may be

found, particularly associated with the Central Quarries where there is also a bakery (Bloxam 2003).

Areas of permanent settlement are unknown, although in the Central Quarries (at Quartz Ridge) small scatters of ephemeral huts are exposed as circular and oval constructions of *ad hoc* dry-stone walls. This area of largely vessel quarries is where there is evidence of a later Middle Kingdom (late 12th Dynasty) presence, although it is difficult to determine if this is related to the quarries or, perhaps more likely, the carnelian mining area 15 km north at Stela Ridge. The mining area at Stela Ridge (see map in Chapter 4) is characterised on the surface as circular, oval and longitudinal subterranean trenches surrounded by spoil heaps (Bloxam 2006). Large pounders and hand axes are variously scattered across the site and the surface is littered with discarded fragments of the gemstone. Ceramics are mainly of the Middle Kingdom late 12th Dynasty (El-Senussi 2004) and concomitant with the quest for gemstones that is a specific feature of raw material consumption in this period (see Bloxam 2006; Shaw and Jameson 1993; Engelbach 1933, 1938; Murray 1939).

Written sources associated with Chephren's Quarry are few. Of the Old Kingdom a stela bearing the cartouche of King Khufu was found in the Central Quarries and a panel of hieroglyphs, inscribed by an 'overseer' of the craftsmen along the ancient transport route, are all that are known. Although the Stela Ridge mining area was damaged by construction of the Uweinat Road in the 1990s, an area of 8 cairns, now largely destroyed, were places where ritual enclosures with stelae and votive objects of the Middle Kingdom were discovered and removed by Engelbach and Murray (Engelbach 1933, 1938; Murray 1939). These objects are now in the Nubian Museum in Aswan.

Large partially worked statue blocks of Chephren Gneiss had to be transported a distance of approximately 1,000 km to the pyramid fields at Giza and hence, the infrastructure to expedite this is one of the unique features of the site. Located in the large boulder quarries where there are statue blanks, particularly in the Central and Northern Quarries, loading ramps usually with artificially dug tracks to accommodate a transport vehicle are of particular importance (see Bloxam 2007; Bloxam 2003). Unlike the purpose-built paved road infrastructure at Widan el-Faras and the West Bank Aswan, no roads were laid despite the overland distance needed to be covered to the Nile (60+ km). This suggests that the ground surface, unlike today, had a load- bearing capacity and moreover, is the possibility that the Wadi Tushka, approximately 15 km from the quarries, played a role in the transportation process as the nearest source of water (Bloxam 2000; Bloxam 2003).

An unpaved track marked by a sightline of cairns (see map) and natural landmarks was discovered by Engelbach and Murray (Engelbach 1933, 1938; Murray 1939) as perhaps one of the transport routes from the quarries during the Old Kingdom. Dropped pieces of Chephren Gneiss, two camps with bakeries and nearby shallow groundwater wells for watering both humans and animals, characterise these well-preserved 3rd millennium BC features (Bloxam 2003). Hence, in similar fashion to the Northern Faiyum and the West Bank Aswan, transport routes and their associated material culture create an extensive quarry landscape.

Reconstructing significance in a landscape of destruction

To archaeologists and geologists studying stone procurement in antiquity, the significance of Chephren's Quarry probably lies in the unsurpassed achievements in quarrying and

transporting blocks of hard stone over 1,000 km to the pyramid fields at Giza 5,000 years ago. To pursue this end, the archaeological record presents a snapshot of how this was achieved through roughed-out object blanks, tools, loading ramps to facilitate transport of the stone, camps for the quarrymen and wells for water supply, as described. The end product of these activities, most conspicuously the Khafre statues, are some of the finest achievements in stone crafting known in antiquity (Bloxam 2007; Bloxam 2003; Storemyr *et al*., 2002; Harrell and Brown 1994; Engelbach 1938). Yet, outside of those interested academics and professionals, Chephren's Quarry is invisible – the area only knowable (to some) as a place where the building of canals as part of the Tushka Hydrological Project aims to make the 'empty' desert 'green' (as discussed in Chapter 4).

However, there is a significant link between the relict quarry landscape linked to stone procurement 5,000 years ago and the canal building today. In essence, both projects are inextricably linked to water and the climatic and environmental conditions of their time. From the archaeological evidence described it seems that quarrying, transporting of stone and subsistence of the labour force was only possible due to favourable climatic conditions, perhaps seasonally wetter, which provided groundwater close to the surface (Bloxam 2003). This is indicated by several shallow wells found in the quarries and along the stone transport route, at approximately 1 metre in depth. Although more speculative, is has been hypothesised that the Wadi Tushka may have played some role in providing access to a source of water for the transportation process to the Nile (Shaw and Bloxam 1999; Bloxam 2000, 2003). Written sources such as the Khufu Stele found in the quarries, although caution is always required in assuming these as representational, describes this landscape as being quite fertile, even an oasis where wine may have been produced called the 'Place of Catching Birds' and 'Place-of-the Fisher' (Rowe 1938: 394-5). The current Tushka Project (see Chapter 4) is rather ironically trying to re-create these conditions, by trying to bring the water back. Yet in the process the developers (and national government), perhaps unknowingly, are destroying the evidence of a past that utilised and lived in the environment they are artificially trying to re-create today.

In these formative stages of articulating significance of this world-class ancient quarry landscape already invaded by the Tushka Project canals, is to get across that as much as the canals are deemed part of a necessary intervention in the landscape today, there is *added value* associated with the integration and preservation of the evidence that it *was* a lived-in environment 5,000 years ago. There could be much national political cachet and value attached to taking such a perspective, particularly linking the legacy of Pharaonic royal power to achieve outcomes in this landscape as having significant reverberations into the present day. Models of significance in this case should perhaps aim to bring the deep past and present together under an environmental theme – internationally this is one of the burning issues of the day. Moreover, the controlling of water resources can often be seen as a principle thread in shaping landscapes (McGlade 1999). Although the final aims of stone quarrying 5,000 years ago and canal building today differ, the imprint they have left on the landscape importantly reminds us, failed or otherwise, of the political, technological and ideological ambitions of their time.

Discussion

The above has attempted to convey the problematics of viewing, in terms of conservation, preservation and the assessment of risks, ancient quarries in simply site-specific terms as representing enclosed and bordered archaeological sites just at the stones' source. The notion

of a 'quarry landscape' has been forwarded as a concept that allows for the inclusion of the diverse range of material culture that can comprise such sites – often spread across large areas. Moreover, it has been argued that this is a crucial construct if the archaeological integrity of these sites is to be maintained. As demonstrated, the three case study areas present a diverse range of material culture in a range of archaeological and modern contexts, necessitating the need to build flexible models of significance that are transportable across a range of other quarry landscapes in Egypt. The methodological approaches described are just some examples of how approaches to articulating significance can be drawn. Concepts from landscape archaeologies, social archaeology, ethnography and anthropology are just some of the analytical tools that can aid in grappling with the often fragmented range of material culture associated with ancient quarries.

Yet importantly, significance and the notion of a 'quarry landscape' needs to be accessible and relevant across a range of levels and interests if there is to be any hope in conserving and protecting these landscapes. Hence, using World Heritage criteria such as 'outstanding universal value' can in some way present a more accessible and broader picture of significance cross-culturally. Although conserving such large quarry landscapes needs to be balanced against modern development needs, it is important that the necessary theoretical tools to disseminate significance can be employed in discussions that surround which elements of an ancient quarry landscape are more crucial to conserve than others. Often, this may not necessarily be those elements that are most visible.

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Chapter 4

Retrospective monitoring of ancient Egyptian quarry landscapes 1965-2007

Per Storemyr

Introduction

This chapter explores what has happened to selected quarry landscapes over the last 40-50 years and assesses the future risks facing these landscapes. The QuarryScapes case studies, presented in Chapter 3, at Chephren's Quarry (Southern Western Desert), Aswan (especially the West Bank) and Widan el-Faras (Northern Faiyum) form the basis for visualisation and evaluation, but also Gebel el-Ahmar in Cairo will be described.

The methodology used for visualisation of the modern development and risk assessment is based on interpretation of satellite images, topographic maps, development plans, conversations with local residents and heritage authorities, as well as fieldwork and field visits between 1999 and 2004, and within the QuarryScapes project between 2005 and 2007. Information has been incorporated into specifically designed GISs for each area, which also include all information collected during the archaeological and geological surveys. The structure of the GIS of the West Bank of Aswan is explained in Storemyr & Heldal (2007). This explanation is also valid for the other case studies (except Gebel el-Ahmar, which has not been subject of fieldwork).

Interpretation of US declassified satellite imagery (Corona, KH7) has proven particularly useful for understanding the situation 40-50 years ago. In the best cases such images have a resolution of about 6 feet (c. 2 m), which implies that even small features are visible. Otherwise, Landsat images from c. 1990 (25 m resolution) and c. 2000 (14 m resolution) have been used for interpretation of large-scale development features, whereas Ikonos (2000, 1 m) and QuickBird (2005, 0.6 m) images have added to the interpretation of recent development. Google Earth is a particularly important source of information into modern development around ancient quarry areas and other archaeological sites, especially in those cases where high-resolution images (QuickBird) are available. Such images cover most of the Nile Valley and many parts of the adjacent desert areas.

Gebel el-Ahmar, Cairo

Gebel el-Ahmar, or "the red mountain", was a key silicified sandstone quarry in Pharaonic Egypt. It is situated at the edge of the Mokattam hills just to the south of Abbasiya in the

Figure 30: The Cairo area in 1965. Corona satellite image.

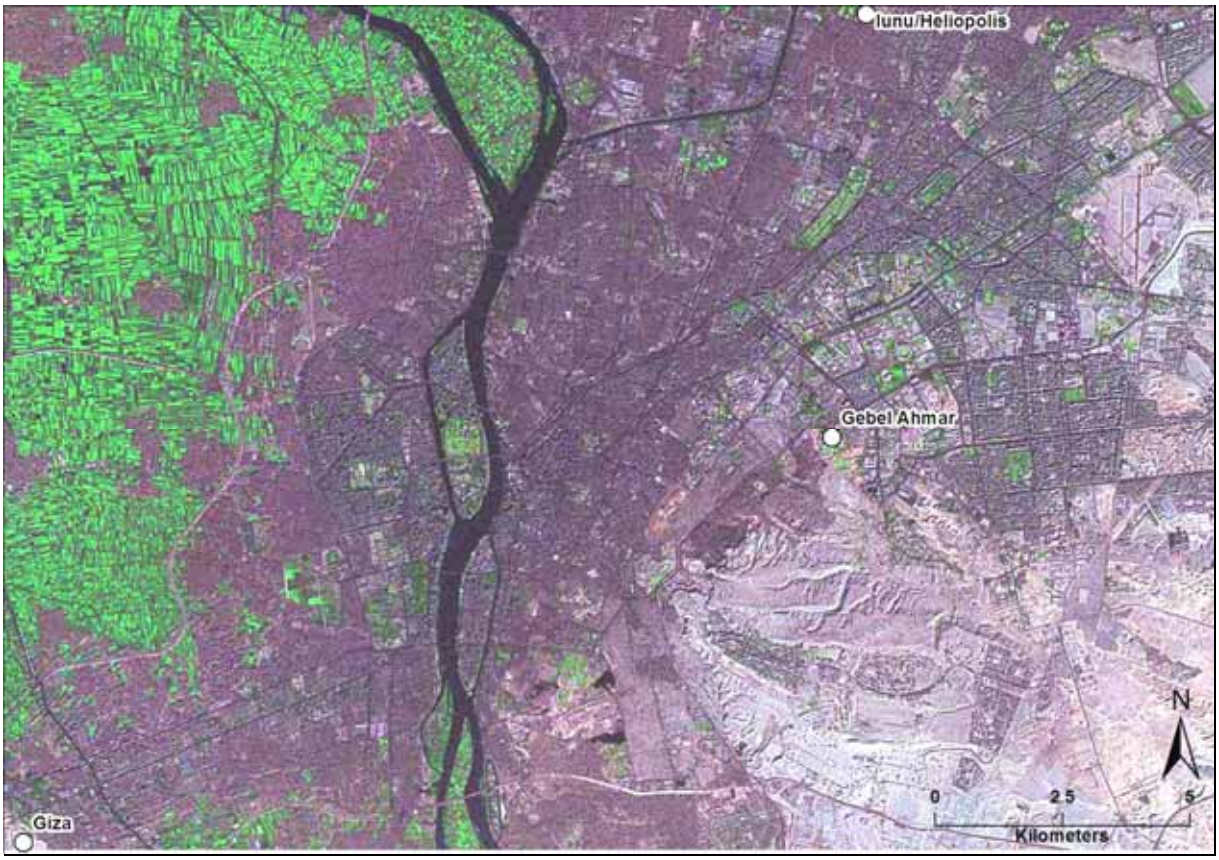

Figure 31: The Cairo area in 2000. Landsat satellite image. Note the development of the eastern part of the city around Gebel el-Ahmar, as compared to 1965 (image above).

Figure 32: The environs of Gebel el-Ahmar in 1965. Corona satellite image

Figure 33: The environs of Gebel el-Ahmar in 2005. QuickBird satellite image. Note the development since 1965 (compare with image above).

eastern part of Cairo, between the Citadel and modern Heliopolis (Klemm & Klemm 1993:284ff; Aston 1994:33ff; Aston et al. 2000:53f) (Figure 30, Figure 31). The significance of the quarry is largely related to its location close to ancient Heliopolis (Iunu), the solar capital of Pharaonic Egypt a few kilometres to the north (Quirke 2001:76ff; but see also Raue 1999:20ff and Bloxam 2007). Moreover, its importance was also connected to the properties of the silicified sandstone, in particular its colour, which ranges from red to gold and which was related to Pharaonic solar cults (ibid; Heldal *et al.* 2005; Bloxam & Storemyr 2005). The quarry was thus a good source of a prestigious, symbolically laden stone, but it may also have held significance as a landmark. Moreover, ancient trade routes from the east naturally converge in the area – a feature which may have added to the significance of the quarry (Quirke 2001:80).

Silicified sandstone from Gebel el-Ahmar has a long history of exploitation throughout antiquity and also into the modern era (see Klemm & Klemm 1993: map p. 286). In the early 19th century several ancient unfinished objects and inscriptions could still be observed (Klemm & Klemm 1993:284f; Aston 1994:33ff; Aston et al. 2000:53f; Raue 1999:20ff – and references therein), but by the investigations of the Klemms in the late 1970s and early 1980s which were severely hampered the area's use for military purposes, these had disappeared. Also, the only visible remains of the ancient quarries were tool marks showing the extraction areas and some ramps and quarry roads.[28] Modern buildings had started to take over the quarry area, the most prominent a casino, located at the highest point of the old site (Figure 34). This was built after 1965, as it is not located on a Corona satellite image from this time (Figure 32). Since the 1980s the quarries have become almost completely overbuilt which in addition to the casino include a hospital, two sports stadiums and other sports grounds, resorts with swimming pools, warehouses, residential areas and a network of large roads (Figure 33, Figure 34). Moreover, remaining hillsides and quarry faces are plastered with stone. Despite continuous heavy construction work there are still a few small hilly islands were the red colour of the stone can be admired and which might show traces of ancient workings.

Given its location within one of the world's largest and continually expanding cities,[29] it is no wonder that the area at and around Gebel el-Ahmar has been pivotal for necessary modern infrastructure. In 1965 the limit of built areas around Cairo was approximately in the vicinity of the ancient quarry, since then it has moved many kilometres beyond as the city's population has more than tripled from about 5 million to more than 17 million people (Figure 30, Figure 31).[30]

Although this significant ancient quarry has been known for more than a century, it seems that no particular protection efforts have been undertaken to save what remains from being overbuilt. This probably reflects the fact that the quarry did not display any monumental archaeological features, contrary to e.g. the Unfinished Obelisk Quarry, which has been protected as a small island within modern Aswan (see below). This may also reflect the difficulties associated with protecting archaeological remains within military areas – and of course the extreme pressure on land in a modern mega-city.

Gebel el-Ahmar is a unique quarry with a special history of destruction. After 3,000 years of use and 2,000 subsequent years during which very little happened to the quarry, it only took

[28] See Klemm & Klemm (1993:284ff), and also descriptions of tool marks in Gebel el-Ahmar by Clarke & Engelbach (1990[1930]:30f). The latter description claims that metal tools were used in the Pharaonic period, which is erroneous. The described tool marks probably belongs to the Graeco-Roman period.
[29] See e.g. Yousry & Aboul Atta (1997) and www.isl.uni-karlsruhe.de/vrl/ResEng/global_trends/cairo/index.htm
[30] See also satellite images at http://na.unep.net/digital_atlas2/webatlas.php?id=178

40-50 years to almost completely eradicate this significant landmark with its ancient workings.[31] Less unique ancient quarries in the vicinity, such as the Mokattam limestone quarries by the Cairo Citadel have also been destroyed (Figure 35), but still not as thoroughly as Gebel el-Ahmar.

Figure 34: The modern landscape within the Gebel el-Ahmar quarry in 2006. Inserted is a picture of the casino at the highest point (photo: Per Storemyr)

Figure 35: The Mokattam limestone quarries by the Cairo Citadel (photo: Per Storemyr 2006)

[31] Since it is unknown whether some archaeological remains might still be visible, it would certainly be an idea to thoroughly investigate the area and perhaps even protect possible remains for residents and visitors.

Widan el-Faras, Northern Faiyum Desert

The expansion of greater Cairo is also part of the reason why another unique ancient quarry, the Widan el-Faras Old Kingdom basalt quarry at Gebel Qatrani in the Northern Faiyum Desert, has been partially destroyed with the surrounding landscape now under increasing pressure. The significance of Widan el-Faras and the Northern Faiyum archaeological landscape, including the Umm es-Sawan Old Kingdom gypsum quarries and a wealth of other sites, has been outlined and discussed in terms of significance in the previous Chapter 3.

Until only 15-20 years ago, the Northern Faiyum, situated within 30 to 90 kilometres southwest of the Giza pyramids, was a remote, barren desert landscape, hardly affected by large-scale development projects, tourists or people living along the southern border of the area (Kom Aushim and the southern shores of Lake Qarun). However, quarrying of basalt for road building, railway line construction and other work started already a long time ago, perhaps as early as in the first half of the 20th century, as determined by close inspection of satellite images and field visits. The reason for this modern quarrying is that the basalt outcrops from Abu Roash and Giza to Gebel Qatrani are of particular value; they represent the only sources of hard stone for modern construction works in Lower Egypt and the northern part of Middle Egypt and are even considered a national strategic resource (Hussein 1990:564). In the early days, modern quarrying seems to have had a small-scale, artisan character, but this changed from around 1960, when large quarries were opened at Gebel Qatrani. Widan el-Faras was not affected in the first place, but gradually the modern quarries closed in on the ancient workings, and from 2001-2002 the old extraction areas became the victims of the modern activity (Figure 36, Figure 37, Figure 38, Figure 39). Since then about one-third of the ancient basalt quarries have been destroyed (Storemyr *et al.* 2003; in press).

None of the countless archaeological sites in the Northern Faiyum Desert (Figure 42) is owned by or under the supervision of SCA[32] and there has been virtually no cultural heritage management of the area until now. However, a large part of the area has, since 1989, enjoyed status as a nature protectorate (Lake Qarun Nature Protectorate), mainly due to its exceptionally rich tertiary fossil record (cf. Simons & Rasmussen 1991). However, this status has not prevented destruction, as indicated by the modern quarrying at Widan el-Faras. This quarrying contravenes the nature protectorate law (no. 102 of 1983), according to which it is illegal to undertake activities such as quarrying within the borders of a protectorate.[33] Much effort has been devoted by QuarryScapes and previous projects to stop the modern quarrying, with SCA/EAIS from 2006 taking a leading role in this work (cf. Storemyr *et al.* 2003; in press). This strategy eventually led to a governorate decision on non-renewal of quarrying licences[34] for the companies operating at Widan el-Faras and since 2006 the most obvious destruction has stopped or been relocated. However, until the site is under controlled supervision of SCA, it is likely that modern activities can resume at any time.

Modern quarrying and mining have traditionally posed the greatest risks to ancient quarries. With the Northern Faiyum now becoming sandwiched between expanding Cairo and

[32] See www.eais.org.eg/index.pl/Al-Fayyum. An exception is the Kom Aushim Graeco-Roman archaeological site.
[33] This is a general problem in nature protectorates in Egypt; another example of illegal destructive activity can be found in Wadi Digla on the east bank of the Nile close to Cairo, see e.g. http://weekly.ahram.org.eg/2001/519/feat1.htm and www.aucegypt.edu/resources/smc/newsstory.cfm?newsid=424
[34] Modern quarry companies need governorate licences for extraction of stone, whereas mining activities are regulated on a state level. See further description of legal issues of modern quarrying and mining in Chapter 6

Figure 36: Basalt crushing machines by the modern basalt quarries at Widan el-Faras. The crushed basalt is used for e.g. road building (photo: P. Storemyr 2005)

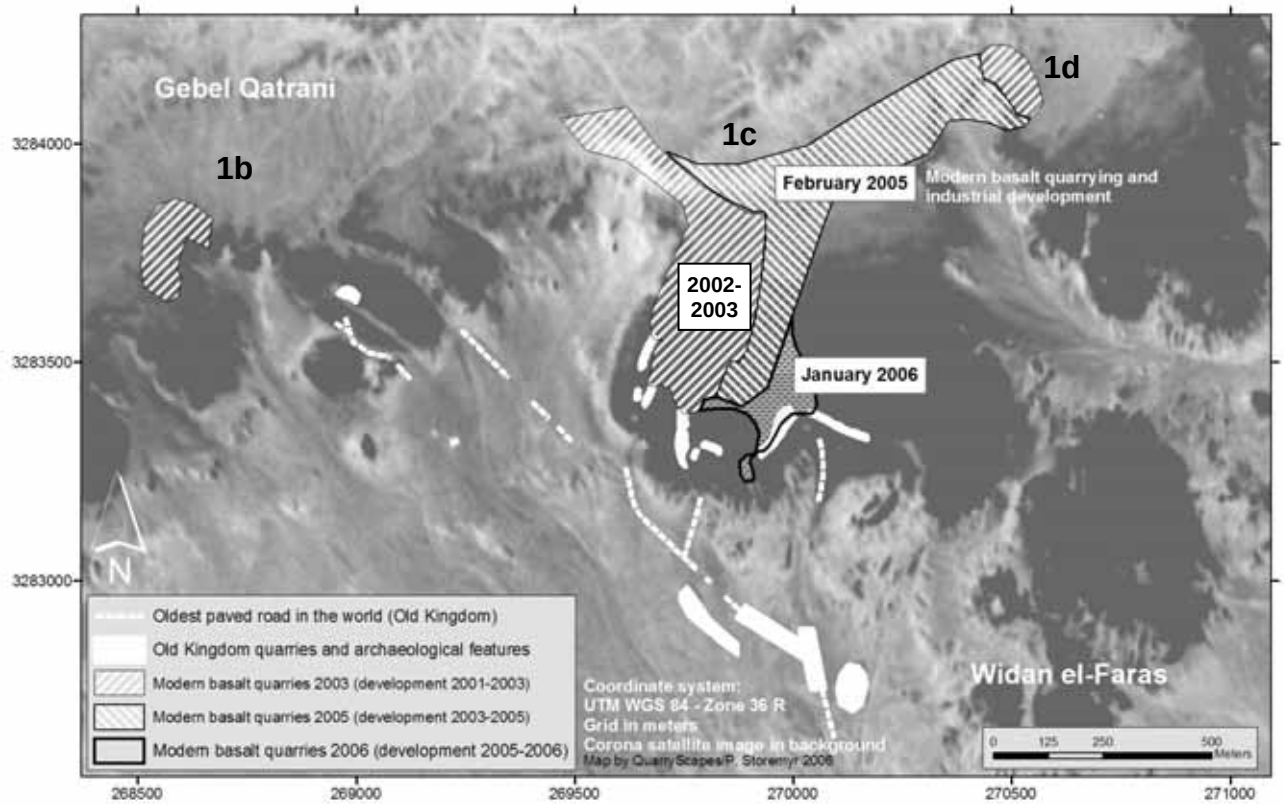

Figure 37: Monitoring of the development of the modern basalt quarries at Widan el-Faras, 2001-2006. Map by QuarryScapes/Per Storemyr 2006

Figure 38: The eastern part of the ancient basalt quarries at Widan el-Faras in 2001. The quarry on the picture was opened in the Old Kingdom, but also used in the Roman period. Lake Qarun in the background (photo: P. Storemyr 2001)

Figure 39: The same ancient quarry as above, destroyed by bulldozers in 2005-2006 (photo: P. Storemyr 2006)

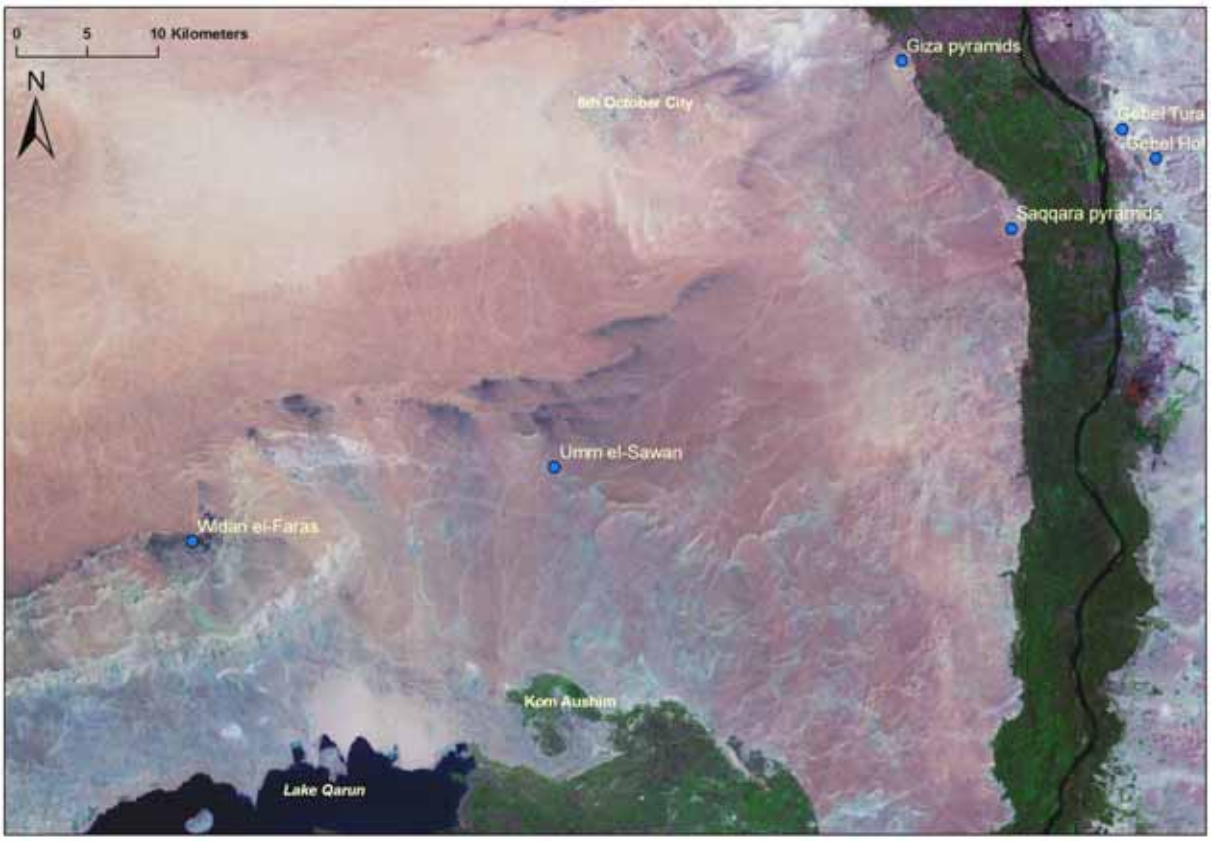

Figure 40: The Northern Faiyum in 1990. Landsat satellite image

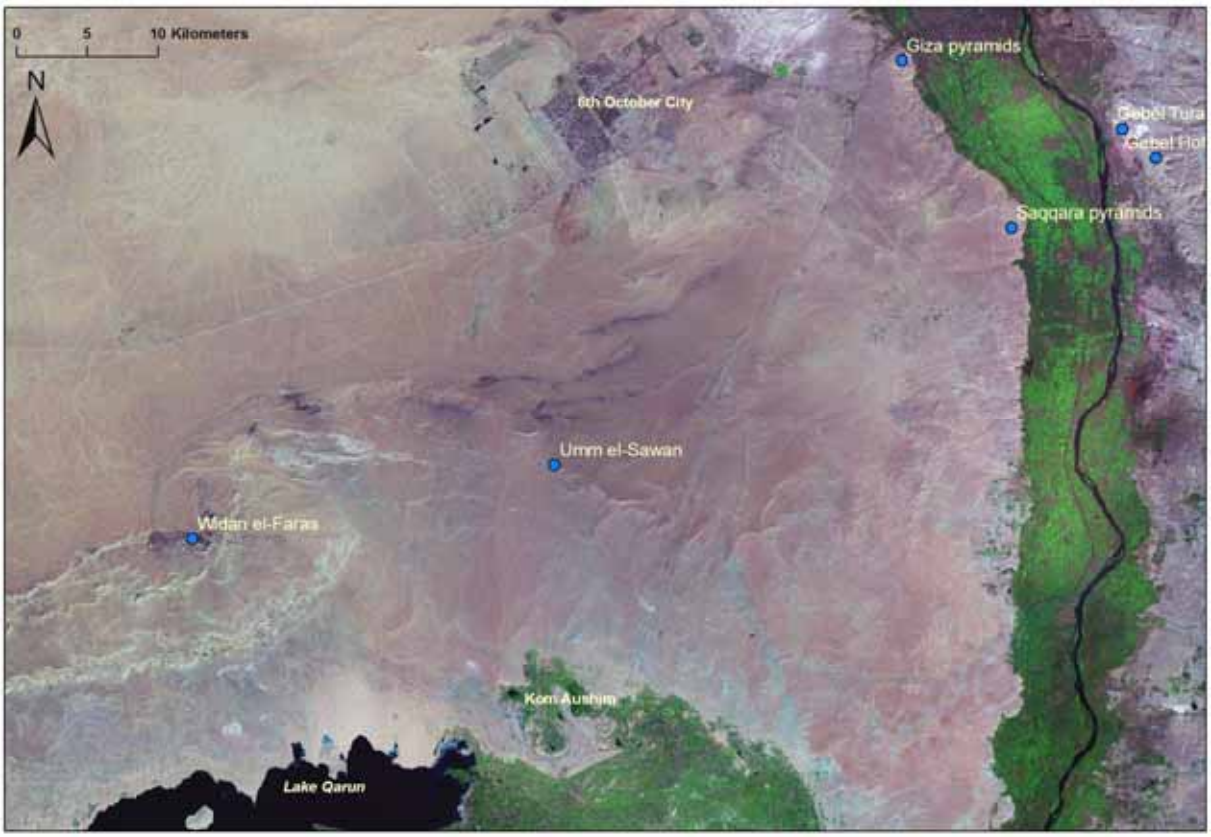

Figure 41: The Northern Faiyum in 2000. Landsat satellite image. Note the development of 6th of October City.

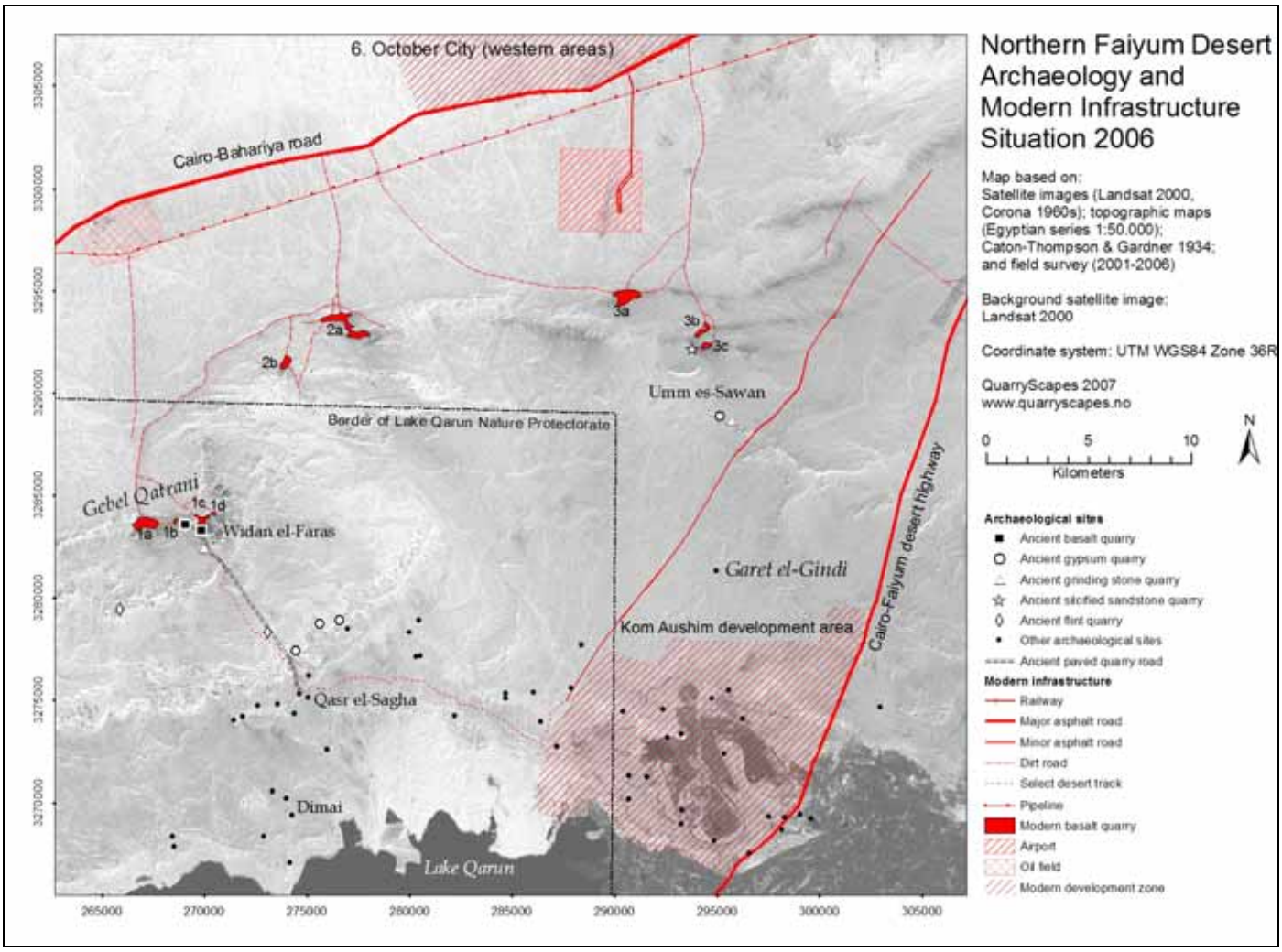

Figure 42: Overview of archaeological features and modern infrastructure in the Northern Faiyum. Map by QuarryScapes/Per Storemyr

expanding Faiyum (Kom Aushim), new risks will soon supersede the traditional ones in this region. Industrial and residential areas of the 6th of October City, a satellite city of Cairo developed from the 1970s (Yousry & Aboul Atta 1997), have already moved more than 40 km into the Western Desert and is now a mere 25 km away from Widan el-Faras (Figure 42). In the 1990s petroleum exploration started north of Widan el-Faras[35] and a modern airport was established about 10 km to the north of Umm es-Sawan. In the not too distant future one can probably envision modern development projects across the plateau between Gebel Qatrani and the Cairo-Bahariya road. The environs of Umm es-Sawan have until recently been a military area, which now seems to have become discontinued. However, large land reclamation projects are currently taking place between the industrial development zone at Kom Aushim and Umm es-Sawan. This land reclamation does not yet pose an acute threat to the ancient gypsum workings, but since there is potential agricultural land around the ancient quarry, it may only be a matter of time before this area is also selected for agricultural projects. Otherwise, industrial and agricultural development at Kom Aushim has already severely impacted on many of the famous archaeological sites that were originally investigated by Caton-Thompson & Gardner (1934). An archaeological project, including a field school for SCA inspectors, headed by Prof. Wendrich works in this area, also trying to protect what is left.[36]

[35] See website of AAPG; www.aapg.org/explorer/2002/08aug/egypt.cfm, also John Dolson, pers. comm. 2006
[36] www.archbase.com/fayum/index.html

Figure 43: Tracks of desert driving along and partially on the ancient quarry road on the middle plateau between Qasr el-Sagha and Widan el-Faras (photo: P. Storemyr 2006)

Due to much easier accessibility through new roads and tracks in the Northern Faiyum and the availability of 4WD cars, over the last 10-15 years the area has become increasingly popular with tourists and desert travellers. On the one hand this is a positive development because it may increase the awareness of archaeological and natural sites and the special character of the landscape. Yet on the other hand, because there is virtually no heritage management of the area, it is impossible to stop visitors from looting and vandalising sites. Since many fragile sites, such as ancient settlements, are hardly visible to the untrained eye, many people don't even know that they may be driving directly across valuable archaeology. A special case is the well known Old Kingdom quarry road from Widan el-Faras to Qasr el-Sagha. Many people take a look at this road by driving along and across it, which causes rapid deterioration (Figure 43). Theft of artefacts such as ancient stone tools and pottery sherds is also very common in the area.

It appears that soon the landscape as a whole will become even more accessible than it was before. An asphalt road is intended along the desert track between Kom Aushim and the western shore of Lake Qarun, probably linked to a new city planned in this area[37] and the Cairo-Bahariya road. Moreover, it seems that the northern shore of the lake has been designated for development of high-standard residential areas and tourism.[38] Without official protection of the archaeological sites and the introduction of an efficient management regime, the effects of these plans on the heritage of the area might become disastrous.[39]

[37] Called "New Kouta", see http://www.urban-comm.gov.eg/english/cities.asp. See also article in The Egyptian Gazette, 26.7.2004, on the dispute regarding the planned asphalt road along the shores of Lake Qarun

[38] Samir Ghabbour, pers. comm. 2007

[39] For the landscape at large the fortunate situation arose that the Egyptian branch of UNESCO and the national environmental authorities in 2006 decided to nominate parts of the Northern Faiyum as a World Heritage Site

The Aswan quarry landscape

As described in the QuarryScapes report by Bloxam *et al.* (2007) and outlined in Chapter 3, Aswan is one of the largest and most long-lived quarry landscapes in the world. Contrary to the Northern Faiyum, which exhibits rather small ancient quarries spread across a large desert landscape, the East and West Bank of the Nile at Aswan features more than 100 square kilometres of almost continuous ancient quarrying activities from the Palaeolithic to the Byzantine period (Figure 44). It is a very complex quarry landscape – and it has an equally complex history of modern impact over the last century. A synopsis of this impact has been made by Storemyr (2007) and in the following we will concentrate on a part of the granite quarries on the East Bank, as well as the silicified sandstone quarry landscape on the West Bank. The latter area has been surveyed in detail by QuarryScapes, whereas the former has been subject to recent investigations by Adel Kelany and his team from SCA.

The Unfinished Obelisk and granite quarry landscape

The famous New Kingdom (and Graeco-Roman) Unfinished Obelisk granite quarry is located within the modern city of Aswan. Yet 40 years ago the situation was entirely different, as the quarry had not been encroached upon by urban expansion. These 40 years have brought enormous changes to Aswan, with the construction of the High Dam in the 1960s as the most important single event. The population is now close to 300.000, almost six times higher than in 1960 (Figure 47). Thus, at first glance the development might look similar, though at a much smaller scale, to what has happened at Gebel el-Ahmar in Cairo (described above). However, with its monumental appearance, the Unfinished Obelisk is the most famous ancient quarry in Egypt, visited by thousands of tourists every year. Over the last decade it has also been almost completely archaeologically excavated and a modern outdoor museum has been developed in and around the quarry. Since 2005 the area has been under protection by SCA (the area is the property of SCA).

There are also other differences when comparing the "non-monumental" Gebel el-Ahmar quarry area with the Unfinished Obelisk quarry. Although we will never really get to know its context, Gebel el-Ahmar does not appear to have been embedded in a larger quarry area, whereas the Unfinished Obelisk is just one element of a continuous ancient granite quarry landscape that stretches from downtown Aswan in the north to Shellal and the Aswan Old Dam in the south, a distance of more than five kilometres. Significant parts of this quarry landscape have over the last century and in particular the last 40 years been overbuilt. In addition, the ancient workings have been massively destroyed by modern quarrying. Modern extraction started in the late 19th century (Röder 1962) and Aswan granite has remained one of the most popular natural stones in Egypt.

Modern quarrying of Aswan granite takes place in bedrock. One of the few ancient granite extraction sites that went into bedrock is the Unfinished Obelisk quarry. Otherwise, granite boulders on the surface were targeted, especially in the early phases from the Old Kingdom

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(WHS) on the basis of its fossil record and as an extension of Wadi Al-Hitan ("Whale Valley"), an already existing natural WHS to the west of the area (http://whc.unesco.org/en/list/1186). Much effort has been devoted by QuarryScapes to ensure that the ancient quarries and other archaeological sites were also used as arguments for inscription; as a combined natural and cultural WHS (cf. Storemyr *et al.* 2003, in press; Bloxam and Heldal 2007). Unfortunately, neither the nomination as such, nor the QuarryScapes effort has yet proved successful. However, the Egyptian State Party aims at resubmitting the nomination of the area in 2008. Note that WP6 of QuarryScapes aims at producing a management concept for the Widan el-Faras area.

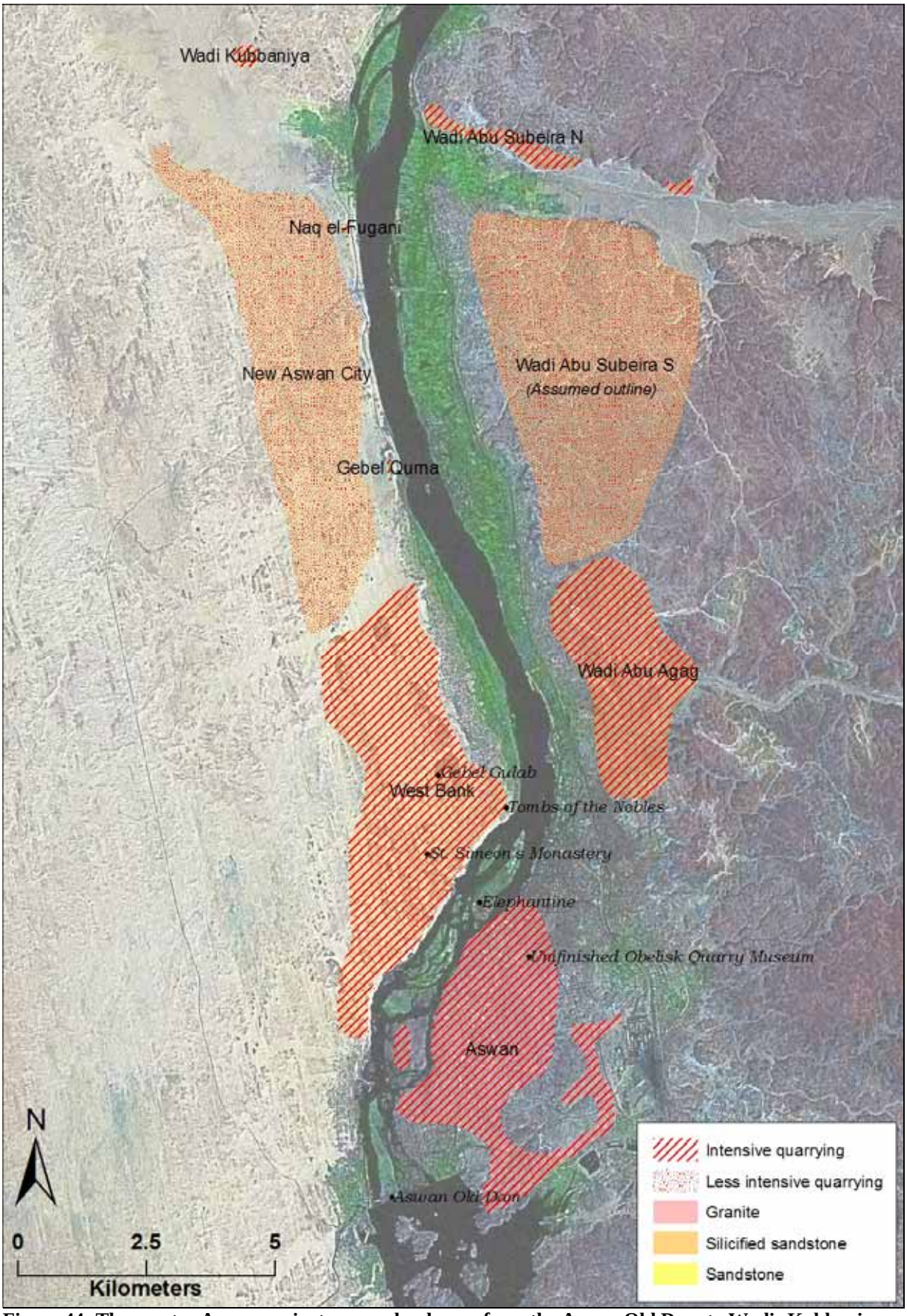

Figure 44: The greater Aswan ancient quarry landscape from the Aswan Old Dam to Wadis Kubbaniya and Abu Subeira. Map (projected on Landsat satellite image) by QuarryScapes/Per Storemyr

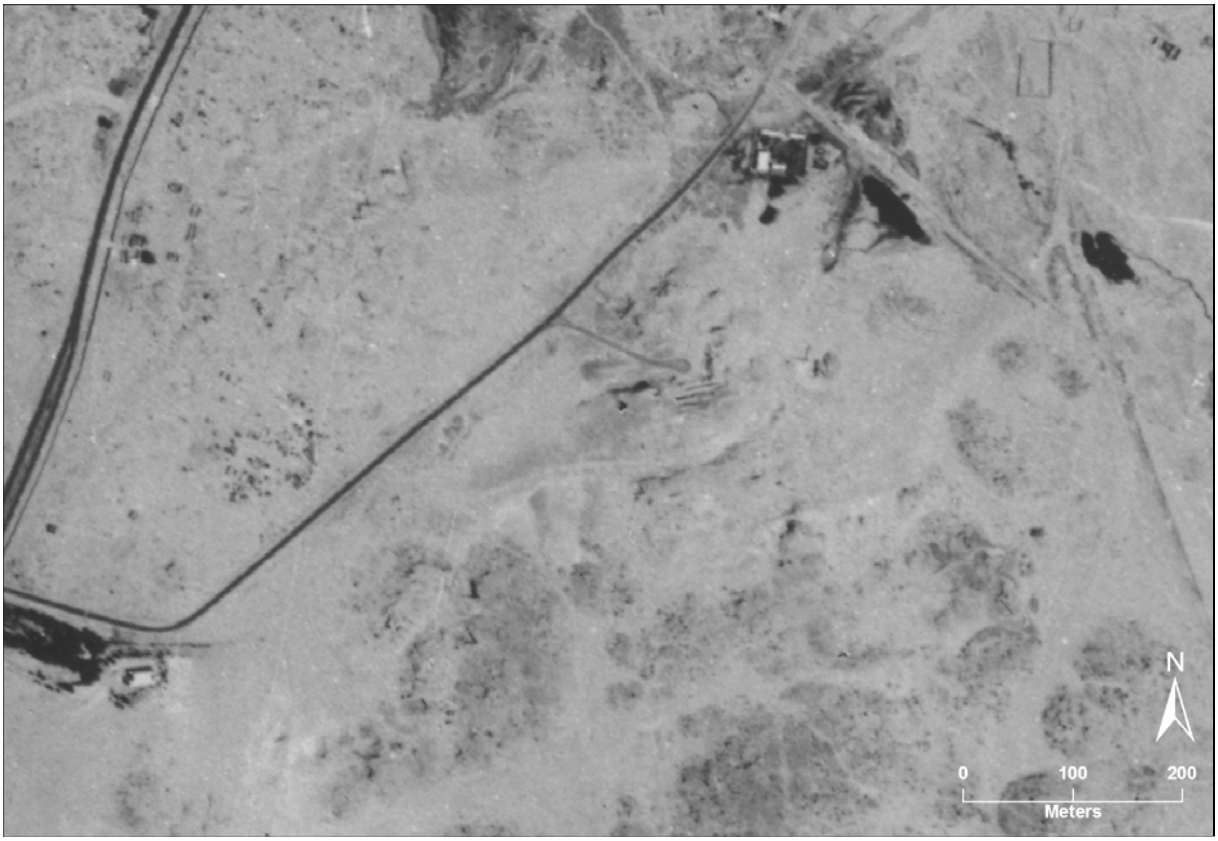

Figure 45: The environs of the Unfinished Obelisk quarry in Aswan in 1965. Corona/KH7 satellite image.

Figure 46: The environs of the Unfinished Obelisk quarry in Aswan in 2005. QuickBird satellite image. Note the development of residential areas around the quarry (compare with image above), which is protected by the SCA (dotted outline).

Figure 47: The population development in Aswan since 1880 (source: www.populstat.info)

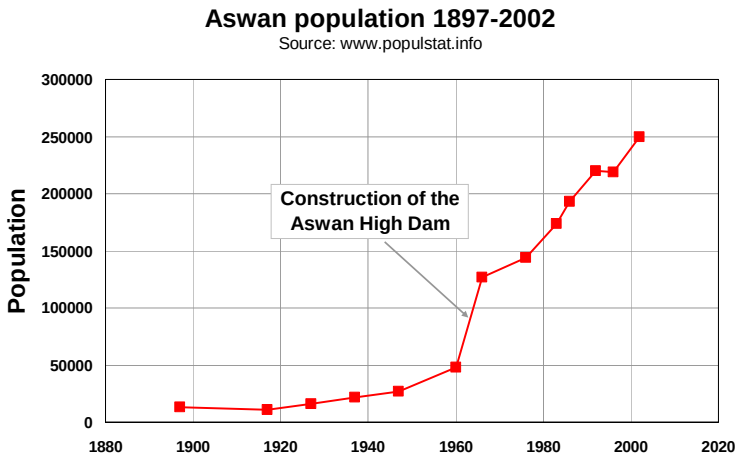

Figure 48: The Unfinished Obelisk outdoor quarry museum in Aswan (photo: Per Storemyr 2005)

onwards. This is the main reason why the quarry landscape over the millennia became so extensive, and also the main factor as regards vulnerability towards modern development and quarrying. Clearly, it is more difficult to preserve such an extensive quarry landscape as compared to bedrock quarries, which often occupy rather limited areas, but may be large in terms of volume extracted. Moreover, boulder quarries do not feature impressive quarry faces or underground galleries, thus they might not be very attractive from a modern visitor perspective and even difficult to properly recognise and value by heritage authorities. The Aswan branch of SCA is currently undertaking rescue surveys to determine the nature, extent and significance of the remaining ancient granite extraction areas in Aswan, and also cooperates with modern quarrying companies in order to save as much from further destruction as possible.[40]

[40] See further description in Chapter 9.

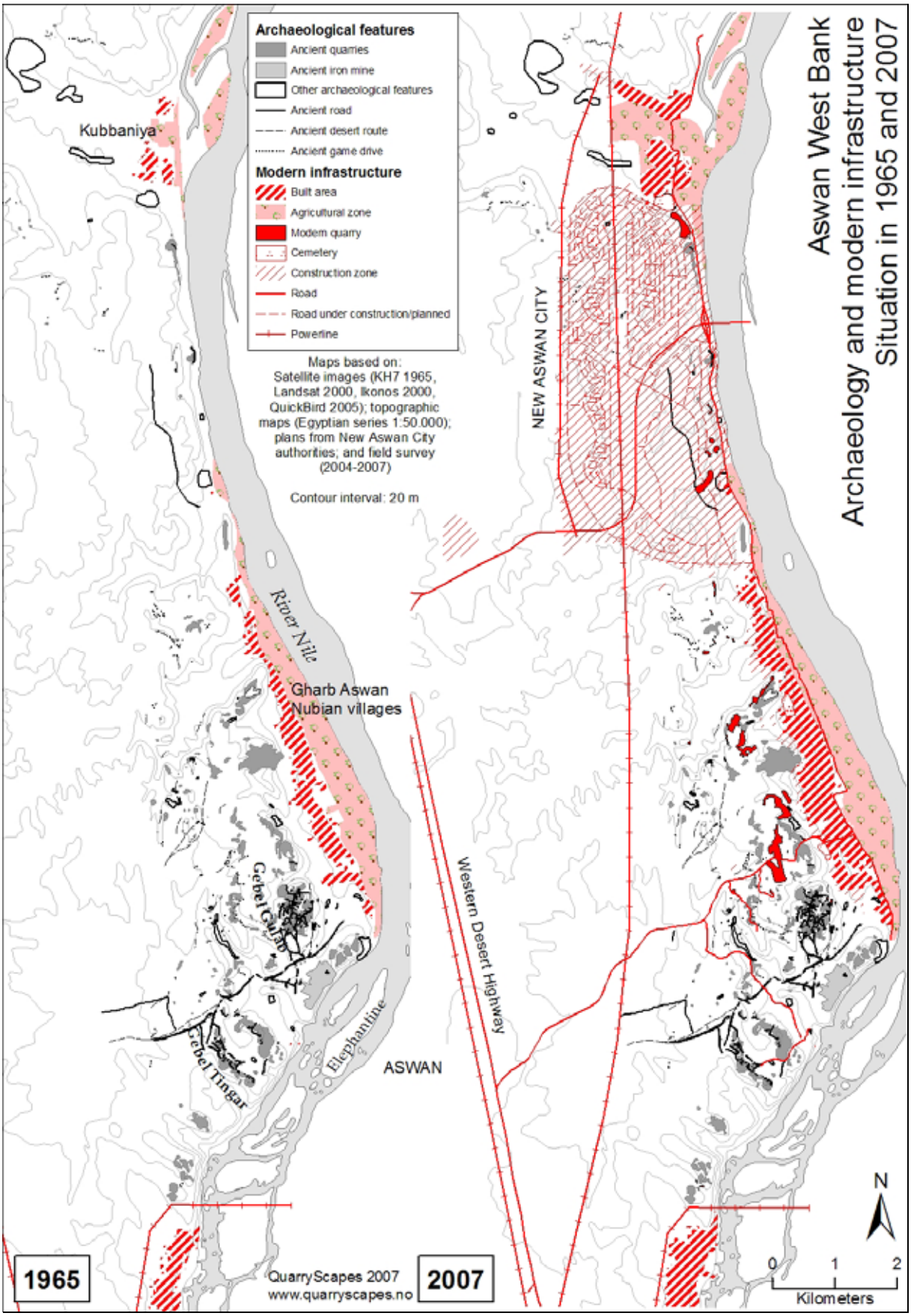

Figure 49: The Aswan West Bank ancient quarry landscape and the development of modern infrastructure between 1965 and 2007. Map by QuarryScapes/Per Storemyr

The West Bank quarry landscape

The West Bank silicified sandstone quarry landscape also predominantly consists of boulder extraction areas, although in the New Kingdom there is evidence for large object extraction and grinding stone procurement that went into bedrock (Heldal & Storemyr 2007). Although it is the southern part that shows most continuous quarrying activity and also features a 20 kilometres long ancient quarry road network, the quarry landscape as a whole is 20 kilometres long, stretching from Wadi Kubbaniya in the north to Gharb Sehel in the south. The quarry landscape is also exceptionally rich in other archaeological remains, such as cemeteries, monasteries, rock art, inscriptions, ancient game drives, and evidence of ancient desert travel (Bloxam *et al*. 2007).

Apart from some modern quarrying,[41] westward expansion of the Nubian villages at Gharb Aswan, now home to more than 30.000 people (Jennings 1995), and minor looting, this serene desert landscape was extremely well preserved until recently. However, building of power lines (to the west of the actual quarry area) from the Aswan Dam (finally completed in 1934) and the High Dam (completed in 1970), as well as associated building of roads and tracks, followed construction of the dams. The main road along the power lines was also linked with the Nubian villages at the West Bank before 1990.

Since 1999 the situation has drastically changed. Although planned long in advance, 1999 marked the starting point for the construction of New Aswan City, situated between Gebel Qurna in the south and Wadi Kubbaniya in the north, a stretch of about six kilometres. New Aswan City, which will house approximately 100.000 people, is part of a long-term national programme of building new urban areas, often in desert regions adjacent to the Nile. The main objectives are to relieve massive population pressure in existing centres, create additional land for industry and agriculture, as well as facilities for tourism.[42] Following the now ongoing construction of the city, a new bridge, inaugurated in 2002, has also been built across the Nile. This bridge will not only serve the new city, but be a major link in the expanding road network in Upper Egypt, especially as regards transportation of goods and products from Toshka, a mega land reclamation scheme 200 kilometres south of Aswan (see next section).[43] Associated with this development is also the new desert highway between Aswan and cities further north, such as Edfu and Luxor. This road is linked with the new bridge and the new city and follows the existing power lines.

For the rich archaeology in the area the construction of New Aswan City is a disaster, especially since no survey or excavation was undertaken before the work began. However, QuarryScapes, in cooperation with SCA in Aswan, has surveyed as much as possible since 2005 and cooperation with the New Aswan City Authorities has been established in order to save the most significant archaeological remains.[44] Of course, it will now only be possible to protect small islands within a soon-to-become urban landscape, for instance the small, but

[41] Before 2000 there were three rather large modern non-silicified sandstone quarries to the north of Gebel Gulab (at the moment discontinued) and several very small ones along the hillsides close to the Nubian villages. The latter quarries had an artisan character and were used for local house building. Many are still used; at the moment there is e.g. activity in the vicinity of Wadi Faras. In the northern part of the area many modern quarries have been or are in operation as a result of the construction of New Aswan City.

[42] See the website of the New Urban Communities Authorities; www.urban-comm.gov.eg/english/aswan.asp. See also Stewart (1996) on new urban centres in desert areas.

[43] See interview with the Aswan governor in Al-Ahram Weekly 2003, issue no. 661 at http://weekly.ahram.org.eg/print/2003/661/eg2.htm

[44] See description of the work in Bloxam *et al.* (2007). Another ongoing survey of the area is described in Gatto (2005) and Gatto and Guiliani (2007). See also Chapter 9.

significant Naq el-Fugani sandstone quarry, some rock-art sites and hopefully examples of some of the presumably very ancient grinding stone procurement sites.

It is highly probable that New Aswan City can be envisioned as the start of a much more extensive urban development along the West Bank. With land along the Nile becoming scarce, in the not too distant future modern settlements may creep southwards towards the very rich quarry areas with their associated archaeological features around Gebel Gulab and Gebel Tingar. A foretaste of such a development is the recent building (2005) of a new road to St. Simeon's monastery. Although this road is intended for making the famous monastery more accessible to tourists, it also makes the area more accessible for other development. As has been argued in the QuarryScapes reports of Bloxam *et al.* (2007) and Bloxam (2007), the quarry landscape in this area is of global significance. This would warrant its official protection as a coherent landscape, which is probably the only means of preventing it from becoming more or less completely built over in the course of, say, 50 years (cf. Storemyr *et al.* in press).

Figure 50: Modern construction work for New Aswan City beside the ancient sandstone quarry at Naq el-Fugani. The new Aswan bridge in the background (photo: P. Storemyr 2006)

A note on Wadi Abu Agag and Wadi Abu Subeira

The ancient silicified sandstone quarries at the East Bank, between the environs of Wadi Abu Agag in the south and Wadi Abu Subeira in the north, have not yet been surveyed in any detail (but see Harrell & Madbouly 2006). However, it is clear that they represent a long-lived, very extensive and highly significant quarry landscape, which was used for both grinding stone procurement and ornamental stone quarrying, much like the West Bank. Compared to the West Bank, the modern development has been of an entirely different

Figure 51: Part of the grinding stone quarries south of Wadi Abu Agag by Aswan. Above: Modern settlement creeping up the hills of the ancient quarries. The satellite image to the right shows the extent of settlement in 2005. Below: Modern large-scale quarrying has eradicated half of the hill with ancient quarries seen "untouched" on the satellite image to the right. Photos: P. Storemyr; satellite images: Google Earth/QuickBird 2005

Figure 52: Entrance to modern underground clay mines in Wadi Abu Subeira, virtually within a very significant ancient quarry and rock-art area. Photo: P. Storemyr

character, as large-scale iron ore (for the steel industry) and clay mining (for the ceramics industry) has transformed the landscape over several decades. Iron ore mining has now come to a halt, but the clay mining seems to increase in importance, especially around Wadi Abu Subeira (Figure 52). It generally takes place as underground mining, but access and transport roads, as well as extreme amounts of clay dust, make a great impact on the area. In addition, informal and formal residential areas along the western part of the quarry landscape also represent a risk. To the south of Wadi Abu Agag informal settlements of modern Aswan are climbing up the hillsides within large ancient grinding stone quarries – even quarry spoil and discarded grinding stones are used for house building (Figure 51). A central part at the north side of Wadi Abu Agag is a military area and has until now remained relatively well preserved. SCA Aswan is presently conducting rescue surveys on the East Bank, and QuarryScapes has aided these surveys.

Chephren's Quarry, Southern Western Desert

Chephren's Quarry, situated 60 km west of Abu Simbel in the extreme south of the country, is a quarry landscape unlike any other in Egypt. Over an almost 100 square kilometre large, flat desert area, scattered boulders of bluish gneiss were the targets of exploitation for funerary vessels, vases and statues in the 3rd millennium BC. Although the history of the quarry may stretch back into the Neolithic, most of the extraction took place in a limited time span in the Old Kingdom. This means, as in the case of Widan el-Faras, that the quarry landscape gives a unique glimpse into one period of working, as it has not been transformed by other ancient quarrying activities (see Chapter 3).

Remote, hyperarid and hot, the Western Desert in this area of Egypt was completely pristine until the 1970s when the water level of Lake Nasser started to rise after the building of the High Dam at Aswan. Like numerous archaeological sites along the new lake, also a part of the ancient track from Chephren's Quarry to the Nile became flooded in this period. In the late 1970s the construction works began for the so-called Sadat Canal, which is an overflow canal for the lake acting as a safety measure. The canal runs along Wadi Toshka, a former (Pleistocene) tributary of the Nile (Haynes 1980), located at the eastern and northern margins of Chephren's Quarry and its ancient track to the Nile. The canal allows water levels of Lake Nasser higher than 178 m to be drained off into a series of depressions of Wadi Toshka.[45] Overflow from Lake Nasser was first observed in the late 1990s, as the water levels were exceptionally high. Since then three large lakes (the "Toshka Lakes") have formed in the depressions, and although they have shrunk in recent years, they still occupy an area of more than 1,000 square kilometres.[46]

The Sadat Canal did not have any great impact on Chephren's Quarry, but the nearby Stele Ridge Middle Kingdom carnelian mine was affected, insofar as the canal is located only one km to the east of this site. However, it was not before the construction of the new asphalt road to Uweinat in the 1990s that the mining site became severely destroyed during digging for gravel. Similar destruction took place in Chephren's Quarry, as the road passes right through a part of the quarry with an ancient settlement site.

[45] The maximum level of Lake Nasser is 183 m above sea level.
[46] See e.g. http://en.wikipedia.org/wiki/Toshka_Lakes

Figure 53: Chephren's Quarry (yellow) and environs in 1990. Landsat image

Figure 54: Chephren's Quarry (yellow) and environs in 2000 after the flooding of the Toshka depression through overflow from Lake Nasser through the Sadat canal. Landsat image

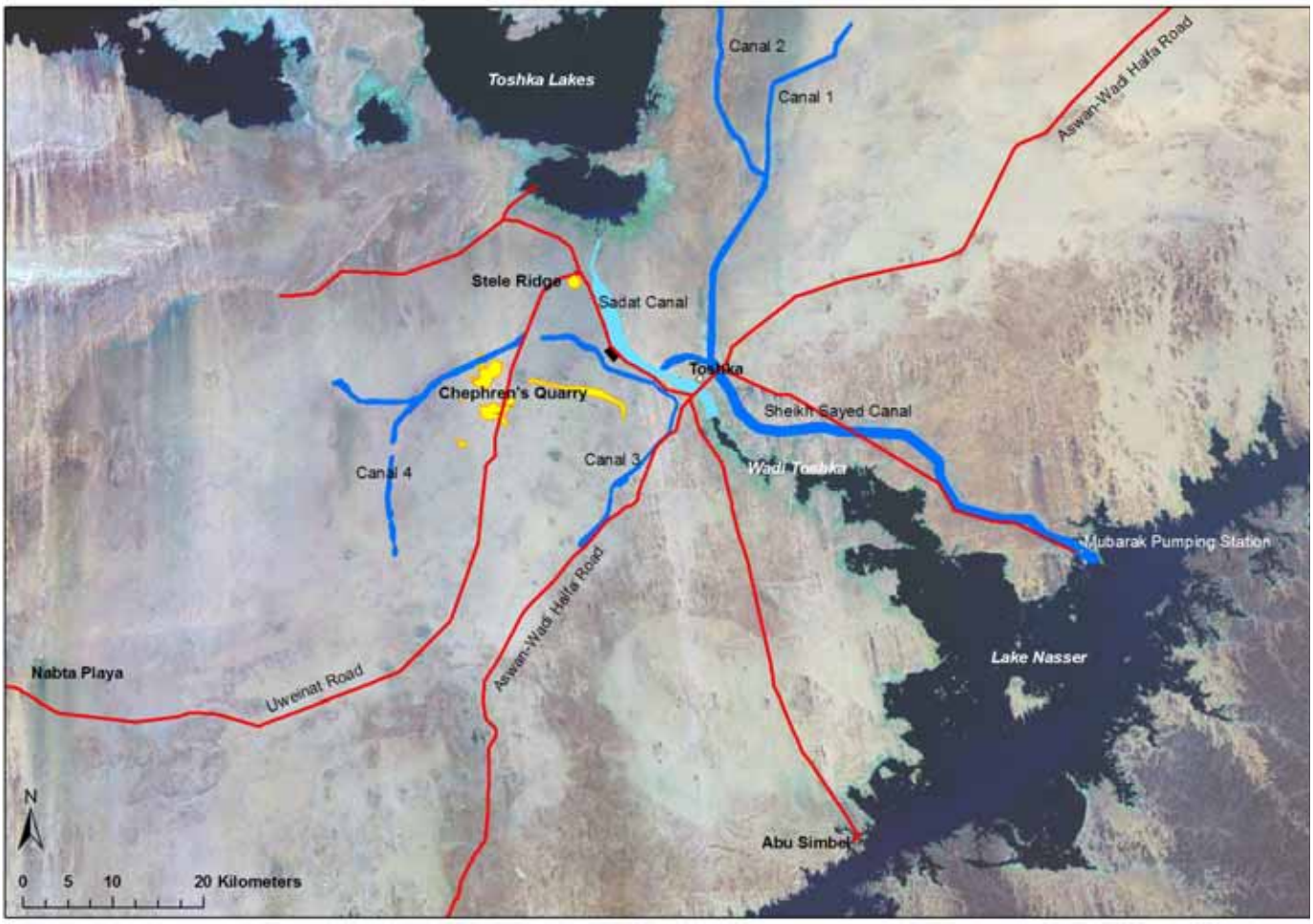

Figure 55: The Toshka project area, status in 2007. Red lines are roads, blue lines are excavated canals. Map by QuarryScapes/Per Storemyr on the basis of satellite images, field survey, topographic maps and plans of the Toshka project. Background: Landsat satellite image 2000

The Uweinat road is an element of the Toshka or "New Valley" project, one of the world's largest land reclamation projects, now taking place along both sides of the Sadat Canal. The first plans were presented in 1992[47] and construction works commenced around 1997. Celebrated and highly criticised, the project ultimately aims to create a green zone through a corridor of the Western Desert parallel to the Nile, from Lake Nasser to the Mediterranean. The first phase of the project has involved the excavation of a canal network more than 150 km long. These canals, of which two of four are in operation (Canal 1 and 2), are fed through the 50 km long Sheikh Sayed Canal and the Mubarak pumping station at Lake Nasser. Groundwater from the Nubian aquifer will be used in other regions of the vast project area to render the desert green (Wahby 2004; Ismail *et al*. undated).

According to original plans, the whole of Chephren's Quarry and Stele Ridge mining site should already have been bulldozed, covered with topsoil and now producing cash crops for the international market. Moreover, the planned Toshka city should have been the home for thousands of people having moved from the overpopulated Nile Valley. However, the project seems to have drained the Egyptian economy to such an extent that from 2003-4 it has come to a partial standstill (e.g. El-Din 2006; Wahish 2006). By Canal 1 and 2 a few farms have sprung up, but the unfinished Canal 4, which cuts through marginal areas of Chephren's

[47] See e.g. http://weekly.ahram.org.eg/2000/466/eg7.htm

Figure 56: Survey of Chephren's Quarry in 2002, while the excavation of canal 4 of the Toshka project went on the background (photo: Per Storemyr)

Quarry, as well as Canal 3, are left as a huge scars on the desert surface. This means that most parts of the quarry landscape remain reasonably well preserved, as observed in 2007.

Because of the new roads, the area is passed by desert tourists en route to Gilf Kebir and the Great Sand Sea. Similar to the famous nearby Nabta Playa Neolithic settlements, many of these tourists do not refrain from looting the sites for artefacts (see also Chapter 7).

After intervention by the editors of this report in 2002 and further work within QuarryScapes, Chephren's Quarry appears now finally to be under request for protection in the SCA system. However, if protection regulations are not enforced and management and monitoring not carried out, the landscape will be severely threatened once canal building and land-reclamation resume.

In terms of cultural heritage management, the Toshka project has many similarities with the much smaller works related to the building of New Aswan City. Although the two projects are of an entirely different nature they share a common trait in that they were planned long ago without any reference to survey, excavation and protection of archaeological sites in their vicinity. Even if the archaeological sites are known to heritage managers, the sites are not found on official or less official development maps and are therefore virtually non-existent from the perspective of the developers.[48] Thus, it should be of high priority to approach the decision makers of such large-scale development projects in order to include archaeological sites on plans and maps, as in the case of New Aswan City. In the case of Chephren's Quarry, the temporary halt of land reclamation activities might help in saving the site, and QuarryScapes is working on including the quarry landscape on development maps.

[48] In the case of Chephren's Quarry, see Yakoub and El-Kady (1998) and Ismail *et al*. (undated).

Development of risk maps

To enable heritage managers and developers to gain simple and quick overviews of selected quarry landscapes and the risks facing them, risk maps have been developed for Chephren's Quarry, the West Bank of Aswan and Widan el-Faras. A general idea behind the development of the maps has been to suggest risk classes that can be put in use for quarries and quarry landscapes across Egypt and also in other parts of the world. This implies that the definition of the classes is formulated in a broad way, not considering particularities of individual places, which then must be explained in text following the maps (Table 1). Five risk classes are used: Immediate, high, medium, low and very low.

Risk assessment in the case study areas has been undertaken on the basis of intimate knowledge of the archaeology and natural features of the landscapes (see Chapter 3), as well as from information such as described above (vulnerability, development of modern infrastructure over the last 40-50 years, known or interpreted development plans and other threats, as well as conversations with residents, heritage managers and developers).

Chephren's Quarry (Figure 57) has been divided into six sub-areas, all of which are regarded as under immediate or high risk until protection is enforced and an efficient management regime introduced. Quarry areas close to canals under construction are considered at the highest risk because extensive excavation work has been, and will be, undertaken at such places. Also quarry areas close to roads are particularly vulnerable; on the one hand due to the risk of further road building, and on the other because such areas are easily accessible for looting and vandalism. The definition of sub-areas at Chephren's Quarry follows concentrations of archaeological remains, such as extraction sites, transport infrastructure, settlements, encampments and wells.

On the *West Bank of Aswan* (Figure 59) the sub-areas of the quarry landscape are defined in a different manner. Since the density of archaeological remains is very high across the landscape and since the sites are not only related to ancient quarrying, natural boundaries such as hills, ridges and wadis, as well as modern infrastructure (roads) are used for subdivision. Thus, 25 sub-areas have been defined, of which nine are under immediate risk. These sub-areas are located within or directly beside the construction zone of New Aswan City. The final plans for the city are not yet completed and are also altered as a result of the ongoing cooperation between the city authorities and SCA Aswan (Chapter 9). However, until protection regulations are efficiently enforced for selected sites, the whole area must be considered under immediate risk. An area with relatively large modern quarries north of Gebel Gulab is also considered at immediate risk. These quarries are not in operation at the moment, but activity may resume at any time. Areas to the north and south of New Aswan City are considered to be at high risk because of modern house building taking place along the eastern margins, due to small-scale modern quarrying and since it is anticipated that New Aswan City will expand over the years. Gebel Gulab and bordering sub-areas are assessed as being at medium risk. Other than slowly expanding villages along the eastern margin and some small-scale quarrying, there is no specific development taking place at the moment. However, looting and vandalism is quite common and the areas are accessible through roads now cutting through the landscape. Gebel Gubbet el-Hawa is considered at low risk, on the one hand since the eastern part is under request for SCA protection (the Tombs of the Nobles) and on the other hand since this area is of great importance as a scenic backdrop of Aswan. In the south we have no indications of specific development plans and these areas are also considered at low risk. However, minor looting takes place and the villages of Gharb Sehel might continue expanding into the sub-area called "Southern Quarries".

In the *Northern Faiyum* (Figure 58) we currently have only made a risk map of *Widan el-Faras* basalt quarry and the associated quarry road to Qasr el-Saga. Here the situation is again different with regard to definition of sub-areas, which follow the main elements of the quarry landscape (quarry, encampment, quarry road etc.). Although the modern quarrying of basalt has come to a (temporary) halt, the basalt quarry sub-areas must be considered at immediate risk because protection and management has not been enforced. Moreover, modern extraction can resume at any time. Except for the ancient quay, from which the basalt was shipped, all other elements of the quarry landscape are assessed at medium risk. There are no large-scale development plans for the area, but the impact of tourism (desert driving and looting) is greatly increasing and has already led to serious deterioration of the quarry road and other features. Since Qasr el-Sagha is more accessible than the other parts of the quarry landscape and because a new asphalt road is planned in this area, this site must be regarded at high risk.

As can be seen from these examples, we have chosen different ways of defining sub-areas of the quarry landscapes. The choices reflect differences in topography and character of the archaeological remains, but also the status of research. Thus, the choices merely reflect a practical way of visualising risks in the best possible way for the moment. It must be strongly underlined that the sub-areas in no way reflect areas that could or should be designated for protection. Such designation has to take other factors into account, such as archaeological significance and value, relationships between different sub-areas and archaeological remains, actual condition, visibility and sight aspects, and – not least – buffer zones and practicalities involved in efficient management and monitoring.

Table 1: Definition of risk classes

Risk class	Definition
Immediate	Sites or features immediately threatened by ongoing modern development projects at the actual place. Some sites or features might already be more or less destroyed. Also applies for halted modern development projects that might resume at any time. Such sites or features are usually also affected by looting and vandalism.
High	Sites or features affected by modern development projects that are taking place or are planned in the very near vicinity, and that are often expanding. Sites or features are not yet much physically destroyed. Also applies for halted modern development projects in the very near vicinity that might resume at any time. Such sites or features are usually also affected by looting and vandalism.
Medium	Sites or features that might be affected by expanding modern development projects in the vicinity or that are threatened by looting and vandalism. Looting and vandalism might have taken place already
Low	Sites or features that are not yet particularly threatened, often because of remoteness or difficult accessibility, or because they are under efficient protection. However, modern development might take place not too far away. Some looting and vandalism might have taken place or might take place in the not too distant future.
Very low	Sites or features that will *seemingly* not be affected by modern development for a considerable time (many years), usually because of very difficult accessibility, or because the sites are under efficient protection. However, some looting and vandalism might have taken place or might take place in the not too distant future.

Definition of terms used above:

Site	*Quarry, quarry area or other archaeological site*
Feature	*Material culture related to quarries, quarry areas or other archaeological sites*
Modern development project	*Examples are quarrying, mining, urban expansion, village expansion, agriculture, road building, canal building, building of power lines*
Looting	*Theft of artefacts or other archaeological features*
Vandalism	*Damage of artefacts or other archaeological features, e.g. by graffiti or car driving*
Protection	*Under some form of SCA regulation (SCA owned site, under SCA supervision or under request for SCA protection)*

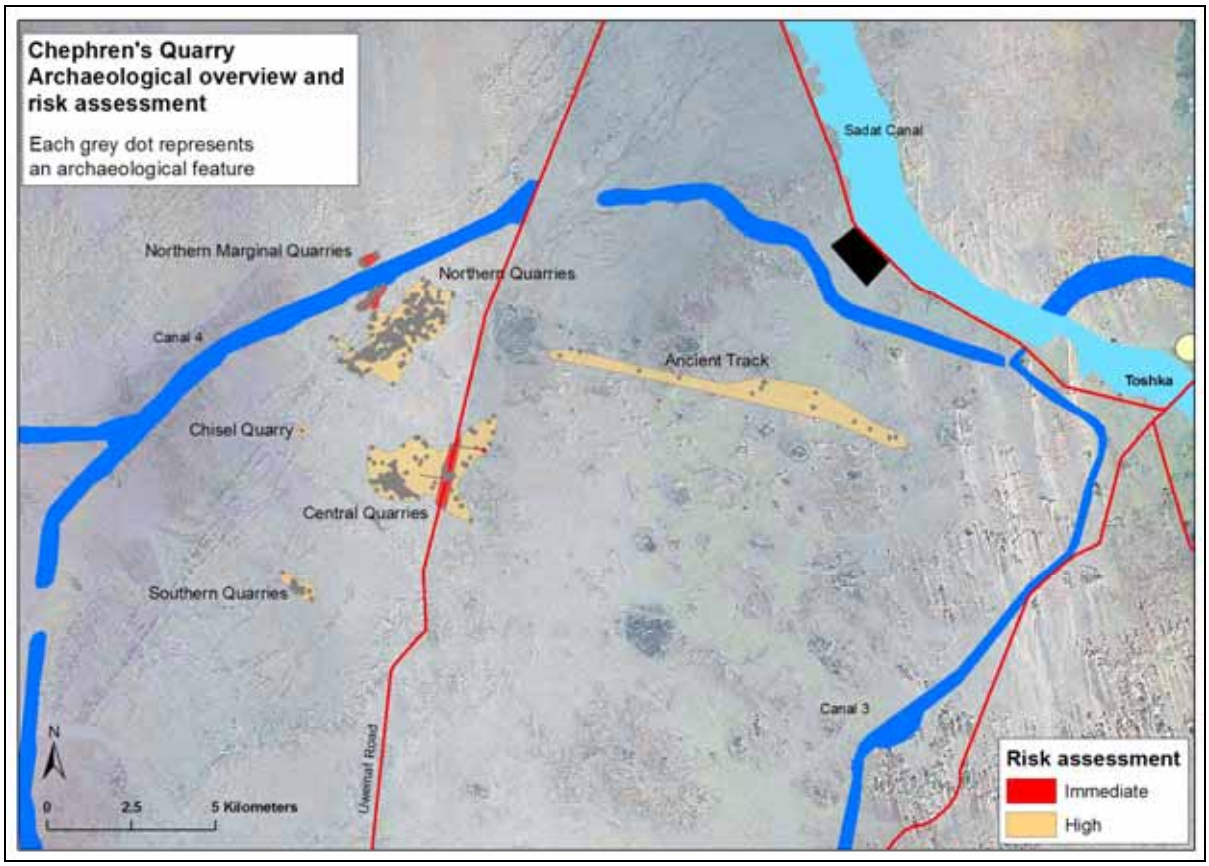

Figure 57: Risk assessment for Chephren's Quarry. Map by QuarryScapes/Per Storemyr/Tom Heldal

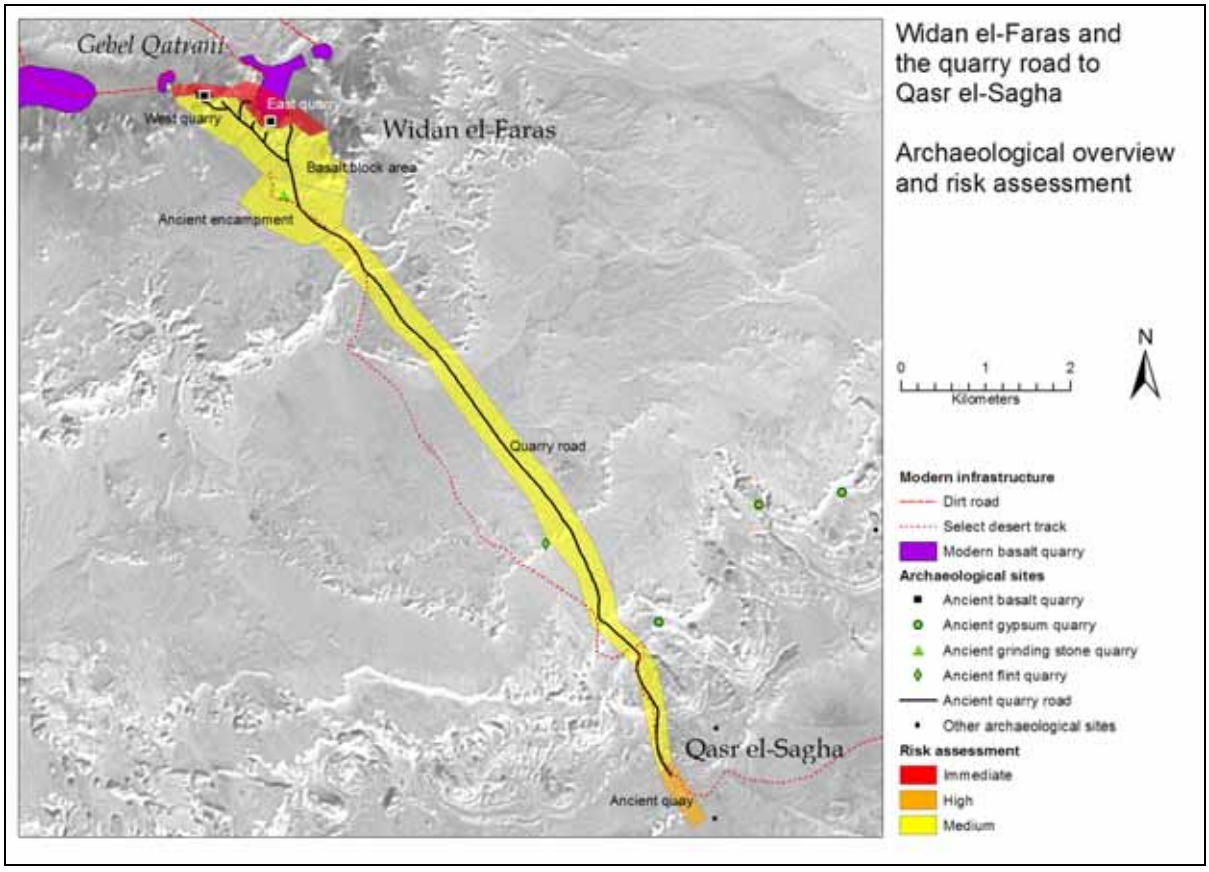

Figure 58: Risk assessment for Widan el-Faras. Map by QuarryScapes/Per Storemyr/Tom Heldal

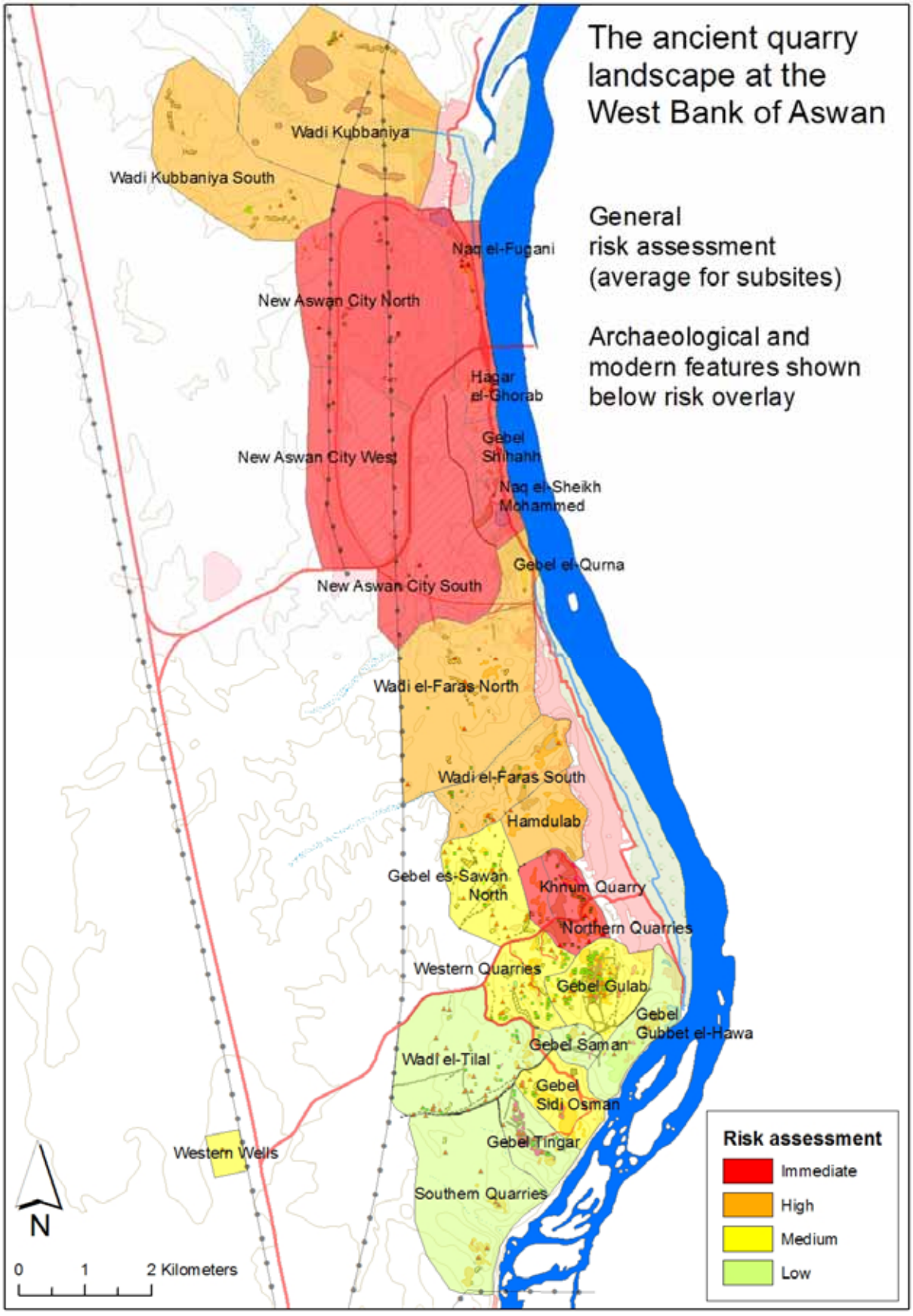

Figure 59: Risk assessment for the Aswan West Bank. Map by QuarryScapes/Per Storemyr/Tom Heldal

Concluding remarks

The case studies have demonstrated what has happened to these key ancient quarries and quarry landscapes and what might be expected in the not too distant future, if efficient protection and management measures are not enforced. From being in an excellent state of preservation until 40-50 years ago, they are now either destroyed, heavily impacted on, or at high risk of being victims of modern development. Much of the destruction and the high risks can be traced to key social and political issues in Egypt; overpopulation in the narrow Nile Valley and the Delta[49] and, especially since the 1970s, large-scale development projects in the adjacent deserts in order to cope with the population growth and to modernise the country. A part of this pattern is also modern quarrying, which has been responsible for much destruction.

With the exception of Aswan, the case studies presented are not particularly representative of Egypt as a whole, given that the majority (about 65%, see Chapter 2) of ancient quarries and quarry landscapes are located along the hills immediately bordering the fertile Nile valley. Moreover, most of them are limestone and sandstone quarries with high quarry faces and galleries, which are vulnerable in an entirely different way than e.g. the extensive boulder quarry landscapes presented above. However, the case studies cover a wide range of issues important to understand current development. In the next chapter we shall see how some of these issues apply to Egypt's ancient quarry landscapes as a whole.

Returning to Gebel el-Ahmar in Cairo, which is largely destroyed due to the development needs in a modern urban area, it may serve as a warning to what might happen (and indeed already happens) to many other quarries and quarry landscapes.

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[49] Since 1965 the population has grown from about 30 million to between 70 and 80 million people. Still, almost the whole of the population lives on only 4-5% of the country's area. See e.g. www.populstat.info and http://en.wikipedia.org/wiki/Egypt

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Chapter 5

Condition and large-scale human threats: A tentative nation-wide overview of ancient Egyptian Quarries

Per Storemyr and James Harrell

The case studies of Gebel el-Ahmar, Widan el-Faras, Aswan and Chephren's Quarry (Chapter 4) have given a foretaste of the condition of ancient Egyptian quarries and the large-scale human threats facing them. This chapter expands the view to include known quarries throughout the country. How is the current condition of the known quarries as seen from a nation-wide perspective? Which are the main human threats facing the nearly 200 known Pharaonic and Graeco-Roman quarries, as well as the Prehistoric quarries mentioned in Chapter 2? This chapter begins with a description of how quarry condition and threat have been assessed, before turning to the quarries of the various regions of the country.

Assessing condition and threat

In Chapter 4 simple risk maps for Widan el-Faras, Aswan West Bank and Chephren's Quarry were presented. These maps have been made on the basis of several years of fieldwork and knowledge of the local and regional situation in terms of modern development projects. For most other Egyptian quarries and quarry landscapes such in-depth knowledge does not exist. However, given that the authors and other QuarryScapes members have visited nearly 150 quarries while engaged in other research projects, there is a body of knowledge both as to the condition of these quarries and some of the threats facing them. In addition, Klemm & Klemm (1993) give hints to the condition of many quarries in their work, especially as related to destructive modern quarrying. It is impossible though to attempt at comprehensive risk assessment on the basis of this knowledge.[50]

Visits to the quarries mentioned above as well as the Klemm & Klemm (1993) work have been undertaken from the 1970s onwards, but mainly since the 1990s. This implies that for many quarries updated information is not available. Thus, the assessed condition may in many cases be worse than mentioned in this chapter. Likewise, for some areas additional threats may today influence many quarries, whereas in other cases threats may no longer be active (e.g. modern quarrying may have ceased). Thus, the assessment presented below is of a tentative character.

[50] See definitions of threat and risk in Chapter 1.

The simplified schemes used for assessment of quarry condition and threats are shown in Table 2 and Table 3, respectively. It must be noted that the assessment of individual quarries and quarry areas have been made by visual means at the time of the visit. The impressions gained have then been reconstructed using field notes, photographs, descriptions in Klemm & Klemm, as well as, in many instances, impressions obtained by analysing satellite images (mainly using Google Earth). All assessments have been incorporated in the database described in the introduction to Chapter 2 (see extract in Appendix 1).

Table 2: Scheme for assessment of condition of ancient Egyptian quarries.

Intact	More or less intact, though small-scale destruction may have taken place (looting, vandalism, development in the near vicinity etc.).
Largely intact	Up to 10-20% (approximately) of ancient workings and associated quarry features destroyed.
Partially destroyed	More than 10-20% (approximately) of ancient workings and associated quarry features destroyed.
Largely destroyed	Over 80% (approximately) of ancient workings and associated quarry features destroyed.
Under Lake Nasser	Quarries under Lake Nasser since the late 1960s.
Unknown	Site not visited or not assessed.

Table 3: Scheme for assessment of actual and potential threats to ancient Egyptian quarries. It must be stressed that in the vast majority of cases the main threats are identical to the causes of previous destruction.

Mining and quarrying	All types of modern mining and quarrying, whether on an industrial or smaller, artisan scale. Also including extraction of surface gravel and sand deposits. The mining and quarrying may take place within the actual ancient quarry area or along its periphery.
Urban development	Urban and rural development (building of residential and industrial areas and associated construction of roads, power lines etc.). May also include military infrastructure, such as the use of ancient quarries as depots and magazines. The development may take place within the actual ancient quarry area or along its periphery.
Urban development - mining/quarrying	Urban and rural development that also includes modern mining and quarrying. It is common that stone quarrying and extraction of lime for cement are taking place in urban and rural development areas.
Agricultural development	Land reclamation along the Nile and in desert areas and associated building of canals and roads etc. The development may take place within the actual ancient quarry area or along its periphery.
Unspecified – high immediate risk	The treats are largely unknown, but much unspecified modern activity has been noted in the immediate environs of the ancient quarry. This may imply that the quarry is at immediate risk.
Unspecified – low immediate risk	The treats are largely unknown, but no or little unspecified modern activity has been noted in the immediate environs of the ancient quarry. This may imply that the quarry is not at immediate risk (not within 1-3 years).
Not determined	The treats are unknown or the quarry has not been visited.
Not applicable	This category is mainly used for quarries now under Lake Nasser.

In Chapter 3 the importance of viewing ancient quarries from a landscape perspective is underlined. Due to the lack of data, for the nation-wide overview of condition and threat it has not been possible to fully consider this perspective. A central problem is the lack of borders of large quarry areas and quarry landscapes. Thus, for example, condition is often assessed on the basis of the state of the actual workings or extraction areas, whereas ancient infrastructure such as shelters, huts, settlements, roads etc. peripheral to the workings may have been partially neglected. As for the assessment of threat, it incorporates those that had previously destroyed archaeological remains or were active at the time of the visit (mostly these are identical). In a few cases it also includes threats that may potentially become active in the very near future. It must be stressed that when an ancient quarry has already been subject to modern mining or quarrying, it is very likely that such activity can resume if no protection regulations are enforced.

Threats to ancient quarries do not only incorporate those that may physically destroy archaeological remains, but also those impacting on views and sightlines, as well as e.g. new roads in the vicinity that may make remoter areas much more accessible than previously and thus increasing the level of threat. Such issues have not been considered in the assessment procedure.

Another important issue is that some quarries have been extensively re-used from the 18th until the 20th century (or even until today), for instance for the building of today's historic centres of Cairo (see e.g. Dobrowolska 2005:17ff) and other cities, or for gemstone procurement. As discussed in Chapter 7, such reuse should not necessarily be looked upon as destruction, as it has added layers of significance to the history of these sites. However, in the assessment of condition such re-use has sometimes been regarded as destruction of archaeological evidence.

National overview

The assessment shows that of the 193 quarries recorded by James Harrell, 25% are still intact and 38% largely intact, whereas 20% have been partially destroyed and 5% are largely destroyed. Four percent of the quarries are under Lake Nasser and for 7% the status remains unknown (Figure 60, Figure 62). About 50% (four cases) of the largely destroyed quarries have been damaged by modern mining and quarrying (e.g. Gebel Rokham), whereas in only two cases urban development is the main destructive factor (e.g. Gebel el-Ahmar).

Mining and quarrying is clearly the greatest threat to the ancient quarries (Figure 61, Figure 63). About 36% are reported as having been influenced by modern mining and quarrying, either in the past or currently. Some 11% are strongly influenced by urban and rural development projects; of these 5% are additionally subject to modern mining and quarrying. Only 2% are reported as being threatened by agricultural development. This is certainly due to the fact that quarries are typically situated on higher ground unsuitable for agriculture (one very notable exception is Chephren's Quarry; see Chapter 4). For a large proportion (36%) of the ancient quarries the threat has not been specified, but the risk of destruction is in these cases generally considered low. Many quarries belonging to this category are situated in the Eastern Desert. However, although the risk of modern impact is considered low at the moment, in Chapter 6 it will be shown that in the not too distant future many of the ancient quarries in this part of Egypt may become subject to modern exploitation aimed at the world natural stone market.

Prehistoric quarries (see locational information in Chapter 2) are not part of the general assessment of condition and threat. However, from descriptions in the literature, our own observations and interpretations, a tentative overview can be provided in Table 4.

As can be seen from Table 4, the two perhaps most important groups of Palaeolithic tool quarries, silicified sandstone workings by the Second Cataract and chert workings in Middle Egypt, are either under Lake Nasser or heavily destroyed. This extremely regrettable situation makes it clear how important it is to consider strict protection regimes for Palaeolithic quarries that are still preserved in order to save some examples of such industries for the future.

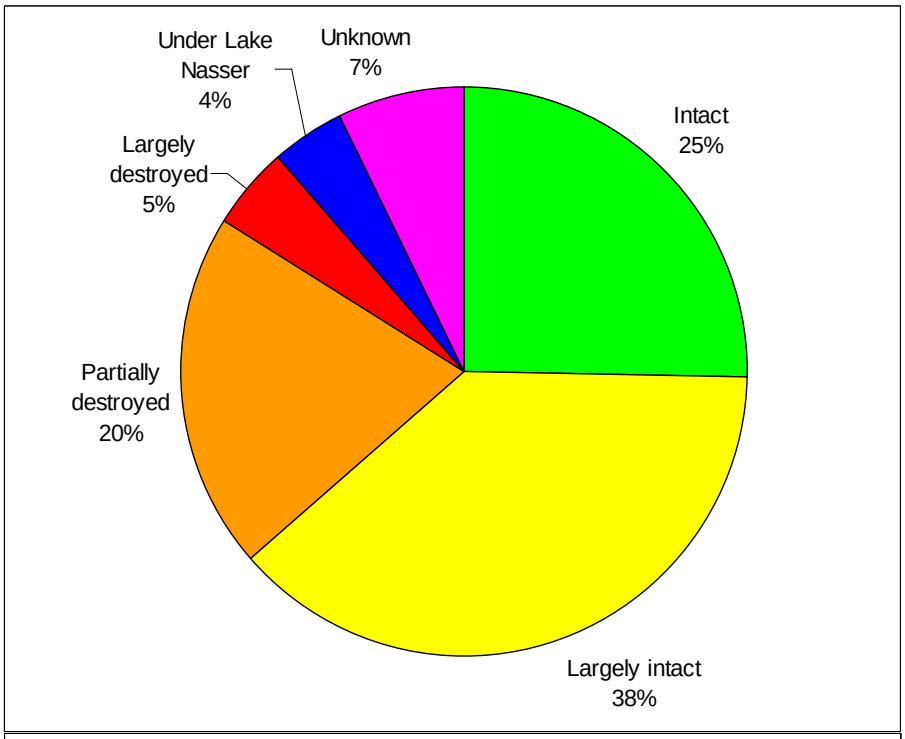

Figure 60: Condition of 193 ancient Egyptian quarries recorded by James Harrell. See text and Appendix 1 for explanations.

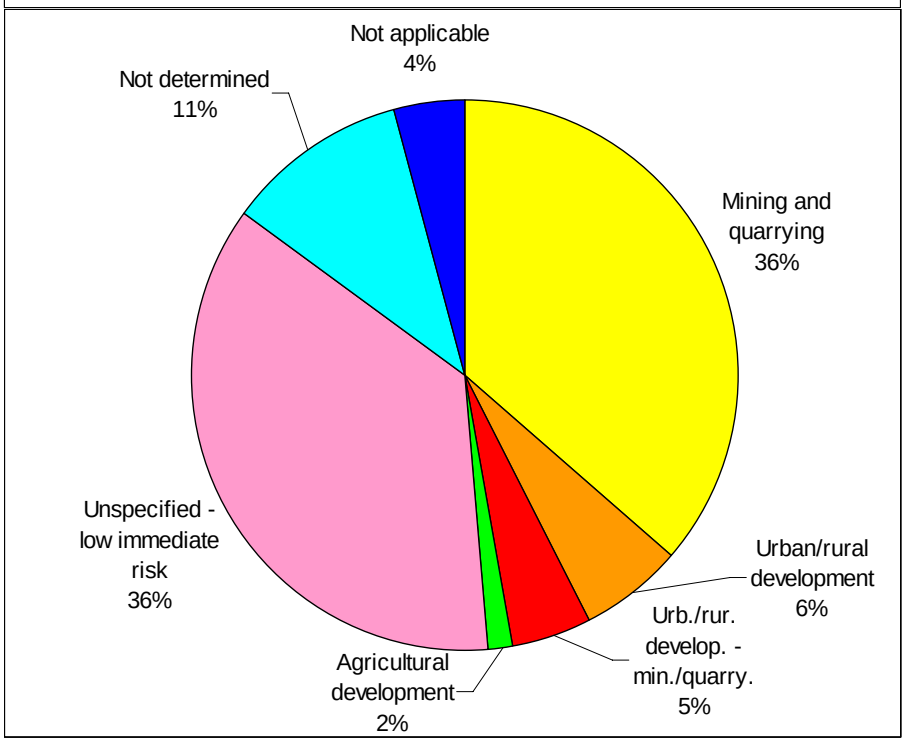

Figure 61: Main threat to 193 ancient Egyptian quarries recorded by James Harrell. See text and Appendix 1 for explanation.

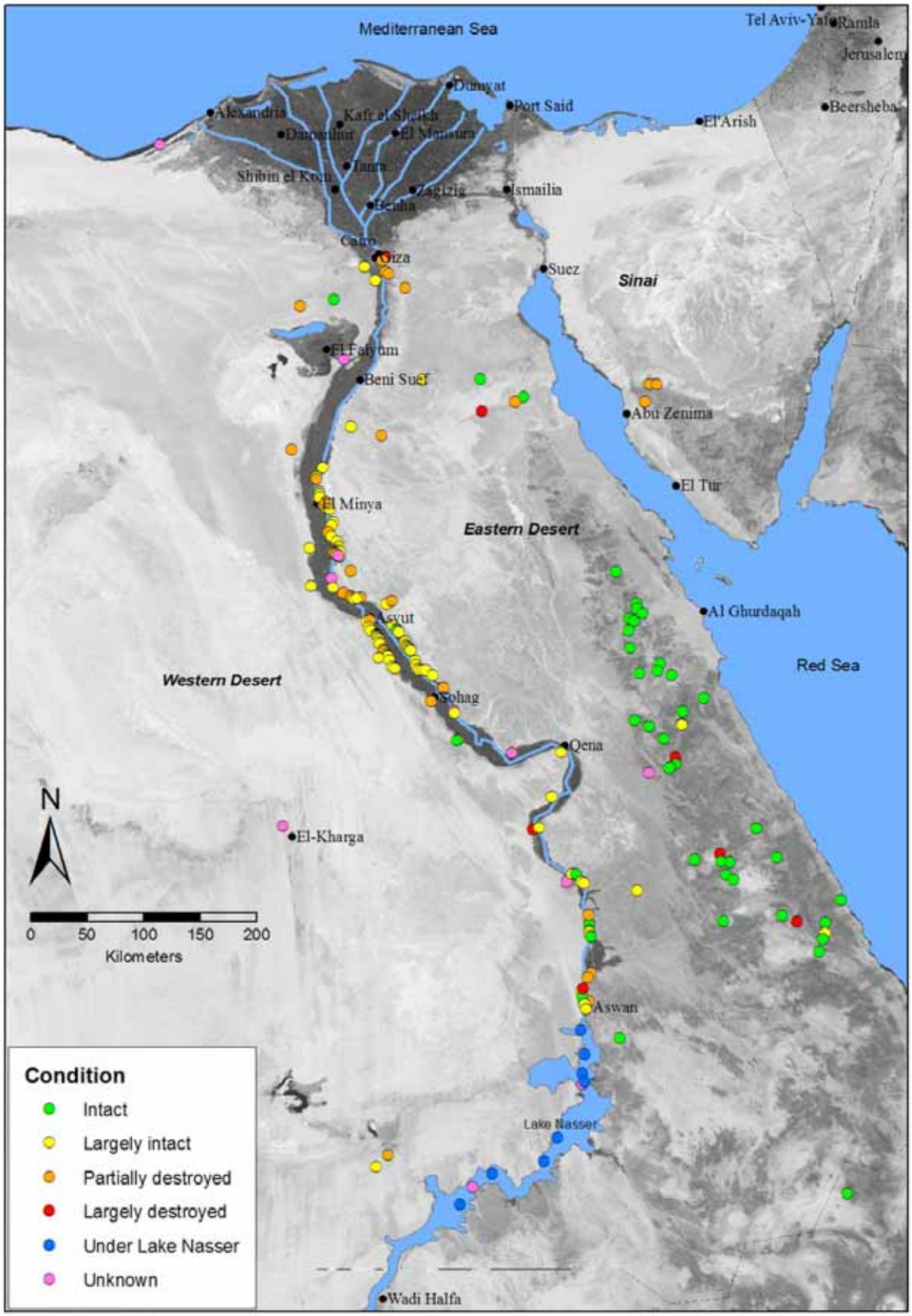

Figure 62: Distribution of ancient Egyptian quarries recorded by James Harrell and their condition. See text and Appendix 1 for explanations.

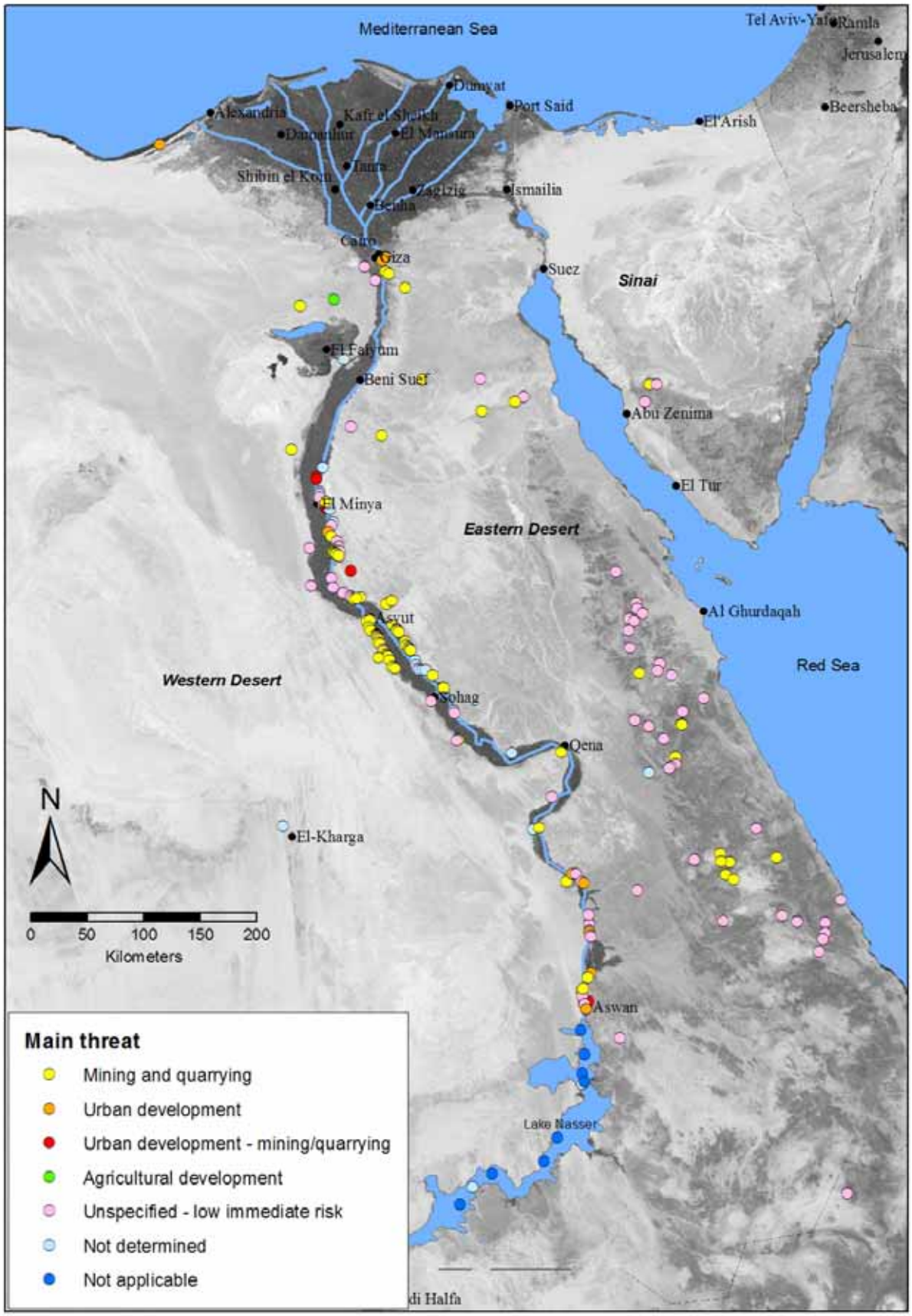

Figure 63: Distribution of ancient Egyptian quarries recorded by James Harrell and the main threats facing them. See text and Appendix 1 for explanations.

Table 4: Tentative overview of conditions and threats to Prehistoric tool quarries in Egypt. See Chapter 2 for locational information and references.

Quarry	Condition	Threat	Reference	Comment
Silicified sandstone quarries for tool production				
Second Cataract area	Under Lake Nasser	-	-	-
Aswan West Bank	Largely intact	Urban development – mining/quarrying	Heldal & Storemyr 2007	Gravel extraction
Dunqul	Unknown	Unknown	Hester & Hobler 1969: 21f	Probably largely intact
Chert quarries for tool production				
Wadi el-Sheikh	Largely intact	Mining and quarrying, looting	Own observations	Largely Pharaonic quarries
"Flint City" (Hierakonpolis)	Largely intact	Agricultural development	Friedman & Youngblood 1999	Also consulted Google Earth
Nazlet Khater	Partially destroyed	Urban development – mining/quarrying	Veermeersch 2002:24	Also consulted Google Earth
Beit Allam	Largely destroyed	Agricultural development	Veermeersch 2002:113ff	Also consulted Google Earth
Nazlet Safaha	Largely destroyed?	Agricultural development	Veermeersch 2002:209	Also consulted Google Earth
Taramsa and Tiwayrat	Partially destroyed	Mining and quarrying	Veermeersch *et al.* 2005	Also consulted Google Earth
Faiyum	Largely intact	-	Own observations	-
Kharga (Refuf Pass)	Unknown	Unknown	Caton-Thompson 1952	Google Earth: Probably largely intact

Figure 64: The Palaeolithic chert quarries at Beit Allam (approx. location) between Sohag and Naq Hammadi in Middle Egypt appears to have become victims of agricultural development. Image from Google Earth, scale bar 1790 m.

Regional characteristics

Many of the known ancient quarries are located within or close to currently "hot" modern development areas, such as Cairo and larger cities like Minya, Assiyut and Aswan. Others are situated in regions which until recently were – or still are – far away from any development projects, such as many quarries in the Eastern Desert. In this section the regional characteristics in terms of condition and threat will be briefly explored, highlighting some of the ancient quarries that are under the most acute threats.

The greater Cairo area

As described in Chapter 4, Cairo has expanded dramatically into adjacent desert areas over the last 30-40 years (see also Yousry and Aboul Atta 1997), implying that archaeological sites from Faiyum to near Suez in one way or another are impacted by this development. There are not many known ancient quarries in this region, but with the exception of the quarries at the pyramid sites of Giza and Sakkara, which are well protected, all the others are severely threatened by urban development and/or mining and quarrying. Gebel el-Ahmar is already largely destroyed (Chapter 4), whereas the major limestone quarries from Mokattam to Gebel Tura and Gebel Hof have been partially destroyed. However, this group of quarries may also paradoxically enjoy partial protection since some sections are located within military areas (cf. Klemm & Klemm 1993:59ff, see also Chapter 6). Of the northern Faiyum quarries (Chapter 4), Widan el-Faras is partially destroyed by modern quarrying and Umm es-Sawan is to some extent threatened by agricultural development from the south (Kom Aushim).

Importantly, most of the quarries in the greater Cairo area are strongly related to the building of the Old Kingdom pyramids and their associated temples – they may be considered as belonging to the "greater pyramid landscape". This implies that they are truly unique quarries that deserve all possible attention in terms of protection and management. Regrettably, with the exception of the quarries within the pyramid sites, none are officially listed with the SCA (see Chapter 2).

Middle Egypt

Middle Egypt, in this report designated as from the environs of Minya to Luxor, a stretch of 350 kilometres along the Nile, features the largest proportion of Egypt's ancient quarries (about 90). Most are relatively large limestone quarry areas situated along the cliffs overlooking the valley, whereas some few travertine (Egyptian Alabaster) quarries can be found in adjacent desert areas on the East Bank.

It is very difficult to gain an overview of the current status in terms of condition and threat for all these quarries – an almost continuous ancient quarry landscape. However, most of them seem to be largely intact or only partially destroyed by modern mining and quarrying (for building stone, cement etc.). With one exception, none are reported as largely destroyed. This may change in the near future due to the building of new cities and villages close to the larger urban centres (Minya, Assiut, Sohag, Qena etc.)[51] and renewed interest in the quarries from a

[51] Like at New Aswan City described in Chapter 4. See the website of the New Urban Communities Authorities; http://www.urban-comm.gov.eg/english/index.asp. See also Stewart (1996) on new urban centres in desert areas.

modern exploitation perspective (see Chapter 6). With respect to new cities now under construction, it seems that only New Minya, and to a much lesser extent New Assiyut, poses serious threats to ancient quarries.

New Minya is located on the east bank of the Nile just opposite the old city. Upon completion it is planned to house more than 150,000 people,[52] but to date only some 4,000 people[53] seems to have moved in. Within and just outside the periphery border of the new city no less than 9 ancient quarry areas are located, though it is the important quarries of Sawada, Nazlet Sultan Pasha, Zawyet el-Amwat and Wadi Sheikh Yasin (all limestone), and el-Qawatir (travertine) that are most threatened, none of them being officially protected. According to what can be seen on Google Earth, all of them are also subject to modern quarrying within or close to the ancient workings. The ancient travertine quarries at el-Qawatir deserve special attention as they may be the largest of their kind in Egypt, superseding e.g. the famous quarry of Hatnub (Klemm & Klemm 1993:206ff). They are very special quarries of principally underground operations along very long veins of travertine. These quarries are now literally squeezed between New Minya and the large area of modern limestone quarrying immediately to the east (Figure 65).

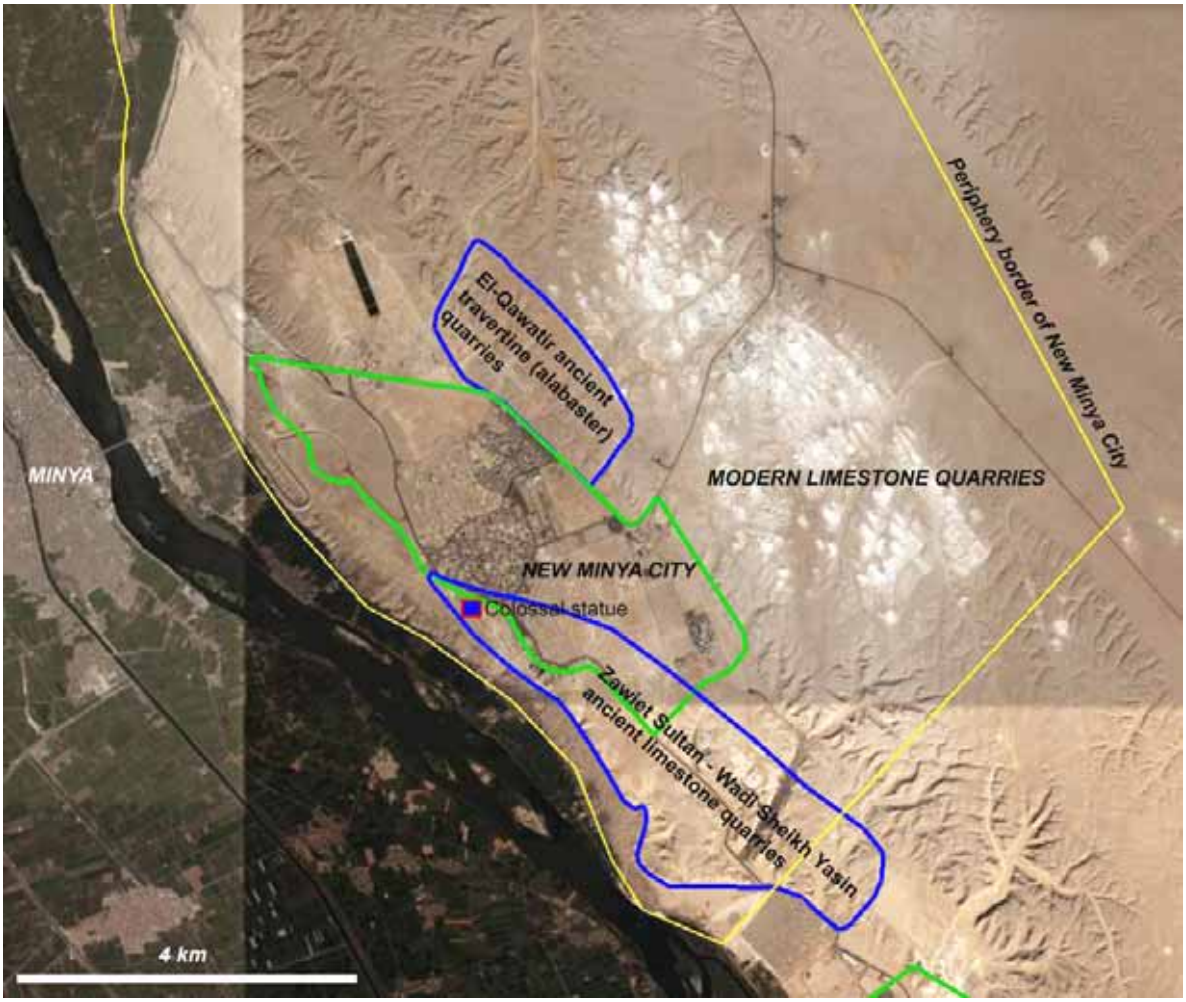

Figure 65: Simplified map of New Minya City and environs. The green line shows the extent of the city, whereas the blue lines mark an almost continuous ancient quarry landscape. Note the large area with modern limestone quarries (white patches). Map made using Google Earth Plus on the basis of Harrell's quarry records, as well as information in Klemm & Klemm (1993: 91ff, 206ff) and from the Egyptian New Urban Communities Authorities (http://www.urban-comm.gov.eg/english/menia_uses.asp**).**

[52] http://www.urban-comm.gov.eg/english/menia_uses.asp
[53] Naguib Amin, pers. comm. 2007

Figure 66: Gebel el-Hamman ancient quarry area (across the Nile) at the mouth of Wadi Abu Subeira, 12 km north of Aswan has been largely destroyed by modern quarrying (represented by the high quarry faces). The picture is taken from one of the villages in Kubbaniya, which is currently rapidly expanding. The new houses are all built by local sandstone rubble (photo: Per Storemyr 2007).

Figure 67: Artisan clay mining within a New Kingdom obelisk quarry at Gebel Gulab on the West Bank of Aswan (photo: Per Storemyr 2005).

Between Minya and Sohag are a string of ancient quarries often located within or close to famous archaeological site such as Beni Hassan, Deir el-Bersha, Wadi Nakhla, Amarna and Deir el-Amir Tadros. Although most are reported to be largely intact, the majority have been or are influenced by modern quarrying, which often has an artisan character. Only Wadi Nakhla and Wadi el-Barshawi are reported as protected by virtue of their value as ancient quarries, though others may be part of protected archaeological areas (Chapter 2). To the south of Sohag there are very few ancient limestone quarries, most of which are partially influenced by modern development.

The limestone and travertine quarries of Middle Egypt pose a special challenge in terms of mitigating risks and putting protection regulations and management at work. This is because it is an enormous, almost continuous quarry landscape, perhaps representing the largest concentration of ancient quarries in the world. It is probably not possible to efficiently protect all the individual quarry areas in this part of Egypt, but it could be proposed that a proportion should be singled out for special investigation aiming at protection and management. Such a procedure has to rely on assessment of the significance of the individual areas, but also on the current risks facing them. In this respect the area around New Minya is certainly of special importance and should be an area of high priority for SCA.

Upper Egypt

Upper Egypt, from Luxor to Aswan, is characterised by a string of ancient Nubian sandstone quarries and two key quarry landscapes: Gebel el-Silsila (sandstone) and the Aswan area (granite, silicified sandstone and sandstone).

For the sandstone quarries at large, they have usually been partially destroyed by modern quarrying and mining, but only one (Gebel el-Hammam, see Figure 66) is reported as largely destroyed. Also village expansion strongly influences the ancient quarries in this part of the country. The villages are not only expanding into ancient quarry areas, but also procurement of sandstone rubble for masonry construction, and siltstone and clay for mortar is taking place within these areas (Figure 67). Moreover, large sandstone and clay quarries are currently in operation. Aswan is a special case described in Chapters 4 and 9: like Cairo and Minya it is one of the "hot" areas for modern development in Egypt, implying that its ancient quarries are at very high risk of destruction. However, as will be shown in Chapter 9, very active local efforts on mitigating risks and putting protection regulations at work are currently being undertaken. This has, for example, resulted in protection of a sandstone quarry like Naq el-Fugani, which is located within the construction zone of New Aswan City, as well as several individual ancient granite quarries. Although the protection status of Gebel el-Silsila is currently unknown, this area appears to be at low risk due to its fame as an ancient quarry with many rock-cut shrines and inscriptions. However, peripheral areas of this quarry are influenced by modern mining and quarrying as well as village expansion.

Eastern Desert

The northern portion of the Eastern Desert, in the currently very active modern extraction areas of the North and South Galala plateaus (Chapter 6), features a few ancient limestone, travertine and chert quarries. Their status varies, but most are influenced by modern quarrying operations.

Figure 68: Current modern quarrying in the Eastern Desert is often taking place in an *ad hoc* manner, locating good blocks and targeting these instead of opening true quarries. This picture is taken in the south-central portion of the Eastern Desert, west of the Barramiya area. The stone extracted is granite (photo: Per Storemyr 2003).

Figure 69: Discontinued modern talc mine close to the ancient soapstone quarries at Gebel Rod el-Baram in the Barramiya area (photo: Per Storemyr 2003).

Figure 70: Part of the Toshka mega-project of land reclamation close to Chephren's Quarry. The picture shows land reclaimed near Abu Simbel, one of the driest desert areas on earth (photo: P. Storemyr 2006).

The central portion of the Eastern Desert, in the Mons Porphyrites – Wadi Hammamat area, hosts some the most famous Roman and several other quarries. With the exception of Wadi Umm Esh (serpentinite) close to Wadi Hammamat, most are excellently preserved and are currently at rather low risk from modern mining and quarrying (Figure 68). However, as will be described in Chapter 6, this situation may drastically change in the not too distant future, as quarries featuring special stones (e.g. porphyry) may become targets for stone extraction for the world market. Moreover, gold prospecting is increasing and may pose an additional threat if large gold projects, such as currently at Sukari (c. 30 km SW of Marsa Alam) are put in operation.

In the southern portion of the Eastern Desert, from the Barramiya area to Wadi Gemal, most quarries are also in good condition. However, the only known marble quarry from ancient Egypt, Gebel Rokham, is more or less totally destroyed by modern quarrying. Also Wadi Fayrouz ancient amazonite mine has suffered this fate. The extremely extensive, mainly Islamic soapstone quarries in the area seem not yet to have been seriously influenced by modern operations. However, at the periphery of some of these quarry areas are modern talc mines, some of which are not currently in operation (Figure 69). Activities in these and similar quarries may resume and impact on the ancient soapstone quarries. The many ancient emerald mines close to Wadi Gemal are quite well preserved and seem to be at rather low risk at the moment

Other areas

The status of the only known quarry along the Mediterranean coast, Mallahet Mariut, is unknown. However, it is likely that it has been seriously influenced by modern development. As has been described in Chapter 4, the famous Chephren's Quarry (anorthosite gneiss) and

nearby Stele Ridge carnelian mine in the southern Western Desert may soon be destroyed by canals and agricultural development related to the Toshka Project (Figure 70). Likewise, it its probable that ancient sandstone quarries on Gebel el-Teir in the Kharga Oasis have become victims of modern exploitation. The Wadi el-Anba'ut gypsum quarry on the Red Sea Coast seems to be well preserved, but the ancient peridot mines at St. John's Island may be largely destroyed by early modern mining.

The turquoise mines on the Sinai Peninsula were extensively reworked in the Islamic period and especially by the British a century or so ago. Traces of the ancient workings can still be seen, but it is difficult tell where the ancient workings stop and the later ones start. Given that the mining areas are either owned or under supervision by the SCA, they are currently well protected.

Conclusions

The most threatened ancient Egyptian quarries are located within or close to "hot" urban development areas, especially Cairo, Minya and Aswan. In these areas the ancient quarries are not only impacted by the building of modern infrastructure, but also by modern quarrying and mining, and to a much lesser extent agricultural development (land reclamation).

Land reclamation is a specific, very high risk in a few ancient quarry areas such as Chephren's Quarry (Western Desert) and the Palaeolithic tool quarries along the Nile in Middle Egypt. However, on a national scale, this threat is minor in comparison to modern mining and quarrying, to which more than 40% of the ancient quarries have been exposed. A similar number is at risk from such activities and the number may significantly increase in the near future due to intensified mineral exploitation.

About 10% of the ancient quarries have been largely destroyed or are under Lake Nasser, whereas 20% are reported as partially destroyed. It is not known how these figures compare with other groups of cultural heritage, but it is clear that with the current threats facing all the other quarries and quarry landscapes, a major part of the Egyptian (and World) heritage may be lost if concerted action is not taken

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Chapter 6

Modern stone and mineral extraction and its impact on ancient Egyptian quarry landscapes

Tom Heldal, Per Storemyr and Adel Kelany

Introduction

Today as in the past, Egypt's rich stone and mineral resources are of crucial importance to the country's development. There is now a strong growth in the production of and search for many mineral commodities, including dimension stone[54], rock aggregate[55], industrial minerals[56] and gold. This activity directly or indirectly influences the preservation of ancient quarries, particularly in situations where the modern industry is targeting the same deposits as in ancient times.

Over the last 10 years the number of active dimension stone quarries has increased by many hundred percent, and a continuous strong growth is foreseen for the next decades. Increasing population and large-scale construction activities also cause a high demand for rock aggregate resources. Moreover, Egypt has important resources of industrial minerals, including limestone and talc, and is, at present, considered to be one of the most interesting regions for gold prospecting. Thus, the pressure on the country's mineral resources is rapidly increasing.

Some commodities, such as metallic ore and industrial minerals, are managed through national legislation and Egyptian Mineral Resources Authority (EMRA, formerly EGSMA) here plays an important role. Their role in locating dimension stone and aggregate resources is also important, but the practical management, permissions etc. in this sector are predominantly maintained by the Governorates.[57]

Below, a summary of developments in parts of the mineral sector, and particularly as related to dimension-stone extraction, will be given.

[54] Dimension-stone: cut-to-size stone slabs and blocks used for building, construction and ornamental purposes
[55] Crushed stone used for road construction and as additive in concrete
[56] Industrial minerals are non-metallic mineral resources applied for a variety of industrial and domestic purposes
[57] The mineral exploration laws date back to 1956 (laws 86 and 151) and provide the official legal basis for state-controlled mineral exploration and exploitation. However, law nos. 43 of 1979 and 50 of 1981 provide the governorates and local councils the power of administration of quarries in their particular regions.

Dimension-stone quarrying

A booming industry

Quarrying and manufacturing of dimension-stone is a booming industry in Egypt. The country's share of the world market has increased significantly over the last 10 years; it is now the world's 8th largest consumer of natural stone and number 7 regarding export.[58] The Egyptian success in the stone market is in part related to international trends; globally, the industry has experienced a significant growth averaging 8-10% annually since 1990. Over the last 10 years, however, most of the growth has occurred outside Europe. Countries like China, India, Brasil and Turkey have been particularly successful, and also in Egypt the growth is significantly higher than in Europe.

A detailed analysis of the Egyptian stone sector and scenarios for the future was published in 2005 for the Egyptian Industrial Modernisation Programme IMR (Ciccu *et al*. 2005). Some of the key 2004 figures for the sector are impressing (see Table 5). Approximately 50,000 people worked in the sector in 2004, and around 700 dimension-stone quarries were active. Most of the production (approximately 3 mill. tons) was calcareous rocks, predominantly limestone.

Table 5: Key figures for the Egyptian dimension-stone sector in 2004, and export forecast 2009. From Ciccu *et al.* (2005)

Factories producing marble and granite	250
Smaller stone workshops	4000
Stone quarries	700
Number of workers in the sector	50 000
Production 2004 (mill. tons)	3,2
Turnover 2004	390 mill. USD
Export share 2004	58,7 %
Export forecast 2009	538 mill. USD

According to the report of Ciccu *et al*. (2005), the growth in the Egyptian stone sector is expected to continue for many years. The potential of Egypt becoming one of the top world producers is high, particularly if the sector manages to introduce modern quarrying and manufacturing technology on a broad scale, and if efforts are made to facilitate legislation in favour of more long-term quarrying permissions. It is, furthermore, expected that many new quarries will be opened in the near future. The report also points at the fact that part of the rapid growth is out of control; the industry increases so fast that governmental regulations and infrastructure development cannot cope. Thus, it can be concluded that the Egyptian quarrying and manufacturing of dimension stone is growing fast, and even within the time frame of QuarryScapes (2005-2008) it can be expected that more than 100 new quarries will be established.

In Table 6 some of the main Egyptian stone quarry areas are summarised (see also map in Figure 71). They represent the majority of stones in the national and international market. The most important are beige to yellowish limestone, in particular being exploited in the Northern Eastern Desert (especially Galala) and in Sinai. The second most important are granite and other igneous rocks, for which the main focus of present production is from Aswan and to the southeast (Wadi Alaki). Other stone types in production include Egyptian alabaster

[58] Statistics from IMM Carrara (see www.immcarrara.com).

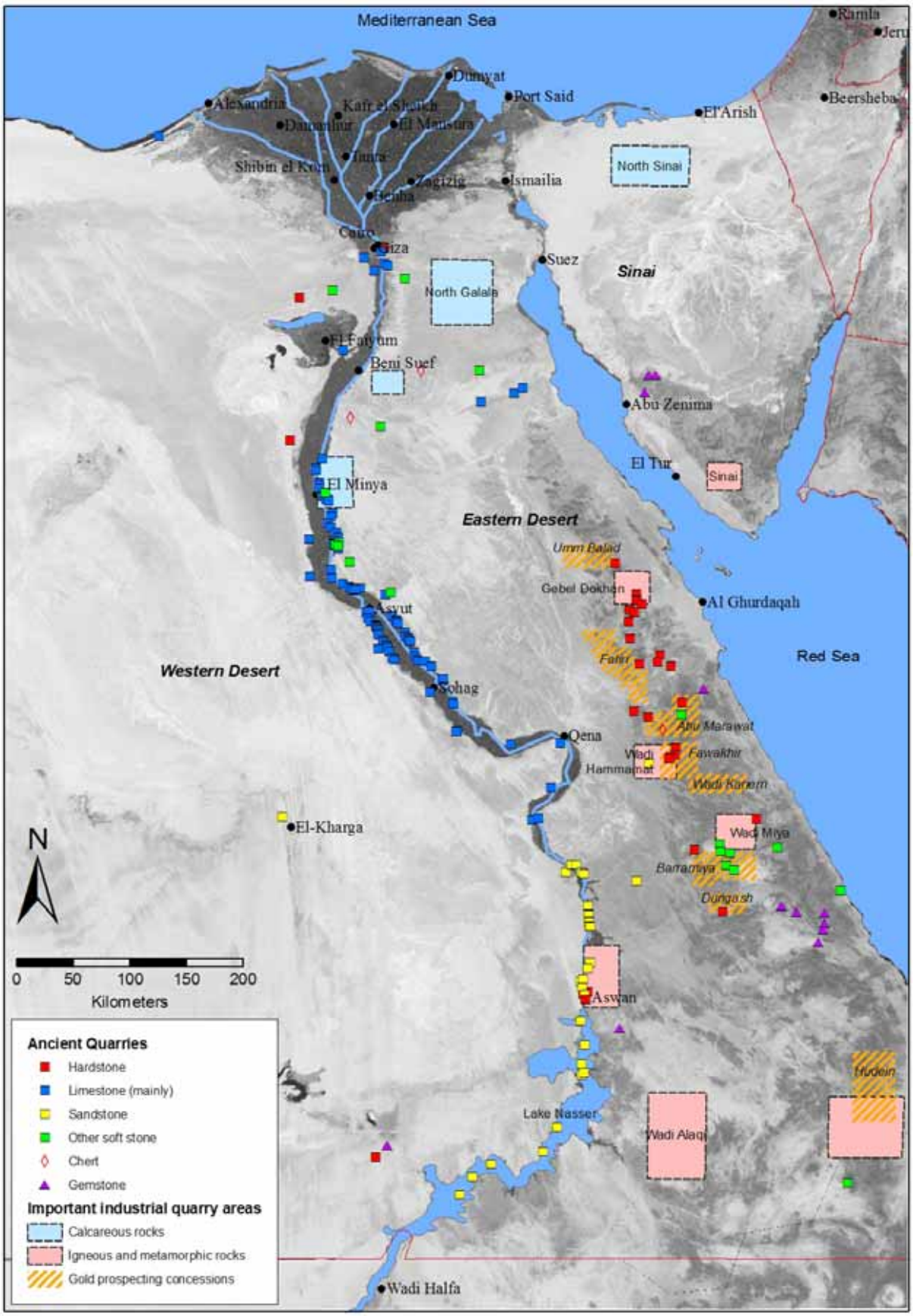

Figure 71: Important modern stone production areas and gold prospecting concessions. Map by QuarryScapes/Per Storemyr based on information in Ciccu *et al.* (2005), Kandil & Selim (undated) and EMRA (2006). The ancient quarries projected on the map are from the records of James Harrell (see Chapter 2). Note that smaller production areas are not shown on the map. Note also that the South Galala area is not marked.

Table 6: Egyptian dimension-stone types and main current production areas (after Ciccu *et al*. 2005)

Stone types	Production area
True marble	Wadi Alaqi, 270 Km southeast of Aswan and Wadi al-Miyah (e.g. by ancient Gebel Rokham), in the Eastern Desert midway between Marsa Alam and Edfu, as well as along the Red Sea coast
Limestone (traded as "marble")	Minya, Assiut, Zafarana, Khasm el-Raqaba, Galala as well as Abu el-Darag and el-Hasana of Northern Sinai
Egyptian Alabaster (travertine	Especially Wadi Sannur, east of Beni Suef
Granite and similar rocks.	Aswan area and to the south towards Wadi Alaki
Porphyry	c. 20 km north of Gebel Dokhan (Mons Porphyrites), Eastern Desert
Serpentinite	Wadi Atallah
Conglomerate/Breccia	Wadi Hammamat

(travertine), marble, porphyry, gneiss, conglomerate, slate and serpentinite. According to Ciccu *et al*. (2005), the regional distribution of quarries region is as follows: South Galala (limestone) – 50; North Galala (limestone) – 300; Aswan – Red Sea (granite etc.) – 100; Sinai (limestone and granite) – 50; other regions/materials – 50. However, according to SCA in Aswan, the number of granite quarries must now be much higher. It is rather in the order of 15 within Aswan and its immediate environs and about 250 in the Wadi Alaki area.

Large-scale quarrying

When viewing the industry from the perspective of the risk it poses to ancient quarries, it is convenient to make a division of the dimension stone quarries in three major categories:

- large-scale, industrial quarrying;
- small-scale quarrying of unique stone types;
- low-tech, artisan quarrying

The large-scale, industrial quarrying mainly includes extraction of limestone and granite, aimed at cut-to-size products for the national and international market. The largest production area of limestone is the Galala Plateau (north and south) in the Eastern Desert (Figure 72). In the short term, it is expected that most of the increasing production will take place here. Although most of the new production sites do not interfere with ancient quarries, there are some areas, especially close to the Nile Valley, where modern quarrying may be in conflict with preservation. There are several other pioneering production areas of limestone, of which some are poorly investigated for ancient quarries, such as in Sinai. Furthermore, it may be a matter of time before the limestone deposits in the Nile Valley (which contains the highest concentration of ancient limestone quarries) become target for more intensive extraction, particularly if underground quarrying is developed on a commercial scale. It must be noted that many ancient limestone quarries along the Nile Valley have been subject of modern small-scale and artisan quarrying (Chapter 5 and Klemm & Klemm 1993).

Egyptian Alabaster (travertine) is quarried east of Beni Suef close to the Nile Valley, especially in the Wadi Sannur area. Production figures are unknown, but they are considerably lower than with regard to limestone. At least three ancient travertine quarries in

Figure 72: Modern limestone quarry in the North Galala area (photo: Tom Heldal)

the area are known (Wadi Umm Argub, Wadi Araba, Wadi Sannur cave),[59] all of which are partially destroyed. Also other ancient travertine quarries in the vicinity of Cairo (Wadi el-Gerawi) and Minya (e.g. el-Qawatir and Hatnub) are partially destroyed or at high risk from modern quarrying (see also Klemm & Klemm 1993 and Chapter 5).

Granite quarrying is increasing rapidly in Aswan and in areas further to the south, such as Wadi Alaki (see above). Most of the granite is used domestically, and the prognoses for the future export of granite from Egypt are somewhat less optimistic than with regard to limestone (Ciccu *et al*. 2005). It is known that granite quarrying is currently in conflict with preservation of ancient quarries in Aswan (see Chapters 4 and 9). Further to the south, no such conflicts are known to exist, as no ancient quarries have as of yet been found in these areas. Due to the conflict with conservation and other land use issues as well as issues related to stone quality, it is expected that the main growth in granite production will take place in Wadi Alaki (Figure 73) rather than in the Aswan area.

In summary, conflicts between preservation of ancient quarries and *large-scale* modern quarrying are currently in particular displayed in Aswan, but also in the ancient travertine quarry areas along the Nile Valley in Middle Egypt. In the future, it is expected that potential large-scale production of igneous rocks in the Eastern Desert and of calcareous rocks in the Nile Valley may significantly add to this risk pattern.

[59] The famous Wadi Sannur Karst Cave is not in the records of James Harrell (see Chapter 2). It was discovered when modern quarrying destroyed its roof in the early 1990s and it was later found that it had been used as a source for travertine in Ancient Egypt (see Halliday 2003 and Middleton 2005). The cave is a Nature Protectorate since 1998 (Egypt State of the Environment 2004).

Figure 73: Modern trial quarrying in granite, Wadi Alaki (photo: Tom Heldal)

Unique stone types

A key issue in the international stone industry is the quest for unique stone types, rare colours and structures that can obtain very high prices on the market. Through Egyptian history, rare stones were also specifically targeted, often because of their aesthetic properties. Some examples from different periods are given in Table 7. Thus, there are similarities between the modern and ancient procurement of stone. For example, in the New Kingdom there was a preference for yellow rocks, reflecting solar symbolism (see Chapter 4). At present, yellow is one of the "booming" colours in the stone market, although architectural trends are now more important than other symbolic values. Deep black and pure white rocks have been targeted since Antiquity, as is also the case with blue stone.

As a result of modern preferences, ancient quarries may easily become subject to renewed prospecting and quarrying. One example is Imperial porphyry, which was attractive in the Roman Period. However, as of yet only very limited modern extraction has taken place in the ancient quarries at Mons Porphyrites, the main modern quarries being located to the north of this area. Another example is the deposit of green breccia (conglomerate) in the Wadi Hammamat area, which has been repeatedly targeted for extraction in modern times. In the latter case, according to Ciccu *et al*. (2005) restrictions have been put on the modern production in order to shelter the archaeological sites in the area, hopefully including the ancient quarries.

The main risks in the future will be massive prospecting and scattered quarrying of some of the unique igneous rocks in the Eastern Desert; porphyries, granites, diorite/gabbro etc. Furthermore, one should consider risks of new quarrying in some of the most attractive types of anorthosite gneiss (Chephren's Quarry) and purple varieties of silicified sandstone (Aswan area).

Table 7: Examples of Egyptian stones valued for their aesthetic appearance in different periods.

Stone type	Peak period of extraction	Key aesthetical aspects
Diorite, Eastern Desert (Gebel Umm Naqqat)	Predynastic	Black and white
Anorthosite gneiss (Chephren's Quarry)	Old Kingdom	Bluish banded
Basalt (Widan el-Faras)	Old Kingdom	Black
Silicified sandstone (Aswan and Gebel Ahmar)	New Kingdom	Yellow, red
Egyptian alabaster (travertine, many quarries)	Middle and New Kingdom	White, yellowish, banded
Imperial porphyry (Gebel Dokhan)	Roman	Purple
Green Breccia (Wadi Hammamat)	Several	Green
Granite (Wadi Alaki)	Modern	Yellow
Limestone (Galala)	Modern	Yellow

Artisan quarrying

In addition to industrialised quarrying aimed for the manufacture of sawn slabs, there is a huge, un-documented part of the Egyptian stone sector that has a very significant impact on ancient quarry landscapes. Small-scale, artisan quarrying for local housing, lime production and other purposes takes place close to cities and villages literally throughout the country. For example, in the Aswan region, sandstone rubble quarries gradually eat their way into the ancient quarries (see Chapters 4, 5, 7 and 9).

The challenge

Not considering artisan and small-scale extraction, and though its impact is large, at the moment there are a limited number of places where modern industrialised quarrying seriously impact on ancient quarries and quarry landscapes (e.g. Minya and Aswan). However, the most likely scenario for the near future is that the hunt for new quarries and stone types will be intensified. This activity will in all probability have a direct focus on specific ancient quarry sites. With this in mind, it is interesting to note that the dimension stone resource maps provided by the Geological Survey of Egypt (presented in Ciccu *et al*. 2005) include many ancient quarries, particularly in the Nile Valley and the Eastern Desert. Importantly, such quarries are *not identified* as ancient on the maps.

There are many reasons to be pleased by the positive development of the Egyptian stone industry, representing a solid input to the country's economic development and also a re-vitalisation of age-old traditions. However, the need for better communication between the industrial sector and heritage authorities is urgent. For example, in the report by Ciccu *et al*. (2005), which is a 300 page detailed analysis of the sector, its stakeholders, legislations and future perspectives, the existence of ancient quarry sites is not mentioned at all, except when arguing for modern production at the same site, as demonstrated by the following quotation (page 133):

> *There is a trend to cancel the licenses of the Quarries which are located at a distance less than 500 m from roads or close to houses, in spite of the fact that those quarries* ***have been there since hundreds or even thousand years*** *prior to any road or house.*
>
> *There is also a trend in Aswan Governorate to terminate the licenses of quarries in Massalla mountain area in order to establish some housing projects,* ***although the earliest quarries in the world exist in that area****.*[Our emphasis in bold]

This is probably not a sign of bad will in the stone industry, but rather reflecting a strong need for information about ancient quarries and that such places are just as archaeologically significant as other types of cultural heritage. Who would use the presence of the ancient town of Elephantine as an argument for building new houses on top of it?

On the other hand, the report points at improved legislations as a key factor for future success in the stone sector. One of the problems today is the difficulties in long term planning of extraction (page 142):

> *Concerning quarrying, … drawbacks include the lack of preliminary geologic investigation in the country and the absence of adequate legislation and rules for the general planning and control of the activity and in particular an unfavorable policy adopted by the public administration in the release of quarrying licenses.*
>
> *In fact, a too small area of the granted permits for a too little time of validity (one year subject to a shorter period of approval by the military authority) discourages the investments in the development of the quarry and in the improvement of extraction methods, resulting in a poor recovery of blocks and in the build-up of huge dumps of waste. Moreover the use of traditional technologies does not promote the professional advance and a deeper involvement of manpower in the production activity.*

Furthermore (on page 128):

> *The Governorates exert an important influence on the development of the quarrying activity since they have been entrusted with the responsibility to release the primary extraction permits and to apply the corresponding fees according to locally established rules, playing a role that was previously committed to the Geologic Survey at a national level. The decentralisation of administrative duties seems not to bring benefit since the Governorates could not control efficiently the quarrying activity, that is developing randomly and in adverse conditions.*

In other words, legislations tend to favour short term *ad hoc* extraction where the space for investing in long term planning is narrow. Indirectly, this has also consequences for the risk posed on ancient quarries: long term permissions favour long term planning and thus greater opportunities to protect ancient quarries within targeted modern extraction areas. Moreover, due to the decentralisation of the permission system – which seems to have had adverse effects on efficient control – there is a risk of broken communication lines between central and local levels, as clearly demonstrated in the case of the modern extraction in the ancient basalt quarries at Widan el-Faras (see below).

What are the perspectives for conservation of ancient quarry landscapes in this framework of rapid growth in modern quarrying industry? Clearly, the legislation system does not stimulate long term planning and sustainability perspectives are generally lacking. Moreover, although many are known to regional authorities, most of the ancient quarries are not even legally registered as cultural heritage (see Chapter 2). In addition to obvious needs for better documentation and legal protection of the ancient sites, communication between heritage authorities and the stone industry should be improved. Furthermore, when expanding into new areas, modern stone industry needs advice on how to avoid destruction of ancient sites. The new Department for Conservation of Ancient Quarries and Mines within the Supreme Council of Antiquities (SCA) could play a vital role in addressing such issues (see Chapter 9).

Other rock and mineral extraction

In some areas quarrying of aggregate for construction has recently been in conflict with preservation of ancient quarries. At Widan el-Faras, Faiyum, modern quarrying has over a period of a few years partly destroyed Old Kingdom Basalt quarries (see Chapter 4). The quarrying of basalt is undertaken for obtaining hard aggregate and rough "heavy" blocks for preventing coastal erosion, and approximately 300,000 tons are extracted annually. Since the basalt layers are rather thin, the quarrying demands huge areas and is progressing fast laterally. Moreover, aggregate quarries in limestone and sandstone in the Nile Valley may in some cases be in conflict with preservation of the many ancient quarries in the area.

Production of industrial minerals is increasing in Egypt. Although no recent record is available, there are certainly many conflicts between modern extraction and preservation of ancient sites, particularly as regards extraction of raw materials for cement (limestone) and probably also talc (soapstone). Aggregate production for cement production has, for example, a long modern tradition at or near the famous ancient pyramid limestone quarries of Tura and Gebel Hof close to Cairo (cf. Klemm and Klemm 1993).

Production of clay to the ceramics industry is also a big challenge in some areas, especially on the East Bank of the Nile at Aswan (see Chapter 4). Clay is also produced in the Kom Aushim area in the Northern Faiyum. There are no ancient quarries here, but many other archaeological sites. This underlines that modern extraction is not only a problem as regards preservation of ancient quarries.

Prospecting for metallic ore deposits, particularly gold, has gained new interest over the last years. New analyses of Egyptian gold deposits have given very promising results, and the prospecting activity is increasing fast. This may be illustrated by the number of concessions given by the Geological Survey in 2006, as shown in Figure 71. Although the gold exploration at the moment does not seem to directly affect ancient quarries, much of the activity takes place in wider ancient quarry landscapes. Moreover, the exploration severely impact on the large number of ancient gold mines. This is a significant challenge that should be urgently resolved.

Conclusions

The Egyptian mineral industry is developing fast, and as regards protection and preservation of ancient quarries it is particularly important to be aware of the following:

- Most of the *large-scale dimension-stone quarrying* takes place outside the main areas with ancient quarries, except in Aswan and probably also within ancient travertine quarry areas in the Nile Valley, where there are current conflicts. However, with new technology and more efficient quarrying methods, ancient quarry landscapes in the Eastern Desert and the Nile Valley may soon come under severe pressure.
- The need for developing new resources of unique dimension-stone is resulting in more focus on ancient quarry areas, particularly in the Eastern Desert, and it is expected that this trend will continue and possibly accelerate.
- Other mineral and rock extractive industries have destroyed many ancient quarries in recent years, and also in the future one should be particularly aware of extraction of basalt, limestone and talc, as well as gold mining.

Obviously, proper documentation and legal protection of ancient quarry sites are crucial in order to avoid destruction by modern extraction. However, the development is progressing at a very high pace, and there is a significant risk that several ancient quarries will be destroyed in the near future, before proper management of the ancient sites can possibly be established (cf. Widan el-Faras, Chapter 4). There is an urgent need for improved communication between the extractive industry and heritage authorities.

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Chapter 7

Re-use, looting and vandalism of ancient Egyptian quarries

Elizabeth Bloxam

Introduction

Previous chapters in this report have focused on past, present and future *large-scale* destruction of ancient quarries from modern quarrying, mega construction projects and the like. On a smaller scale, looting, vandalism and re-use of ancient quarries from antiquity into the present day has also led to significant transformations of these sites. This chapter aims to review some of the issues surrounding these *smaller- scale* transformations of ancient quarry landscapes and discuss some of the broader implications that such activities may have in terms of risks, conservation and preservation of these sites. In particular, the contradictions and ambiguities that such transformations of ancient quarry landscapes highlight in terms of compromising their authenticity and significance. For instance, how do we determine what constitutes a loss of authenticity of a cultural property by re-use, against significance that can be attributed to multi-layered cultural landscapes whereby their transformation to other uses may give added value. Such issues are of importance in terms of risk assessment and conservation as it underlines the many 'grey' areas that exist between viewing quarries within dynamic living landscapes whereby re-use may enhance visibility and be advantageous to the sites' integrity and conservation, as opposed to wholesale destruction due to modern development, looting and vandalism.

Looting and vandalism of quarries, in similar fashion to re-use, is a product of antiquity as well as modernity. This chapter will give an overview of some of the ways in which looting and vandalism have impacted on ancient quarries. In particular, it will address such issues in the present day where access to remoter desert areas of Egypt by tourists is constituting a significant loss of archaeological material from ancient quarries. A concluding discussion will revisit the issues raised and address ways in which we can view these varying degrees of risk and what can be done to mitigate those that wilfully compromise the archaeological significance of ancient quarry landscapes.

Acts of destruction or re-configuring the social landscape?

Several commentators are debating the vexed question of how we grapple with issues of authenticity, integrity and significance of cultural heritage in respect of static views of history that place such attributes into a specific point in time (Johnson 2001:76). As argued in

Chapter 3, ancient quarry landscapes are dynamic cultural landscapes in which material culture may represent not only a direct relationship to quarrying, but other activities over time and space. Re-use of quarries is one of the dynamic transformations of such places - defined here as transforming their function from places of stone production by re-using elements created by quarrying for other purposes, such as burials, monasteries, temples, settlements and military camps. The major conceptual problematic is how we draw a line between practices such as 're-use' which can add new layers of significance, against looting, vandalism and even archaeological excavation, given that all are forms of destruction. Yet, as pointed out by Johnson (2001: 88) certain acts of destruction may be privileged over others, or in other words, such acts may be of significance to certain people at certain times as a reflection of changing social, political and economic conditions. For instance, in the way that communities relate to their past may involve what we might term destructive practices, such as Australian Aboriginal communities recently re-painting rock art motifs as a means to re-create a past for themselves (Layton and Thomas 2001: 17).

Hence, the issues addressed in this chapter are by no means clear-cut and represent many paradoxes in which ancient quarries, not unlike other cultural landscapes, can form the backdrop to human activity far divorced from their initial use. As Emerick (2001: 279) explains: '*…monuments survived and died in landscapes – social, economic, political and geographic. Without exception life around monuments continues up to the present*.' In way of illustration, the massive cemetery in Cairo called the 'City of the Dead' is home to over a million of the living today. Similarly in antiquity, mortuary and valley temples associated with the Old Kingdom (3rd millennium BC) pyramid complexes were re-used as dwellings shortly after their initial function and significance was lost (Kemp 1989: 141-9). These re-configured social landscapes are thus added layers of significance to cultural landscapes that may have had differing values to different people at different times. Hence, who decides on what is more significance to protect and/or conserve is, as Emerick (2001: 281) points out, deeply value-laden. Therefore, in addressing issues of re-use, vandalism and looting, it is important to apply caution and avoid falling into the trap of seeing *all* such transformations of ancient quarry landscapes as destructive. What may be more useful, as suggested by Johnson (2001: 88) is to view acts of destruction as human actions which on the one hand may be more predictable, structured and ordered, such as re-use, and on the other, those that are more unpredictable, chaotic and disordered which may be related to acts such as war and tourism.

Re-use of quarries as temples, monasteries and burials

Re-use, particularly of temples and tombs from the earliest periods in pharaonic history to the Coptic Christian Period (3rd millennium BC to 4th century AD) is a well observed phenomenon. These forms of re-use can typically be either for dwellings, such as the 'villagization' of the Old Kingdom valley temple of Menkaura at Giza (Kemp 1989: 141-149), or, as in the Coptic Period, as chapels, churches and monasteries (Kamil 2002: 73, 135). Although much is known about monumental re-use in antiquity, rather less is known about the re-use of ancient quarries and so a considerable amount of information has been lost. For instance, the Speos Artemidos and other rock-cut shrines containing hieroglyphic inscriptions of the New Kingdom (2nd millennium BC) near Beni Hassan in Middle Egypt were actually placed in disused limestone quarries (Klemm and Klemm 1993: 104-5) rather than, as previously assumed, being purpose-built (Fakhry 1939: 709-23; Gardiner 1946: 43-56). Hence, it was not until the extensive quarry survey work of Klemm and Klemm (1981; 1993) during the 1980s that the true scale of ancient quarry re-use began to emerge.

Figure 74: St. Simeon's monastery on the West Bank at Aswan is built on top of an ancient sandstone quarry (quarry face to the right) (photo: Per Storemyr)

As would be expected, the best remaining examples of re-used quarries belong to the Coptic period. Coptic churches, chapels and monasteries, largely clustered along the east bank of the Nile in the environs of Asyut in Middle Egypt, have made spectacular use of many of the ancient limestone gallery quarries. With *Deir* (in Arabic) meaning 'monastery' (Kamil 2002: 135-6) a look at the map of Middle Egypt easily defines the location of such places, even if these structures may no longer exist. Some of the best preserved examples of quarry re-use by early Christians are can be found at Deir Amir Tadros, Deir Deronqa, Deir Ganadla and El-Ghanayim (Klemm and Klemm 1993: 138-9, 154, 158-9). Many of the limestone gallery quarries of the pharaonic and Roman Period were re-used to often spectacular effect, whereby quarry walls have been elaborately decorated with reliefs and windows have been put in. For instance at Deir Abu Hennis, one the oldest Coptic centres in Egypt (Klemm and Klemm 1981: 18-20; 1993: 113-5) which presents a fine example of the layering of material culture that lies in parallel with the transformations of pharaonic temple buildings.

Such re-configured landscapes whereby a quarry landscape is dramatically transformed into a place of religious pilgrimage, even into the modern day, reminds us of the cyclical and dynamic aspects of these transformed landscapes. For instance, in the environs of the 'suspended monastery' at Abu Foda where several hermitages of the 3rd centuary AD have been restored, these remain central places in the local community (Kamil 2002: 215-6; Klemm and Klemm 1993: 130-5). Hence, rather than seeing re-use as destruction of material culture locked in a specific point in time, the material culture attributed to these re-configured social landscapes can add more layers of significance. Most importantly, these landscapes have values and relevance to those living there today, to the extent in which this can aid in their preservation. Even the plastering over of walls by early Christians of a pharaonic temple at the New Kingdom workmen's village of Deir el-Medina on the west bank at Luxor, intended to obliterate pharaonic gods and rituals, had the unintended consequence of providing excellent preservation (Kamil 2002: 136). Hence, there are many paradoxes that surround issues of re-use as destruction which will be discussed further below.

Figure 75: The West Bank at Gebel el-Silsila with quarries and funerary shrines (photo: P. Storemyr 1999)

A quarry re-used for religious and ritual purposes was, and is, not only for the living. Quarries re-used as burial grounds and as cenotaphs are known throughout antiquity. Although examples from the pharaonic period are harder to come by, given re-use in later periods, some can still be observed in the sandstone quarries at Gebel el-Silsila (Figure 75). Located on the west bank of the Nile between Luxor and Aswan, thirty funerary shrines or tomb-chapels for burials of New Kingdom (18th Dynasty) officials lie in a row into the cliffs. It is difficult to know if they re-used existing galleries cut by quarrying, as this was not inferred by Caminos's investigations (Caminos 1955: 51-5), although their irregular size might suggest this. Moreover, Caminos (op. cit.) could not determine a connection with, or significance of, why the shrines are located where they are, apart from being opposite the ancient town of Keny in the east bank quarries. Perhaps one could speculate that the Silsila west bank quarry landscape was temporarily re-configured as a necropolis, these practices seeing an abrupt end when quarrying was re-established. Re-configuring the landscape back to quarrying, after its significance and function as a necropolis ended, may be demonstrated by the over-cutting of many shrines by such activities (Caminos 1955: 53-4).

Re-use of quarries as necropoli are perhaps most evident from our own investigations of the Aswan West Bank, where from the Late Period into the Coptic Period many of the silicified sandstone and sandstone quarries were re-used for such purposes. At Gebel Tingar these now plundered inhumations are clustered inside disused silicified sandstone quarry excavations that formed caves (see Bloxam *et al*., 2007; Heldal *et al.*, 2005: 26-7) (Figure 76). These largely Coptic period burials further imply the social re-configuring of this part of the Aswan quarry landscape during the Christian period, probably connected with the nearby monastery of St. Simeons. Moreover, the location of a possible hermitage in the quarries to the north of the monastery and other places that could be dwellings for hermits, attest to this social transformation of the landscape in the early Christian period when silicified sandstone quarrying largely ceased (see Bloxam *et al*., 2007). Outside the Nile Valley, particularly in the Faiyum, there are many instances of small hermitages located in rocky overhangs (Kamil

Figure 76: Ancient quarry re-used for later Coptic Period burials, Gebel Tingar, Aswan West Bank (photo: Per Storemyr)

Figure 77: Natural rock overhang with Christian period pottery, indicating likely re-use of Old Kingdom quarrymen's dwellings by hermits. Umm es-Sawan gypsum quarries, Northern Faiyum Desert (photo: Per Storemyr)

2002: 46). For instance at the Umm es-Sawan gypsum quarries, there is evidence from ceramics that dwellings previously for Old Kingdom quarrymen were probably re-used by Christian hermits (El-Senussi 2006) (Figure 77).

Figure 78: Present local small-scale artisan quarrying on the West Bank Aswan (photo: Elizabeth Bloxam)

Quarry use and re-use of the modern age: acts of destruction or preservation?

The examples of ancient re-use described above in antiquity, largely connected to transformations in religious practices, have been argued as significant re-configuring of quarry landscapes that can be value added. Yet, can the same notion be applied to quarry landscapes used in the modern age for purposes other than religious practice? For instance, modern small-scale artisan quarrying as observed on the Aswan West Bank may on the one hand been seen as destructive practice, but on the other, represents a re-configuring of some parts of the landscape back to quarrying.[60] If we can accommodate re-use of quarries as a 'norm' of antiquity through which we gain insights into changes in practices on a social and technological level, then can we exclude *small-scale* artisan quarrying of the modern age in such arguments? Can we include small-scale scavenging for other raw materials on the Aswan West Bank as destruction or part of human interaction with landscapes as dynamic processes?

In some ways, modern *small-scale* practices might inadvertently preserve sites when executed by local communities on which an economic dependency may lie. For instance, the artisan

[60] See also the work of Dobrowolska (2005: 17ff) on traditional stone working practices in Cairo

quarrying described in Aswan actually maintains local livelihoods and gives values to these re-configured landscapes outside of their historical significance to outsiders (Fig. 3). Such intrinsic values may thus be well guarded by local people and consequently be a force to keep those at bay, particularly large outside contractors, who seek to destroy it. As Emerick (2001: 281) points out, conservation may sometimes be better written from the inside out, rather than by professionals from the outside in.

Even more *large-scale* use of ancient quarry landscapes, particularly for purposes of the modern military, can unexpectedly provide protection by the imposition of large exclusion zones around them. Though some destruction will have happened due to establishment of military magazines in ancient galleries, quarry landscapes such as Gebel Tura by Cairo, by Assiyut and by Wadi Abu Agag in Aswan (cf. Klemm & Klemm 1993) might have been far more deteriorated at present without a military presence.

The Umm es-Sawan gypsum quarries in the Northern Faiyum have been particularly well-preserved by a military presence for several decades. Although the remains of unexploded shells and craters from explosions can be observed in and around the quarries, far from destroying the site, the inability of tourists (and archaeologists) to gain access to the area for almost 70 years has actually preserved the site. Now demilitarised, the distribution of unexploded shells that remain in the quarry environs may, paradoxically, further safeguard this part of the Northern Faiyum quarry landscape in the short-term (Figure 79). Hence, quarry landscapes may become across time arenas of political significance, not only by military presences, but as historical continuances as refuges for those escaping persecution (see Kamil 2002: 60-82; 213-5).

Figure 79: Documenting unexploded shell remaining from the former military presence in the environs of the Umm es-Sawan gypsum quarries (photo: Elizabeth Bloxam)

Chaotic and disordered: looting and tourism

The examples of re-use of ancient quarry landscapes may perhaps be described as *structured* transformations, whereby elements of past function provide backdrops to significant social, political and economic change. In some instances ancient quarry re-use may enhance intrinsic elements, for example, monasteries and chapels in gallery quarries often amplify and complement architectural elements created by quarrying. Moreover, it has been argued that modern use and re-use of quarry landscapes can sometimes be an important indicator of social change, yet also provide arenas where local traditions, be those religious or small-scale artisan quarrying, hold important values at local levels today. Hence, we may find historical continuances and even profound examples of the cyclical nature of landscape use, whereby significance is not just situated in one static point in time.

Unstructured and unpredictable interventions in ancient quarry landscapes, although often small-scale and over time, present risks of a rather different nature in terms of the wholesale loss of significance, value and integrity of these landscapes. In the assessment of risks, outside of urban development, mega construction projects and *large-scale* quarrying which are discussed elsewhere in this report, sporadic vandalism and looting have often fallen under the radar.

Chaotic and disordered, conflict as well as trophy hunting of cultural landscapes has long historical antecedents in Egypt (see France 1991; Fagan 2004). In antiquity, monuments and inscriptions were famously defaced when a ruler fell out of favour, such as Queen Hatshepsut and Akhanaton, whose names and monuments were either completely obliterated or re-used (Trigger *et al*., 1983: 218-9, 222). Old Kingdom pyramid complexes, for example, were plundered for their building stone throughout antiquity (Verner 2002: 206, 221-2). However, assigning such intentional vandalism and looting to quarries in antiquity is a more tricky business, particularly determining when this may have occurred, given their previously poor documentation. Yet, as scholars have argued, the tourists and archaeologists from the 19th century onwards have probably caused more damage to Egypt's *monumental* cultural heritage than in the previous 6,000 years (Fagan 2004: 189).

Until recently, quarries had largely been exempt from the destructive forces of mass tourism and the exotic artefact hunters of the 19th and 20th centuries. Undocumented, remote, and not an obvious source of exotic artefacts, their invisibility aided their protection. However, within the last 10 years, this situation has changed for ancient quarry landscapes in remoter parts of the Western and Eastern Desert. Influxes of 'unsupervised' groups of people into these desert regions is generally on the increase, for reasons connected to large construction projects, as well as 'desert tourism' and *ad hoc* 'archaeological' surveys. It is the unpredictable nature of actions by such groups of 'outsiders' that arguably out-way, in terms of *small-scale* loss of material culture and damage, destruction of ancient quarries in antiquity.

No longer remote since the construction of the Uweinat Road in the 1990s, Chephren's Quarry now finds itself not only in the centre of a huge construction project (Chapter 4), but also on one of the main corridors for 'desert tourists' travelling into and out of the Nile Valley to places such as the Gilf Kebir in the far Western Desert. Previously extremely well preserved, the first act of modern vandalism known at Chephren's Quarry occurred at Quartz Ridge in 1999 (see Chapter 3). A cache of 21 rare intact Middle Kingdom storage vessels were, shortly after being excavated and back-filled, dug up and smashed - only 4 survived (Bloxam 2003) (Figure 80). Connecting this act of random vandalism with the sudden influx of people into the area, perhaps connected with the Toshka Project, cannot be discounted.

Figure 80: Vandalised Middle Kingdom storage vessels and illegal diggings at Quartz Ridge, Chephren's Quarry, Lower Nubia. Occurring post April 1999, photo taken April 2000 by Elizabeth Bloxam

Figure 81: Pottery collected and put in boxes at Quartz Ridge, Chephren's Quarry, Lower Nubia, by 'desert tourists' in August 2006. Photo taken March 2007 by Elizabeth Bloxam

Usually comprising small groups travelling in 4 WD's with guides, the 'desert tourist' phenomenon has particularly taken off in southern Egypt, partially related to the desire to explore remoter archaeological sites in the Western Desert. Stop-off places have included the Neolithic settlements at Nabta Playa, which are now under severe pressure from the casual picking-up of artefacts by such groups (Pers. Comm Mohammed Hamed, Director of SCA Abu Simbel, March 2007). Although the rate of artefact loss from these groups at Chephren's Quarry, 50 km east of Nabta Playa, is relatively small, the site is now at high risk from the ever increasing numbers of these groups in the region. A foretaste of what is to come became evident during a QuarryScapes monitoring survey of Chephren's Quarry in March 2007. A group of unsupervised 'desert tourists' managed to locate the site in 2006, and proceeded to collect up ancient ceramics at Quartz Ridge and place them in boxes (Figure 81). Although this may seem inconsequential and perhaps not even an act of vandalism or looting, there are consequences of this action. Firstly, a loss of context for the ceramics collected that negates further serious archaeological investigations of the immediate area. Second, is the probability that other artefacts, such as small object blanks (see Chapter 3 for a description) as well as ceramics may simultaneously have been permanently removed from the site.

This *ad hoc* looting and vandalism clearly comes from increased accessibility to these once remote sites. For instance, in the environs of the Widan el-Faras basalt quarries in the Northern Faiyum Desert, the marked increase in desert tourists has led to an exponential loss of ceramics and stone tools from an Old Kingdom (3rd millennium BC) encampment since it was first surveyed in 2001 (Bloxam and Storemyr 2002). Places where small groups of tourists are allowed to visit unchecked has had a demonstrable effect on the Aswan West Bank, particularly around the location of the obelisk tip on Gebel Gulab which is a favoured destination for those who want to experience a camel ride into the desert. It is notable that in this area ceramic evidence is now negligible in comparison to other areas of the site. Moreover, casual diggings around the nearby obelisk quarries (Figure 82) where some inscriptions are located are all recent acts of vandalism and looting. Panels of rock art in the environs of Gebel es-Sawan have also been removed in recent times.

Figure 82: Top of obelisk at Gebel Gulab, Aswan, with looted extraction site in the background (photo: Per Storemyr)

Archaeologists and geologists have similarly had a hand in stripping remote ancient quarries of their more portable artefacts: ceramics and stone tools being the main targets. Such activities actually have a name amongst these groups, 'sherding' or the random collection of diagnostic pieces of pottery, meaning those that comprise a datable element, are known to have been collected by archaeologists travelling in remoter regions of the Eastern Desert. Even though modern quarrying and mega construction projects pose enormous threats in terms of how risks are assessed, the visibility of such actions and the potential for authorities such as the SCA to engage with contractors is something more tangible. What is becoming increasingly problematic in terms of risks to ancient quarries are these unstructured, unpredictable seemingly *small-scale* acts of looting and vandalism, or the 'chaotic and disordered' activities that tend to slip under the radar.

Discussion and concluding remarks

One of the many challenges faced in the assessment of risks, in terms of conservation and preservation of ancient quarry landscapes, is how, outside of the mega building projects and modern quarrying, we can assess the threat to sites from other types of destruction. The examples of re-use, looting and vandalism both past and present of ancient quarries described above represent only a snapshot of the outcomes of such human actions. However, the sites selected for discussion demonstrate the ambiguities that surround what may initially be perceived as destruction of authenticity or original function on the outside, yet from the inside may represent a significant re-configuring of the social landscape. Moreover, the unintended consequences that re-use and even military presences can have in aiding the preservation of ancient quarries. In essence, an attempt has been made to theorise small-scale destruction of ancient quarry landscapes within two broad parameters: structured and highly visible, as opposed to insidious, unstructured and invisible.

An argument has been advanced that *structured* re-use of ancient quarries as churches, shrines and burials may not necessarily compromise authenticity, but add new layers of significance that may aid in their conservation and preservation. Moreover, *small-scale* artisan quarrying, rather than being destructive, can represent living traditions that carry a raft of values and significance on the inside to local people, totally unrelated to the landscapes' historical significance at a particular point in time. The idea of re-configured social landscapes may be a framework in which we can assess destruction and degrees of risk in a more discursive way. For instance, actions that may aid in conservation or present new layers of significance, as opposed to those that inevitably comprise a total loss of integrity and authenticity.

Risks from the unstructured, unpredictable and insidious have been greatly underestimated. These actions may often be arbitrarily placed on the shoulders of local populations, when such practices may largely be those of outsiders. Although mass tourism from outside has been perceived as one of the burning issues of the day in terms of site destruction, it could be argued that this may be overplayed. For instance, the large groups of visitors to sites such as the 'Obelisk Quarry' are actually well organised and regulated. The direction to be looking in is the current demand of small *ad hoc* groups of individuals, largely 'Westerners' who not only wish to view some of the few remaining big and remote desert landscapes, but also visit some archaeological sites in the process. Hence, it is addressing ways to mitigate the risks that these largely invisible small groups pose, as well as those 'professionals' who engage in small-scale trophy hunting.

As one of the most pressing issues in the context of gradual site destruction, this is also the most problematic given the remoteness of these vulnerable landscapes that are most at risk. Although such issues are discussed in more detail later in this report, one of the baseline needs is an engagement at local levels in mitigating risks, particularly with the tour guides, rather than physical means to restrict accessibility of these remote sites. The idea is not necessarily exclusion, but finding levels of engagement that place responsibility and guardianship of remote quarry landscapes with those whose interests are best served by their preservation. Education is key and it is thus essential that the significance of ancient quarry landscapes is incorporated into the curriculum during the training courses for tour guides in Egypt. In essence, tourism of this nature has to become more structured, regulated and visible.

Accepting that landscapes are dynamic places, in which, as Johnson (2001:88) points out, various narratives of destruction may be integral to their significance, it is thus important to navigate a way through these competing narratives and how they may figure strategically in personal, local and national political projects. In the assessment of risks from a conservation perspective, which relies on estimates of significance and value to gauge what may be expendable, as Emerick (2001: 284) suggests, the narrative is far from simple. Communication with those who inhabit these landscapes and decision makers on local and national levels have to be engaged in the process of drawing up scales of significance and value in terms of preservation and conservation.

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Chapter 8

The impact of natural hazards, weathering and erosion on ancient Egyptian quarries

Per Storemyr

Introduction

When not influenced or destroyed by modern development, ancient Egyptian quarries are remarkably well preserved due to the hyperarid climate that has prevailed since the end of the Holocene "wet phase" and which terminated before the Pharaonic period (e.g. Nicoll 2004; Bubenzer & Riemer 2007). Yet, collapse of quarry galleries, flash floods impacting on quarry settlements and weathering of inscriptions and tool marks may lead to serious loss of cultural heritage values. Hence, in this section some of these natural risks facing ancient quarries will be briefly reviewed. The following hazards and weathering agents are of greatest importance:

- Torrential rains and associated flash floods
- Earthquakes
- Wind action (deflation and erosion)
- Weathering due to salt, clay expansion and other agents

In most cases these hazards and weathering agents work together, influencing or strengthening each other, as there is rarely one single cause leading to decay.

The overview presented below is based on visits to c. 40 ancient Egyptian quarries since 1999, especially in the Eastern Desert, in the Cairo-Faiyum area and in southern Upper Egypt (Luxor to Toshka). Quarries in the Nile Valley between Helwan and Qena have not been visited, implying that deterioration problems facing large and important ancient limestone quarries cannot be described from first-hand experience. For these quarries descriptions in Klemm & Klemm (1993) have proven useful in order to evaluate the situation. The overview does not consider quarries and quarry infrastructure buried under aeolian sand or Nile mud deposits, or having been subject to erosion or other vagaries of the Nile River. Only features of the quarry landscapes that can be identified above ground form part of the discussion, but excluding low, ephemeral stone structures, such as shelters and stone circles, found in large amounts in ancient quarries. Such features may have been subject to minor collapse, but are often relatively well preserved, if not influenced by major deflation. Also prehistoric tool quarries, which have to be considered in long-time perspectives of erosion and sedimentation (e.g. Guichard & Guichard 1968; Marks 1968) are omitted from the discussion. Deterioration of artefacts in quarries, such as ceramics, is also omitted from the discussion.

Flash flood and deterioration of quarry infrastructure

Rain is very uncommon in Egypt, except for the Mediterranean coast, and practically absent in the southern Western Desert. However, in the mountainous Eastern Desert localised torrential rains may occur from time to time, which form the basis for Bedouin life, (Hobbs 1989:1-6; Krzywinski & Pierce 2001), but can lead to serious destruction of ancient quarry infrastructure. Along the Nile Valley torrential rain and flash flood may have disastrous consequences for people and infrastructure (e.g. Kassas & Girgis 1964, cited in Hobbs 1989:4 and Weeks *et al.* 2006:57-62). One of the most recent flash flood events, in Upper Egypt in 1994 had a great impact on cultural heritage, flooding many tombs in the Valley of the Kings at Luxor (McLane & Wüst 2000; Weeks *et al.* 2006:57-62). Other, recent evidence for the impact of flash flood is found in Maxfield & Peacock (2001:2-3), who tell the story of the need to rebuild the washed-away road to Mons Porphyrites in the Eastern Desert three times (1995, 1997 and 1998) to access the area during their survey and excavation project.

Although the many Roman and older quarry settlements in the Eastern Desert still bear detailed witness of former life in this remote part of Egypt, all are to a greater or lesser extent in a ruinous condition (e.g. Peacock & Maxfield 1997; Maxfield & Peacock 2001; Sidebotham *et al*. 2004) (Figure 83, Figure 84, Figure 85, Figure 86). Roofs and walls have tumbled down and sometimes whole parts of settlements have been swept away. Their current state is not only a result of torrential rain and flash flood, but probably also of earthquakes,[61] and – not least – man's choice of building ground and construction techniques. When located on higher ground, away from the parts of the wadis that are active during flash flood events, or in smaller wadis that do not carry much water, the outline of the settlements are normally well preserved (Figure 87). However, the current condition of the masonry is very dependent on building technique.

Generally, settlement walls are constructed from local rubble stone without mortar, but clay may occasionally have been used for levelling purposes and bonding (e.g. at Mons Claudianus, see Peacock & Maxfield 1997:28f), whereas lime plaster can be found on buildings such as small temples (and in cisterns). If walls are well-built, featuring, for example, stable foundations, horizontal levelling courses, binders between outer an inner facings and good quoins, they are sometimes very well preserved, if not having tumbled down due to earthquakes. When the builders did not adhere to sound masonry construction practice, the upper parts of the walls will normally have collapsed, but the resulting piles of stone often protecting the lower courses from further decay. Few major quarry settlements in the Eastern Desert are situated within larger wadis, but some stations along the ancient roads leading to quarries are located at such places. An example is Apollonos in Wadi Gemal close to Wadi Sikait emerald mining area. Here the wadi has literally swept away half of the fortified station (Figure 88).

Flash flood has also heavily impacted on ancient quarry infrastructure in other parts of Egypt. One example is Widan el-Faras Old Kingdom basalt quarry, where a large storage area of basalt blocks[62] has been partially destroyed by floods in a very small wadi (Bloxam & Storemyr 2002) (Figure 89). However, in this case natural weathering of basalt blocks is also

[61] See record of earthquakes in Egypt in Ambraseys *et al.* (1994). Except for the Suez-Cairo-Faiyum area, very few earthquakes have been recorded in Egypt over the last 2000 years. However, it is likely that although other areas are generally rather stable, they might be underreported. For the Eastern Desert some of the few earthquakes in the Red Sea might have had an impact. See also Weeks *et al.* (2006:53-56) on the interpretation of the impact of earthquakes in the Valley of the Kings in Luxor.

[62] Formerly believed to have been a quarrymen's camp, see Harrell & Bown (1995)

a major factor of decay leading to the crumbling of large blocks into small pieces (see description below), which can be carried away by floods. Also parts of the Old Kingdom paved quarry road from Widan el-Faras to Qasr el-Sagha has been swept away by flash floods. This road is otherwise subject to wind deflation of the surrounding sediments, implying that pavement collapses along the edges (Figure 90).

It is sometimes possible to prevent the worst consequences of torrential rains and flash flood. First, in a few cases walls and wall heads can be consolidated, e.g. by careful reconstruction and protective covering. Second, flash flood can be diverted away from quarry infrastructure, by building low stone walls at strategic places. Both types of measures have recently been applied at the Wadi Sikait emerald mining settlement by the American-Dutch project working there (Figure 91).[63] However, it is clear that such measures demand resources (e.g. 4WD cars for access) beyond the capabilities of the Egyptian heritage authorities (SCA), and hence it is normally only foreign missions working with SCA that can undertake such projects.

Figure 83: The main settlement by the granite quarries at Umm Ballad in the Eastern Desert, showing a fine cistern, though with weathered plaster, and the tumbled-down walls. This is a good example of the mixture of well and less well preserved quarry infrastructure (photo: Per Storemyr 2001)

[63] See description of some of the measures undertaken at www.egypt-archaeology.com/Sikait4a.html

Figure 84: From a distance the central settlement area at Mons Porphyrites in the Eastern Desert looks like a pile of rubble. On close inspection, details of room division and other features become appearent (photo: Per Storemyr 1999)

Figure 85: Ruined temple area at Mons Claudianus, Eastern Desert (photo: Per Storemyr 1999)

Figure 86: Collapse of a corner of the platform at the "Tripartite Building" in Wadi Sikait, Eastern Desert (photo: Per Storemyr 2006)

Figure 87: The main settlement at Wadi Barud in the Eastern Desert, showing how it is located higher than the flood waters of the wadi, which can be identified by the bushes along the stream (photo: Per Storemyr 1999).

Figure 88: The road station of Apollonos in Wadi Gemal close to Wadi Sikait is located in the middle of the wadi, which has flushed away the left-hand side of the remaining walls (photo: Per Storemyr 2006)

Figure 89: The basalt storage area (marked with arrows) below the Widan el-Faras Old Kingdom basalt quarries in the Northern Faiyum. Short wadis carrying flood water have seriously impacted on the area (photo: Per Storemyr 2003)

Figure 90: A portion of the Old Kingdom paved quarry road from Widan el-Faras to Qasr el-Sagha in the Northern Faiyum. This portion has been subject to wind deflation, causing that the road stands up from the surrounding sediments. This again leads to collapse of pavement slabs (photo: Per Storemyr 2006).

Figure 91: The main settlement area in Wadi Sikait. Note the low stone walls (arrows) that have been built in order to divert flash flood in an attempt to protect the nearby houses of the settlement (photo: Per Storemyr 2006)

Figure 92: Partial collapse of a gallery quarry at Gebel el-Silsila, East Bank (photo: Per Storemyr 1999)

Collapse and rock fall

Limestone, sandstone and some travertine (Egyptian alabaster) quarries along the Nile Valley feature underground galleries some of which are extensive, reaching depths of 250 m or more (Klemm & Klemm 1993:45-281). Naturally, after several thousand years, parts of the galleries will have collapsed, as the following mentioned by the Klemms:[64]

- Mokattam in Cairo
- Wadi el-Nahkla (Middle Egypt)
- Quseir el-Amarna (Middle Egypt)
- El-Salamuni (Middle Egypt)
- Sidi Moussa (Middle Egypt)
- Gebel el-Silsila (Upper Egypt) (Figure 92)

The causes of collapse are impossible to evaluate without detailed investigation of each case, but it would seem that earthquakes might play a role.[65] However, it has to be considered that weak pillars may be unable to withstand the dead load over prolonged periods, as well as weathering of such pillars, will also be important factors. Moreover, in some cases pillars and other structural features have been subject of modern quarrying or "theft of stone", certainly contributing to their weakening.

Partial collapse of exterior quarry faces and rock-fall from such faces will certainly take place from time to time, but there is no record of such issues. Given that some quarry faces (e.g. in Gebel el-Silsila) are up to 40 m high, there is a certain danger for people at such places.

[64] Except Gebel el-Silsila (sandstone) all the others are limestone quarries
[65] But see Weeks *et al.* (2006:53-56) mentioned in footnote 1.

Possibly except along the tourist trails at Gebel el-Silsila, it unlikely that unstable rocks have been secured or removed in other quarries.

Weathering in hardstone quarries

Weathering of basalt at Widan el-Faras

One of the most intensively weathered ancient extraction sites in Egypt is the Widan el-Faras Old Kingdom basalt quarry in the Northern Faiyum (see also Chapters 3 and 4). 25 million years old basalt layers caps sedimentary rocks in this area (e.g. Bown & Kraus 1988), a situation that has led to the formation of a long and high escarpment, along which basalt for the mortuary temples of the pyramids were extracted. In addition to columnar joint cracks formed upon cooling of the basalt lava and thermal cracking due to extreme temperature differences,[66] also the transformation of olivine and volcanic glass in the basalt seems to contribute to the severe weathering.[67] This result in blocks tumbling down massive scree slopes. Moreover, the growth of much lichen in this area is probably an important factor of deterioration (Figure 96).[68]

The basalt weathering has produced a striking landmark in the desert landscape (Figure 93), but it has also led to tremendous deterioration of the ancient quarries, which are now very hard to distinguish along the edge of the escarpment (Figure 94). Since they are so difficult to see and there are hardly any tool marks left, they were in fact not discovered before the early 1990s (Harrell & Bown 1995), although their presence had been postulated for almost a century (cf. Beadnell 1905; Caton-Thompson & Gardner 1934). Typically, it is a small Roman quarry that is most visible, having been subject to weathering for "only" 2,000 years, whereas the 4,500 years old Pharaonic quarries are significantly more weathered.

As indicated above, it is not only the actual extraction areas that suffer from the weathering. An area of basalt stone circles, located below the escarpment, is affected by weathering to such an extent that it is extremely difficult to determine the function of this area because the originally large blocks have turned into smaller pieces and fragments causing the walls of features to collapse into each other (Figure 95). Similar weathering can be observed on the many basalt blocks still on the quay at the termination of the quarry road at Qasr el-Sagha (cf. Chapter 3), but at this spot also salt weathering (see below) plays a role. Interestingly, the same basalt is much less weathered at the places where it was finally used – especially for the floors of pyramid mortuary temples. There is a reason for this difference, namely that the basalt floors were protected by aeolian sand for millennia before excavation commenced a century ago or so.

[66] It is probably the extreme temperature fall when an occasional rain shower hits a sun bathed, hot basalt that is most important for thermal cracking. The temperature fall is accompanied by simultaneous uptake of water, which leads to volume increase and additional stress to the stone.
[67] Olivine and volcanic glass are not stable minerals; occasional rains and the humidity in the air contribute to their transformation into minerals with a larger volume (e.g. iddingsite), the pressure exerted thus resulting in disintegration of the basalt.
[68] See preliminary description of the weathering in Storemyr (2001:36ff). See also Klemm & Klemm (1993:417-8). It is important to note that the proximity of the Northern Faiyum to the Mediterranean Sea implies that this area receives significantly more rain than areas further south in Egypt.

Figure 93: Weathering of basalt has produced a spectacular landscape at Widan el-Faras in the Northern Faiyum Desert (photo: Per Storemyr 2003).

Figure 94: Massive scree slope at Widan el-Faras. Old Kingdom basalt quarries are located at the edge of the escarpment, visible as a series of benches and small depressions (photo: Per Storemyr 2001).

Figure 95: Presumed basalt storage area at Widan el-Faras. Originally large blocks of basalt have weathered to small pieces and fragments (photo: Per Storemyr 2003)

Figure 96: Probably because of morning dew and occasional rain, Widan el-Faras is one of the few places in Egypt with massive growth of lichen. The lichen appears to influence the weathering of the basalt. This picture is taken within an Old Kingdom basalt quarry, with the fragmented stone in the middle perhaps once intended for a pyramid floor (photo: Per Storemyr 2003)

Weathering of Aswan granite and the Unfinished Obelisk quarry

Widan el-Faras is one of the few ancient hardstone quarries in Egypt that suffers from severe weathering, but it is not the only one. Some granite quarry areas, especially Aswan (see brief description in Chapter 4), are subject to pronounced weathering. However, unlike Widan el-Faras where the properties of the rock and the ambient climate result in a rate of weathering so high that traces of ancient quarrying may be eradicated after a few thousand years, in Aswan we are confronted with disintegration of boulders and bedrock that can be measured in tens of thousands of years or more. The weathering of granite in Aswan is called "onion skin" or spheroidal weathering and initially took place along cracks in the bedrock, ultimately "releasing" single blocks and creating a landscape strewn with boulders weathered on the outside, but with sound cores (Figure 97, Figure 98).[69]

In this way boulders had become naturally and easily available for early hardstone quarrying in Pharaonic Egypt.[70] That the weathering in the Aswan granite is taking place at generally very low rates can be seen by the many unfinished objects spread across the quarry area from the Unfinished Obelisk Quarry in the north to Shellal in the south. On these objects the old weathered skin has been removed and the resulting surfaces are hardly weathered after several thousand years, which is of course also a result of the hyperarid climate that has prevailed in this area for at least 5,000 years. Also ancient inscriptions in the quarries are generally still well preserved (Figure 98).

For the extraction of large objects, such as obelisks in the New Kingdom, it was necessary to move into bedrock, as seen at the Unfinished Obelisk Quarry. The stone surfaces in this quarry are extremely well preserved not only because the weathering is proceeding slowly, but because the quarry has been protected by sand and quarry debris since it was abandoned in the Roman period. However, due to recent archaeological excavation in the quarries, weathering is about to become a serious problem. Over the last few years these large archaeological excavations have uncovered a vast quarry area and extraordinary evidence of New Kingdom working techniques (Figure 99). In the Unfinished Obelisk quarry excavations went down below the ground water table by an ancient canal used for stone transportation and the problem now encountered is the disintegration and flaking off of important epigraphic data and tool marks (Figure 100). This deterioration is followed by salts, known as one of the most destructive agents in stone weathering (see e.g. Goudie & Viles 1997).[71]

Since the work of Ball (1907) and Passarge (1914, published in 1955) it is known that, as in other arid places of the world, the ground in Aswan contains much soluble salt. The origin of the salts in the Unfinished Obelisk Quarry has not been studied, but it may be suggested that they stem from both the granite quarry debris (see e.g. analyses by Ball 1907:64-5) and more generally from the ground water, which may have picked up salt from various sources. When a salt-loaded quarry face that has been buried for thousands of years is suddenly brought in

[69] On spheroidal weathering with particular reference to Aswan, see Ball (1907:72), Passarge (1955:28-30), Klemm & Klemm (1993:308). Spheroidal weathering involves long-term, very complex processes that have not yet been extensively explained

[70] Aswan is not the only quarrying area in which natural boulders were a primary resource for quarrying. Also Chephren's Quarry (gneiss), to a large extent the Aswan West Bank (silicified sandstone) and some quarries in the Eastern Desert are boulder quarries

[71] Weathering of granite obelisks is also of relevance for the weathering in the quarry, see Winkler (1980, 1996) and comments in Storemyr (1997:39-41). The problem of the salts in the quarry has also been published elsewhere recently: National Geographic (http://news.nationalgeographic.com/news/2007/10/071024-ancient-egypt.html), Science Daily (www.sciencedaily.com/releases/2007/10/071016131326.htm) and EurekAlert (www.eurekalert.org/pub_releases/2007-10/ps-aoq101607.php)

contact with the ambient air, the salt is bound to crystallise. Some of this crystallisation will take place immediately behind the surface, leading to flaking and disintegration of the rock.

Depending on the type of salt present, it is also possible that differences in relative humidity (RH) between day (low RH) and night (high RH) lead to cycles of dissolution and re-crystallisation of the salt. Moreover, since the quarry face in this case is situated by an ancient, sediment- and water-filled canal, there will be a capillary rise of water that brings new salts to the surface over and over again; thus a process of destruction has been initiated that probably cannot be mitigated before the water has been drained away or the quarry face reburied. This type of weathering is in principle similar to what is encountered at temples, which lower parts have been excavated/uncovered over the last century or so, along the Nile Valley throughout Egypt, especially in Luxor. Whereas in Luxor the high ground water table caused by irrigation, the now stable level of the Nile and ultimately the Aswan High Dam is responsible for salt weathering of masonry in contact with the soil, it has not yet been positively confirmed that this is the case in the Unfinished Obelisk Quarry. However, given the proximity to Lake Nasser, it is more than likely that the ground water has risen in Aswan after the completion of the High Dam in 1970.[72]

Figure 97: Boulder landscape created by spheroidal weathering in the southern part of the Aswan granite quarries. Note the Roman bathtub having been carved from a boulder. Note also the modern quarrying in the background (photo: Per Storemyr 1999)

[72] See e.g. Kim & Sultan (2002) on the recharge of the Nubian aquifer and the resulting rise in groundwater table.

Figure 98: Spheroidal weathering of granite (left) and a New Kingdom inscription carved below the weathered layer (right). Aswan granite quarries (photos: Per Storemyr 1999 and 2006)

Figure 99: Before (above) and after (left) recent excavations (2002-2006) in the Unfinished Obelisk Quarry (photos: Per Storemyr 1999 and 2006)

Figure 100: Salt weathering on the extensive quarry face shown on the picture above. Note that the dolphins and other drawings are becoming affected (photos: Per Storemyr 2006)

Weathering of softstone quarries

The weathering of ancient limestone and sandstone quarries also to a large extent involves soluble salts, as noted for many places by Klemm & Klemm (1984; 1993:45-281). However, expansion of clay minerals is also an important weathering agent. Since few limestone and sandstone quarries along the Nile have been visited, it may be useful to consider the weathering of one particular limestone quarry, the Wadi el-Muluk quarry by Qurna in Western Thebes (see description in Chapter 4). Understanding the weathering in this quarry also benefits from the detailed investigations in the nearby Valley of the Kings, as well as recent studies on the behaviour of this particular limestone on monuments in the Theban necropolis. Thus, the weathering of this quarry may serve as a model also for other quarries.

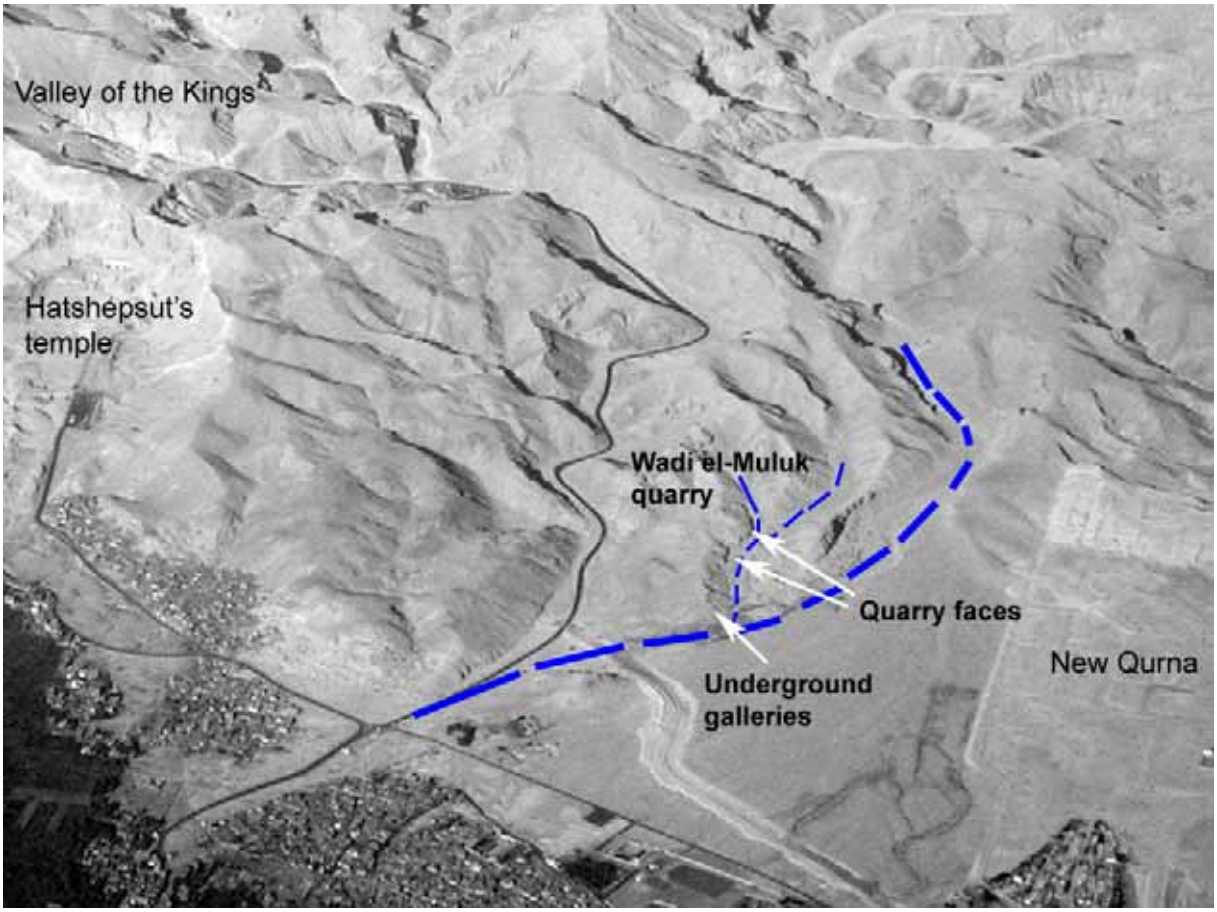

Figure 101: The Wadi el-Muluk quarry in Western Thebes. Photo taken from aircraft by P. Storemyr 2003. Blue lines indicate wadi courses.

Weathering of the Wadi el-Muluk quarry, Qurna, Western Thebes

The Wadi el-Muluk quarry is not badly deteriorated, as tool marks and inscriptions are well preserved, and it is mainly in the underground galleries that there are localised signs of salt weathering along the quarry floors and walls (Figure 102). Several investigators have found that the limestone formations in Western Thebes naturally contain much salt, especially halite (NaCl) and gypsum ($CaSO_4 \bullet 2H_2O$) (e.g. Wüst 1995; Wüst & Schlüchter 2000) and these are probably also the main types occurring in the quarry. Moreover, other authors have paid attention to the great role that expansion of small amounts of clay minerals may have for the progress of weathering of this particular limestone (Zehnder *et al*. 2000).

Many tombs in the nearby Valley of the Kings, but also in the Valley of the Queens and in Qurna ("Tombs of the Nobles") are damaged by salts, but here the effects are much more dramatic than in the Wadi el-Muluk quarry since it is predominantly the vulnerable plaster and paint that become the victims of weathering. Clearly, the naturally occurring salts are becoming active mainly due to meteoric water provided by thunderstorms through rock-fissures and flash flood water entering galleries (cf. Weeks et al. 2006:57ff). However, condensation and changes in relative humidity also play a significant role as to the activity of hygroscopic salts (cf. Zehnder et al. 2000:752).

Thus, the weathering model is simple: Salt weathering occurs in the galleries and on the faces of quarries which naturally contain salt, especially halite and gypsum, and due to the influence of meteoric water, condensation and changes in relative humidity. The weathering may be enhanced by expanding clays.[73] Generally, this model would also apply for many sandstone and other types of quarries.[74]

Figure 102: Underground gallery in the Wadi el-Muluk quarry. Salt weathering predominantly takes place along the lower reaches of the walls (photo: Per Storemyr 2001)

Figure 103: Weathering of Qurna limestone, probably from the Wadi el-Muluk quarry, in the temple complex at Karnak. Note that the limestone is much more susceptible to weathering that the surrounding Nubian sandstone. In this particular case the weathering is influenced both by naturally occurring salts (and clays) in the stone and salts provided by ground water (photo: Per Storemyr 2001)

[73] The salt load may be enhanced if meteoric water (and ground water) seeps through other salt sources (e.g. from agriculture) before reaching the quarry walls.
[74] See also similar models for weathering of old quarries in cold temperate climates (Zehnder 1980; Storemyr 1997)

Figure 104: Differential weathering in the sandstone faces of the Tombs of the Nobles on the West Bank of the Nile at Aswan (photo: Per Storemyr 2001)

Notes on additional weathering and erosion issues in softstone quarries

Most quarry faces display differential weathering as a result of the primary properties of the stone. For sedimentary stone quarries in Egypt this is largely due to the occurrence of expanding clays within the layers that were targeted for quarrying or, more commonly, clay-rich layers between the usable stone. A particularly good example can be found at the "Tombs of the Nobles" on the West Bank of the Nile in Aswan, which may also have been used as a quarry.[75] Here, thin clay-rich layers have been subject to much more weathering than the rather friable Nubian sandstone over the c. 4000 years the tomb face has been exposed, though within this time span it has also been covered by sand (Figure 104). In the Aswan area, as elsewhere in the Nubian sandstone region of Upper Egypt and adjacent deserts, the sandstone is often partially silicified. Such layers or patches of the sandstone are cemented by secondary silica and thus much more resistant to weathering than non-silicified sandstone.[76]

Salt may play a role in differential weathering and also in what is generally perceived as "sand blasting", or the combined effect of wind and aeolian sand. However, for many softstones, such as Nubian sandstone, sand blasting alone is probably capable of severely eroding delicate surfaces. In the Aswan area there are many examples of erosion of friable Nubian sandstone quarry faces by sand blasting. This may become a problem when such surfaces display fine tool marks, inscriptions and rock-art. Below are some examples of the effect of sandblasting on valuable sandstone surfaces in the Aswan area.

[75] See Klemm & Klemm (1993:271-3) and Heldal & Storemyr (2007:122-124)
[76] See Heldal *et al.* (2007) on the weathering and erosion of silicified sandstone at the West Bank of Aswan.

Figure 105: Prehistoric rock-art in the grinding stone quarries on the West Bank of the Nile at Aswan. Picture taken by Hans Winkler (1939: Plate XIV) in the 1930s. The rock-art has been severely eroded by mainly sand blasting, or the combined effect of wind and aeolian sand. The panel is located on horizontal Nubian sandstone bedrock

Figure 106: The same rock-art as in Figure 105. Note the development of the erosion (photo: Per Storemyr 2006)

Figure 107: Prehistoric rock-art on a vertical Nubian sandstone face in the grinding stone quarries in Aswan. In this case it is suggested that the weathering and erosion is a combined effect of sand blasting and salt crystallisation (photo: Per Storemyr 2006)

Figure 108: Heavily eroded Nubian sandstone quarry face in the Naq el-Fugani quarry on the West Bank of the Nile at Aswan (photo: Per Storemyr 2007)

Summary and concluding remarks

Although natural hazards, weathering and erosion represent a minimal risk to Egypt's ancient quarries as compared to the actions of man, some may seriously contribute to rapid deterioration of quarry infrastructure and quarry faces. Rainstorms and flash flood, especially in the Eastern Desert, must be regarded the most destructive hazard. Collapse of galleries and rock-fall is also a main risk in some areas. Moreover, salt weathering, clay expansion and the combined action of wind and aeolian sand (sand blasting) may lead to serious loss of tool marks, inscriptions and rock-art.

In most cases little can be done to mitigate natural hazards, weathering and erosion. This is partially due to the nature of the risks, but also to the limited resources at hand for targeted conservation programmes. However, when such a programme has been decided upon, as in all areas of conservation, it is important to find the multiple causes of deterioration before intervening – and not react on symptoms.

Particularly useful measures may include diverting flash flood away from valuable quarry infrastructure. This can sometimes be undertaken by simple means, such as building stone walls. Moreover, one should think twice before uncovering valuable quarry faces. When these are becoming rapidly exposed to the elements after thousands of years under sand and debris, weathering is often bound to occur, as has happened in the Unfinished Obelisk quarry in Aswan. Reburial may be the only means to mitigate weathering in such cases, a measure that may also be useful in other cases of rapid weathering of valuable quarry faces.

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Chapter 9

Reflections on monitoring and protection of ancient quarries, with examples from Aswan

Per Storemyr and Adel Kelany

Introduction

Risk assessment and monitoring within the cultural heritage sector are closely related fields of study, as normally various kinds of recurring investigations are undertaken in order to identify threats and assess risks (Storemyr *et al.* 2004:11-12). There exists a vast range of risk assessment and monitoring systems and programmes within cultural heritage today, from high-tech remote sensing to the traditional, repeated documentation on the basis of visual inspection (ibid, 6-10). With regard to World Heritage, a similar range of systems and programmes are in use, and it is important to note that UNESCO requires that State Parties undertake periodic monitoring/reporting of World Heritage Sites.[77]

The risk assessment and monitoring approach to ancient stone quarry sites and landscapes, as taken within QuarryScapes and described in this report, has combined field checks with simple analysis of historic and recent satellite images, topographic maps and development plans. Moreover, all relevant documentation has been feed into simple Microsoft Access and ESRI GIS databases (see description in Storemyr & Heldal 2007; Chapter 2 and Appendix 1). Addressing an Egyptian context, the main guiding principle for the work has been that risk assessment and monitoring should serve *practical purposes*, namely the efficient protection, conservation and management of sites and landscapes. However, also *simplicity* and *low cost* are considered essential. This is because the Egyptian heritage sector, with the Supreme Council of Antiquities (SCA) as the central, legal body and its governorate inspectorates ("Tafteesh'es") as the actors executing the practical work on a regional and local level, has limited financial and technical resources. They often depend on foreign missions and projects to carry out archaeological surveys and conservation tasks. Moreover, there is a lack of professionals with skills needed to carry out risk assessment and monitoring. With these limitations in mind and with the experience gathered through QuarryScapes work, the aim of this chapter is to reflect on how risk assessment and monitoring of quarry landscapes can be furthered in Egypt, suggesting practical methods for the work. Moreover, the roles of the Egyptian Antiquities Information System (EAIS) as the main SCA body responsible for

[77] See the comprehensive report on "Monitoring World Heritage" by UNESCO WHC (World Heritage Centre) and ICCROM published in 2004 (World Heritage Papers 10). The report is available at: http://whc.unesco.org/documents/publi_wh_papers_10_en.pdf

official site records and well as the new SCA Department of Conservation of Ancient Quarries and Mines (see Chapter 1) will be incorporated in the discussion, which will use examples from practical risk – or rescue – surveys and protection work in the Aswan area.

Indicator development for regional and national monitoring

The target groups for results of risk assessment and monitoring efforts on a regional and national level will usually be politicians, managers, administrators and others responsible for cultural heritage protection, but also national and international NGOs, such as UNESCO. These groups need adequate, simple overviews of the state of cultural heritage in order to draw up broad strategies furthering protection and management, as well as to allocate financial and other resources.

For similar purposes, in the closely related field of environmental protection, indicators allowing easy access to status and risks are today in use throughout the world, certainly also in Egypt.[78] These systems are usually closely related to "State of the Environment Reports". Several countries have also introduced similar indicator-based systems for cultural heritage. For example, in Norway regional, municipality-wise repeated surveys of the state of archaeological sites (Figure 109, Figure 110) are fed into a national system, which is linked with political goals on reduction of the loss of such sites (max. 0.5% annually).[79] This work procedure requires that investigation using a pre-defined indicator methodology identifying loss and threat is carried out in select municipalities. Even an official Norwegian Standard has been developed for this purpose.[80] Additionally, the Norwegian system features indicators for the state of protected buildings,[81] but is seems that as of yet no indicators are in use as regards cultural environments (or cultural landscapes). However, the actual number of cultural environments legally protected is used as a hint to the development.[82] In Australia a similar system based on indicators for the state of cultural heritage and archaeological sites has been developed.[83] The associated report on indicator development gives very valuable hints as to definition of useful indicators,[84] and was used extensively by one of the authors of the current report during indicator development for archaeological sites in the Colli Albani area near Rome 2001-2004 (Storemyr *et al.* 2004: 59-69) (Figure 111). This work was part of an EU-project called "Demotec" on monitoring of archaeological sites and landscapes, headed by the Norwegian Institute for Cultural Heritage Research.[85]

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[78] See e.g. the website of the Egyptian Environmental Affairs Agency (www.eeaa.gov.eg), their "State of the Environment Report 2005" (www.eeaa.gov.eg/English/info/report_soe2006) and their "Environmental Indicators Newsletter" (www.eeaa.gov.eg/English/reports/Newsletters/IndicatorsBulletinAug07.pdf, in Arabic)

[79] See "Annual loss of archaeological monuments" at the Norwegian State of the Environment website (www.environment.no/templates/status____3991.aspx)

[80] See overall description on the website of the Directorate for Cultural Heritage (www.riksantikvaren.no/Norsk/Fagemner/Miljoovervaking/Overvakingsprosjekter, in Norwegian). See also the website of the Norwegian Institute for Cultural Heritage Research for a range of reports on monitoring in different municipalities (www.niku.no/index.asp?strUrl=//applications/System/publish/view/showobject.asp?channelid=1000051&noart=1000&menuid=1000520). The Norwegian standard is called NS 9450 "Automatically protected cultural heritage sites and monuments. Registration of loss and damage"

[81] See www.environment.no/templates/MaalNokkeltallForside____3981.aspx

[82] See www.environment.no/templates/themepage____2428.aspx

[83] See www.environment.gov.au/soe/heritage

[84] The report can be downloaded from: www.environment.gov.au/soe/heritage/heritage-ind.html

[85] See description of the "Demotec project" at: www.niku.no/index.asp?strUrl=//applications/System/publish/view/showobject.asp?infoobjectid=1000893&menuid=1000512

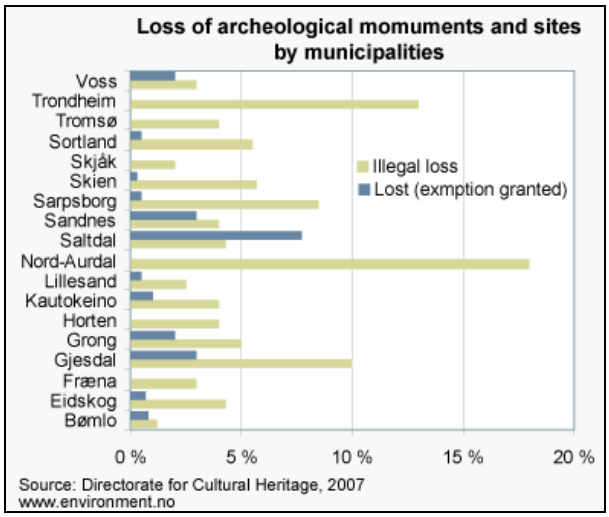

Figure 109: Example of loss of archaeological sites in selected municipalities in Norway between the 1970s/1980s and c. 2000. Loss is legal if an exemption under the Cultural Heritage Act has been granted. The data show that most loss involves breaches of the Act. In many cases, people fail to notify the authorities before starting activities that will disturb or damage cultural heritage sites that are protected by law. Source: Directorate for Cultural Heritage / www.environment.no

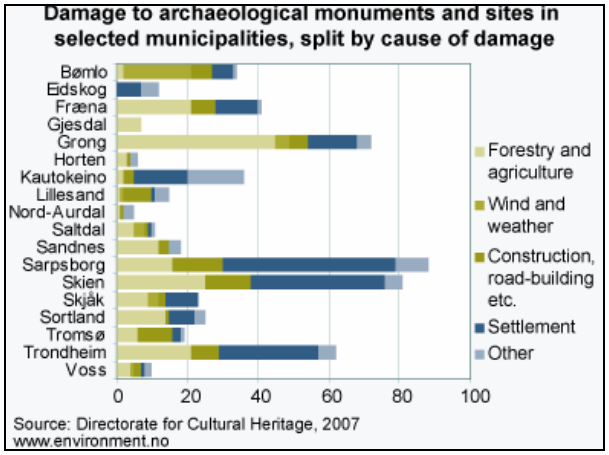

Figure 110: Example of damage to archaeological monuments and sites in selected municipalities in Norway, split by cause of damage. Monitoring programmes shows that the damage to archaeological monuments and sites is most frequently caused by agricultural operations, including cultivation of areas for the first time. The construction of new buildings, expansion of housing and holiday cabins and construction of infrastructure is also a threat, particularly in urban areas. Source: Director. for Cultural Heritage / www.environment.no

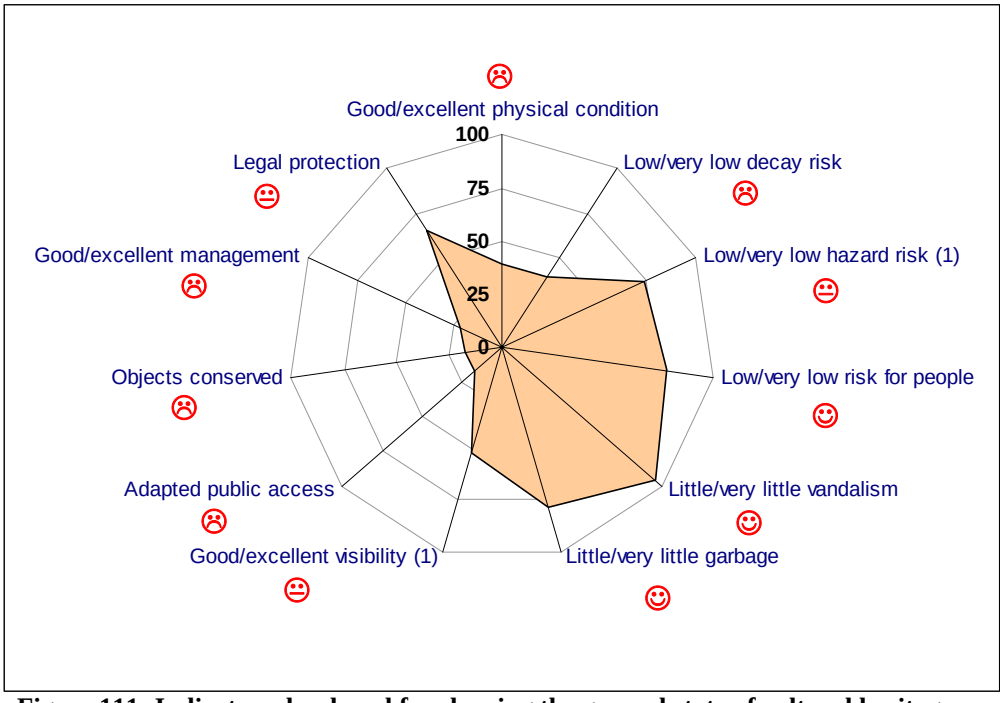

Figure 111: Indicators developed for showing the general state of cultural heritage sites in the Nemi basin in the Colli Albani area near Rome (2004). The axes shows percentage of sites (of 23 investigated) fulfilling the criteria of the various indicators. The faces give hints to whether the situation is "good" or "bad". Source: Storemyr *et al.* (2004: 67). See also further description in this report

Like in many other countries, the heritage authorities in Egypt have not yet embarked on development of indicators that can visualise the state and development of its cultural heritage. As mentioned in Chapters 1 and 2 Egypt does not yet have comprehensive (electronic) site records for its cultural heritage, which is a prerequisite for undertaking monitoring and analyses of development trends as to threats and risks. Still, in the not too distant future EAIS will have gathered enough material in their site record databases to enable serious reflection on development of nation-wide and governorate-based monitoring systems. In this respect the overviews of c. 200 ancient quarries presented in Chapters 2 and 5 of this report may serve not only as an example of a *baseline* for monitoring of these particular sites, but also give input to the development of monitoring tools and systems for the Egyptian heritage at large.

Using the Norwegian and Australian systems as inspirational models and drawing on the tentative nation-wide overviews of ancient Egyptian quarries in Chapters 2 and 5 (Pharaonic and later quarries, Prehistoric ones not considered due to lack of data), a core set of simple indicators can be suggested. The following proposal distinguishes between "hard" or quantitative indicators and "soft" indicators, of which the latter are based on evaluation with a certain subjective element (Table 8).

The most important "hard" indicator would be related to the actual number of sites that have a secured legal protection. This indicator takes official protection decrees issued as a point of departure, disregarding those sites that are only mentioned as being protected or which has a disputed legal status. Currently, only 5% of the ancient quarries have a secured legal status, which must be considered very low. However, as discussed in Chapter 2, several other areas *may* have such a status, and some 50% appear be known to governorate inspectorates. Knowledge of ancient quarries may also be expressed by the number of sites at which guards are present. The use of guards is very common in Egypt and in many cases it may be an efficient method of mitigating risks. However, due to transportation problems in remote areas, it is virtually impossible to have guards present other than close to modern settlements. The number of quarry sites with guards is presently not known and such information will have to be gathered from the inspectorates. Similarly, the number of sites which have some form of management plan is unknown. This number would be a very important indicator of the actual development of sites in terms of conservation measures and promotion to the public.

"Soft" indicators considered pertain to the assessed physical condition of recorded sites. The number of entirely or largely destroyed sites is, fortunately, still limited (tentatively 9%, of which 4% are under Lake Nasser), and keeping this number low certainly represents an important future goal. It is more difficult to suggest indicators that give information on the number of sites that have been physically affected by modern development. One possibility is to use the number of largely intact sites (38%) since this includes quarries that are not yet partially destroyed (20%), thus it is also useful as a measure related to future goals. The number of intact sites (25%) is in this respect also a useful measure.

In the Norwegian example above, threat identification is also considered within its nation-wide monitoring based on information from selected municipalities. The same can be suggested for Egyptian quarries, drawing on information gathered in Chapter 5. It has been shown that c. 40% of the quarries have been influenced by modern mining and quarrying with this threat also representing the main risk in the future. Quarries directly influenced by development of urban and rural settlements/expansion (11%) is rather low at the moment, but is expected to increase dramatically in the future. These figures can at the moment only be used as very rough indicators, as for a large group of quarries (more than 45%) threat is unspecified (but risk considered low) or not determined.

Table 8: Proposal for a core set of indicators for monitoring of ancient quarries (mainly Pharaonic and later). See Chapters 2 and 5 for further descriptions. Prehistoric quarries mentioned in Chapters 2 and 5 are not part of the tentative nation-wide status 2007.

Indicator	Description	Tentative nation-wide status 2007		Evalu-ation
		Number	Percent	
Number of recorded sites ("hard")	Since there will be many more quarries not yet recorded, this number is a measure of survey effectiveness in finding and defining new sites	193	-	-
Number of protected sites ("hard")	Number of sites protected by official decree (sites owned or supervised by SCA), in which ancient quarries are specifically mentioned or are completely within the protected area. Sites which are only orally reported as officially protected are not included. This indicator is thus based on the number of official decrees existing. The actual decrees are listed in the EAIS electronic site records. It hints at the extent that ancient quarries are officially furthered in terms of protection and conservation.	10[86]	5%	☹
Number of sites with guards ("hard")	Number of sites, officially protected or not, that have guards regularly present. This indicator must be based on information from the inspectorates in the respective governorates. It hints at the regional and local knowledge of ancient quarries, which is important in terms of mitigating risks.	Unknown[87]	-	-
Number of sites with management plans ("hard")	Number of sites for which management plans have been developed and which specifically includes ancient quarries. This indicator must be based on information from the inspectorates in the respective governorates.	Unknown[88]	-	-
Number of largely destroyed sites ("soft")	Number of largely destroyed sites according to definition in Chapter 5 (more than approx. 80% of ancient workings and associated quarry features destroyed). This indicator is based on evaluation made during survey.	17	9%	😐
Number of largely intact sites ("soft")	Number of largely intact sites as defined in Chapter 5 (up to approx. 10-20% of ancient workings and associated quarry features destroyed). This indicator is based on evaluation made during survey.	74	38%	😐
Number of intact sites ("soft")	Number of intact sites according to definition in Chapter 5 (more or less intact, though small-scale destruction may have taken place, such as looting, vandalism, development in the near vicinity etc.). This indicator is based on evaluation made during survey.	49	25%	😐

[86] Four sites in the Eastern Desert are only orally reported as being officially protected; see Chapter 2

[87] All the officially protected sites will have guards, but in addition there are guards at places such as Gebel el-Silsila.

[88] It is likely that some kind of management plan exists for sites such as the Unfinished Obelisk (Aswan) and Serabit el-Khadim (Sinai)

Many more indicators could be suggested, especially as regards the landscape aspects of the sites. However, there is as of yet hardly any data that would enable the use of indicators giving information on themes such as "visual impact of modern development".

Putting monitoring at a national and regional level at work

Validating and updating the archaeological records and borders of ancient Egyptian quarry sites, as well as their legal status, condition and risk tentatively assessed in this report, need to be undertaken before indicators such as those proposed above can be used securely. It must be remembered that the tentative overviews presented is based on location by centre coordinates only (see also Figure 112). Only in rare cases such as the Unfinished Obelisk in Aswan and Serabit el-Khadim in Sinai there are as of yet any official borders defining the sites as cultural heritage. In particular, the numerous limestone quarry areas along the Nile Valley are still extremely poorly defined in terms of where one quarry ends and another one starts. Moreover, survey and field check results on which condition and risk assessment is based in this report might sometimes be outdated.

The most promising way of furthering validation and updating of the ancient quarry site records would probably be to proceed governorate-wise, ultimately putting indicators such as those proposed and others at work for each governorate in which ancient quarries are located. Fortunately, the recently established SCA Department for Conservation of Ancient Quarries and Mines (short "SCA Ancient Quarry Department") should be able to deal with this task.

This Department is located at the SCA-premises by the Unfinished Obelisk quarry museum in Aswan. It is based on specific assignment of SCA inspectors in the various governorates to the Department. This implies that a number of inspectors in each governorate will be responsible for tasks such a recording, documentation and, not least, protection proposals and basic management. Specific education and training will be required to undertake such tasks (see section below), which fundamentally must aim at defining the borders of ancient quarry areas. This is certainly a difficult task involving survey of large areas, essentially in a similar way as it has been done in the QuarryScapes case study areas (see Chapters 3 and 4 and Bloxam *et al.* 2007).

Given the limited resources at hand in the inspectorates it may be necessary to simplify survey methodologies used in QuarryScapes; it is, for example, hardly possible to use expensive satellite images and comprehensive GIS databases as tools. Since Google Earth features high-resolution satellite images for a large proportion of Egypt it may become a very helpful tool, though, especially as it is available in Internet cafes (inspectorates do not have comprehensive computer and Internet facilities). One may, for example, envision that images are printed, used during fieldwork aimed at recording sites and defining site borders, and in the end handed over to EAIS that can incorporate borders and update site information in their nation-wide databases and GIS, which now includes all known Pharaonic and later quarries (see Chapters 1 and 2) (Figure 112).

If such a system could be put out in practice, it is likely that the actual work will generate knowledge and interest that may enhance public awareness of ancient quarries. Thus, it may in itself become a valuable "promotion programme", which might aid in mitigating risks. But it is also important to keep the long-term perspectives of monitoring in mind, collecting data that can be used for indicators, as suggested in this chapter. Moreover, monitoring is useless if results are not communicated to target groups. In this case of national and regional overviews

the target groups would be, as mentioned above, relevant authorities, managers and politicians responsible for protection and resource allocation.

Undertaking validation and updating of Egypt's ancient quarry site records, including archaeological features, site borders, legal status, condition and risk by those ultimately responsible for the day-to-day management, namely the inspectorates, the new SCA Ancient Quarry Department and EAIS, will be a lengthy task. It is thus too early to speculate on sensible intervals for field checks aimed at controlling the development on a national and regional level. However, the normal time span for such controls would be in the range of 5 to 15 years, with results fed into adequate databases and communicated to relevant audiences.

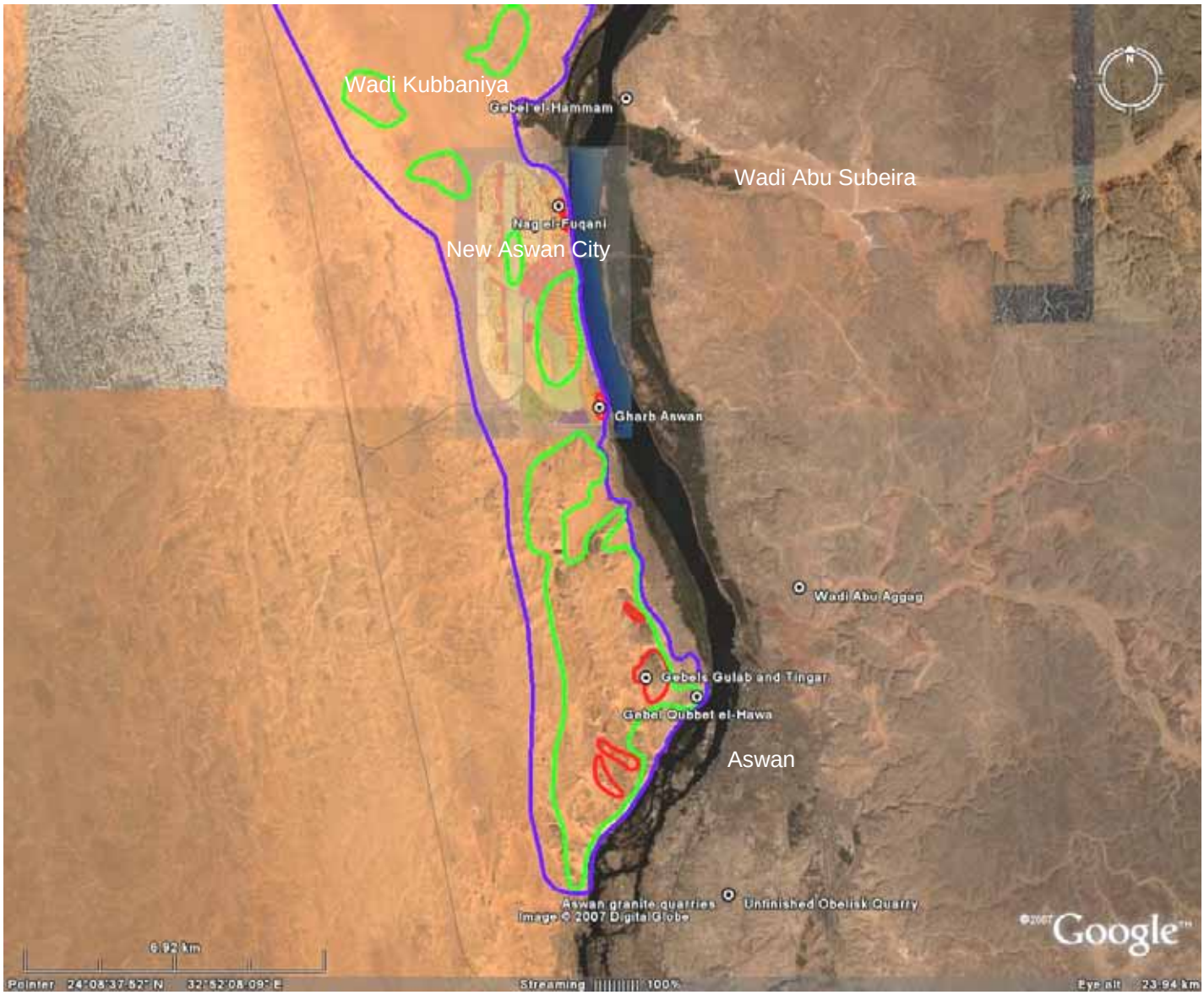

Figure 112: Example from the Aswan West Bank of how Google Earth can be used for redefining quarry sites and draw up simplified borders of quarry landscapes: The points represent quarry sites as they are recorded in the database based on James Harrell's work (see Chapter 2). Red enclosures are quarry sites used for ornamental stone mainly in the New Kingdom and Ptolemaic-Roman period. Green enclosures are extensive grinding stone and other types of mainly utilitarian quarries used from the Palaeolithic to the Roman-Byzantine periods. The blue enclosure defines the whole quarry landscape. Note that there are many other types of archaeological sites within the enclosures, but that the ancient quarries define the archaeological character of the area. Note also that the development plan of New Aswan City has been projected on the map (upper portion). Compare with survey maps in Bloxam *et al.* (2007), as well as with maps and descriptions in Chapters 3 and 4 of the present report. Scale bar: 6.92 km

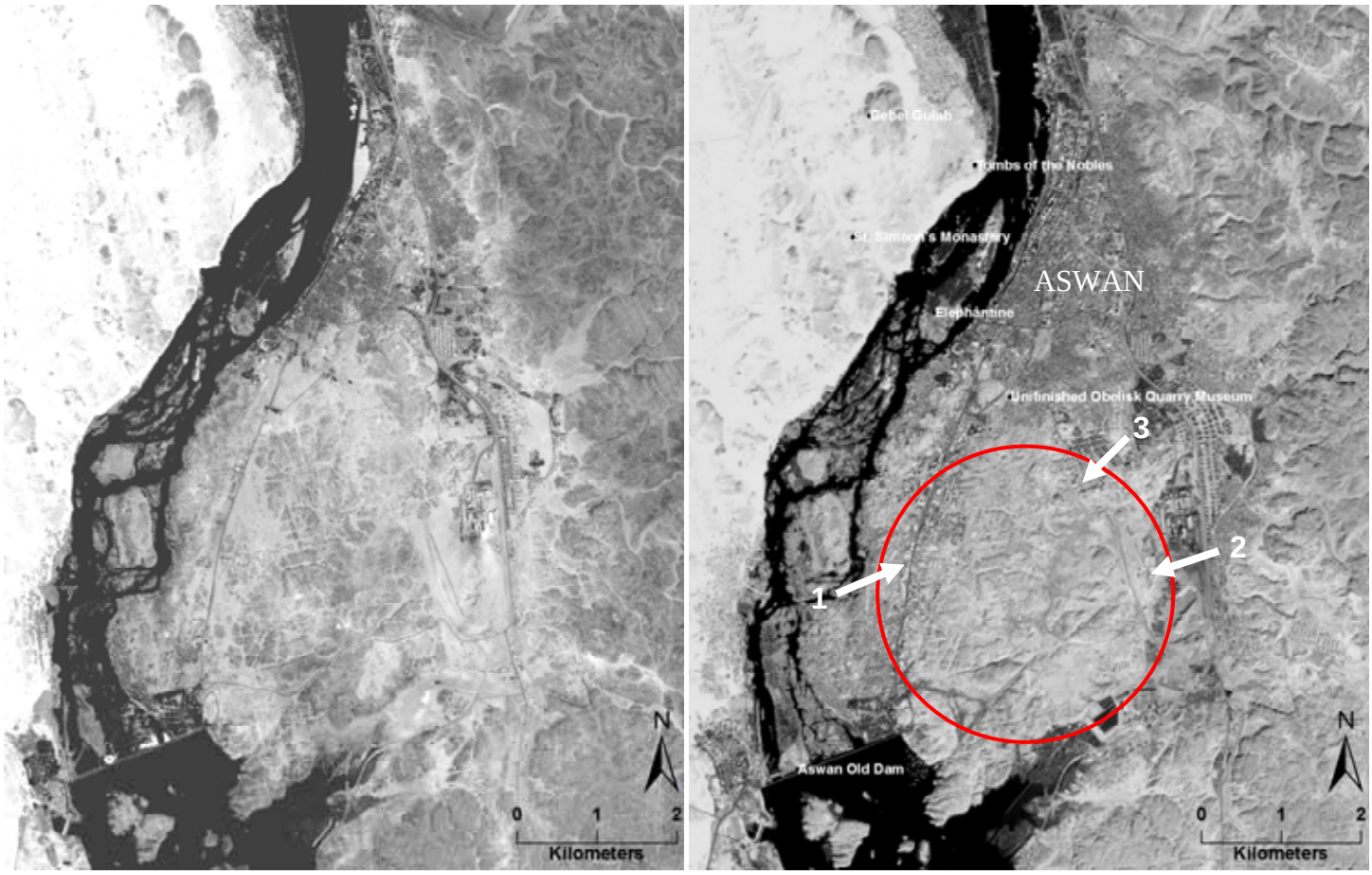

Figure 113: Satellite images showing the development in Aswan between 1965 and 2005. The red circle gives the overall location of the southern ancient granite quarries. Note that modern quarrying operations cannot be seen on the images. The arrows show areas of Aswan with particularly strong urban (1 and 2) and industrial development (3). Left image: Corona KH7 1965; right image: QuickBird 2005

Dealing with risks on a local level – the Aswan case

Monitoring using indicators on a national and regional level is essentially *reactive* since damage and destruction have already happened when results of the monitoring programme is communicated. Although in the *long term* such monitoring is of fundamental importance for policy-making, it is crucial that further work with the ancient quarries also includes *proactive* elements in the sense that threats are identified and risks mitigated before damage and destruction take place, or at least that the quarries are properly documented before they might disappear. Such work can, of course, only be undertaken on a local level, by people who know the local situation and are familiar with development plans, as well as in cooperation with various authorities, developers and other stake holders. Thus, on the basis of the regional surveys needed to develop and further a monitoring programme (see above), sites at high risk should be targeted for further work, aiming at adequate mitigation, protection and conservation/management measures.

Such work has already started in Aswan by the Aswan SCA inspectorate and the Ancient Quarry Department. It is no coincidence that this kind of "ancient quarry rescue archaeology" has commenced in Aswan. First, Aswan is one of the largest and most important ancient quarrying centres worldwide, as has been amply demonstrated by QuarryScapes work (e.g. Bloxam *et al*. 2007). Second, especially the famous granite quarries in and close to the city on the East Bank of the Nile are at immense risk from urban development and modern quarrying.

Figure 114: Still well-preserved ancient ramp leading up to a small quarry in the Shellal area, which is part of the southern granite quarries in Aswan (photo: Per Storemyr 2007)

Third, over the last years a positive environment for rescue archaeology has been established and furthered in the area by the Swiss Institute for Egyptian Architectural and Archaeological Research in cooperation with SCA. As the city is constantly becoming modernised, the Swiss Institute and SCA have undertaken many rescue excavations, which have enabled the identification of the large extent of ancient Aswan (Syene). This rescue archaeology programme is unique in Egypt.

Likewise, the Aswan SCA inspectorate and the Ancient Quarry Department has for some two years worked intensively on documenting the southern ancient granite quarries, aiming at halting and relocating the many modern quarries that have been in operation here for a long time. Moreover, experiences from this work led to a similar rescue survey in the area of New Aswan City. This work has been undertaken in cooperation with QuarryScapes and has also relied on input from another archaeological survey taking place in the area, by Maria Gatto and colleagues.

The Aswan ancient granite quarry rescue survey

A large proportion of the famous ancient granite quarries in Aswan, described by Ball (1907), Röder (1965), Klemm & Klemm (1993:305-53) and Aston *et al*. (2000:16, 35-37), are now destroyed and damaged as briefly mentioned in Chapter 4 (see also selection of photos below). However, within this highly disturbed quarry landscape there are still islands of preserved archaeological remains, such as extraction areas, large unfinished objects, roads and ramps, stone tool workshops, epigraphic evidence and ceramics. Thus, it is of high priority to save what is left, both in the form of documentation and protection of selected areas.

Figure 115: Aswan granite quarries: A modern quarry has destroyed part of the ancient workings. In the foreground is a large, unfinished object of probably New Kingdom date (photo: Per Storemyr 2007)

In doing so, the essential task has been not only to survey and document, but to stop modern quarrying and/or relocate operations away from the ancient sites. The legal basis for such efforts can be found in the Law on Antiquities (117/1983), in which paragraph 20 states that modern companies are obliged to ask permission from SCA before any modern quarrying concessions are granted (by the governorate quarry office). In recent years this paragraph has not been widely put forward and in a sense the protection work in Aswan represents "re-activating" the law. Yet, in Aswan as elsewhere, it is difficult to achieve good and lasting results by trying to force modern quarry companies out of the area. Thus, a strategy was developed for constructive cooperation with the companies and the governorate quarry office. This strategy is founded on two pillars:

- If a quarry company has to give up its extraction place because of law violation it should be offered an alternative place;

- at this alternative place long-lasting concessions should be given by the governorate, and not short-term permissions (like previously) that favour *ad hoc* quarrying and no investment in planning (see also discussion in Chapter 6)

Some modern companies, especially small ones with a short history of quarrying in the area, have already agreed on relocating their activities according to this strategy. Some have also agreed to pay expenses for antiquity guards to continuously monitor the area if continued operations will take place close to archaeological remains. However, there is a problem with a few larger, traditional companies that have worked here for decades. They have their entire

infrastructure, such as heavy machinery and administration offices, close to the quarries, which implies that it is very expensive and time-consuming to move to other places. This problem has not yet been solved.

Before new concessions are granted companies are invited to come to the SCA Ancient Quarry Department to obtain information, and they are also invited for common field trips to survey the areas in question for archaeological remains. Usually, this strategy has paid off and several companies have shown great understanding. Some have even started to become seriously interested in ancient quarrying technology and may provide cars and equipment for fieldwork. The lack of adequate cars (e.g. 4WD) is a constant problem for SCA.

A further step in this management process is to prepare maps and reports for the central SCA Cairo offices in order to put selected areas under official supervision and make some of them SCA property (see also Chapter 2). Such work has not yet commenced. Also awaiting initiation is cooperation with the housing authorities in Aswan since new residential areas (e.g. 1 and 3 in Figure 113), which have irrevocably destroyed several ancient quarries, are now being built dangerously close to some of those remaining. Hence, although positive results have been achieved, many problems still await their solution.

Figure 116: Photos illustrating the situation in the Aswan granite quarries. Left row: Above: Statue of Osiris still lying in a highly disturbed modern quarry landscape. Below: Ancient quarry road close to a modern quarry, with urban development in the background. Right row: Above: Scattered remains of large unfinished objects. Below: Part of the SCA Ancient Quarry Department team with the owner of a modern quarry company cooperating with the department. Photos: Per Storemyr and Adel Kelany (right, below) 2005-2007

Figure 117: Roman tub in a highly disturbed area of modern quarrying. The eastern part of the Aswan granite quarries (photo: Per Storemyr 2005)

The New Aswan City rescue survey

The area of New Aswan City and environs on the West Bank of the Nile has an entirely different character than the rugged landscape of the East Bank. It is an undulating, serene desert landscape, until very recently practically unspoilt. However, as the rest of the 20 km stretch of the West Bank from the Old Aswan Dam to Wadi Kubbaniya, the area is dotted with hardly visible archaeological remains from the Palaeolithic to at least the Byzantine period – and there are many ancient quarries, both ancient grinding stone production sites and building stone quarries, the latter mainly from the Roman period (see comprehensive description in Bloxam *et al*. 2007, as well as in Chapters 4 and 5 of this report, and Figure 112). Since New Aswan City is located within a main QuarryScapes survey concession area, and since in 2005 it became clear that the construction of the new city would literally wipe out most of the archaeological remains here, an initiative was taken for a special rescue survey in this area.

The survey has been undertaken mainly in cooperation with SCA Aswan and the SCA Ancient Quarry Department, which on their side launched cooperation with the New Aswan City Authorities in order to promote the archaeological significance of the area and explore the possibilities of protecting special zones with a representative range of archaeological sites. Given that the city had been planned long ago and is a necessary project in order to relieve the population pressure in the Aswan region, it was clear from the outset that only "islets" of ancient sites could become preserved.

Figure 118: The southern part of the area of New Aswan City, as seen from a highly visible hill (with ancient quarries and tombs) called Gebel el-Qurna. Construction work is at the moment taking place in the northern part, to the north and west of the bridge (photo: Per Storemyr 2005)

The survey has been undertaken in steps until recently, it is still ongoing from the SCA side, but preliminary results were published in the QuarryScapes report of Bloxam *et al*. (2007). Moreover, results of a complimentary survey related to specific remains of the Nubian presence in the area have been published by Gatto (2005) and Gatto & Guiliani (2007). Many meetings and several field trips together with the New Aswan City Authorities have also been undertaken. For these purposes a very important task was to develop simple maps showing the type and extent of archaeological remains (Figure 119)

Perhaps surprisingly, since this form of rescue survey and simultaneous cooperation with development authorities is uncommon in Egypt, the New Aswan City Authorities have agreed to further protection of ancient quarries and other archaeological sites in the area (Figure 120). According to the Antiquities Law they are certainly obliged to do so, but everyone understands that it is extremely difficult to alter plans developed long ago and give away space originally intended for housing and other facilities, also because contracts with private purchasers of land have to be changed. Importantly, large parts of the land close to the Nile, which has a very high concentration of archaeological sites, have now also been designated as protected. This area was originally planned for development of hotels and tourist facilities. It implies that several of the "best" locations may remain as archaeological sites (Figure 120).

The case of New Aswan City shows that through dedicated survey and cooperation with involved parties it is indeed possible to save "mundane", largely invisible ancient quarries and other archaeological features from wholesale destruction in Egypt. However, such work of course also involves negotiations and giving concessions and all archaeological features will certainly not be protected. Moreover, the serene desert landscape is lost forever. It remains to be seen if promises are now being kept and the designated areas declared officially protected, the subsequent step being active management and promotion of the sites.

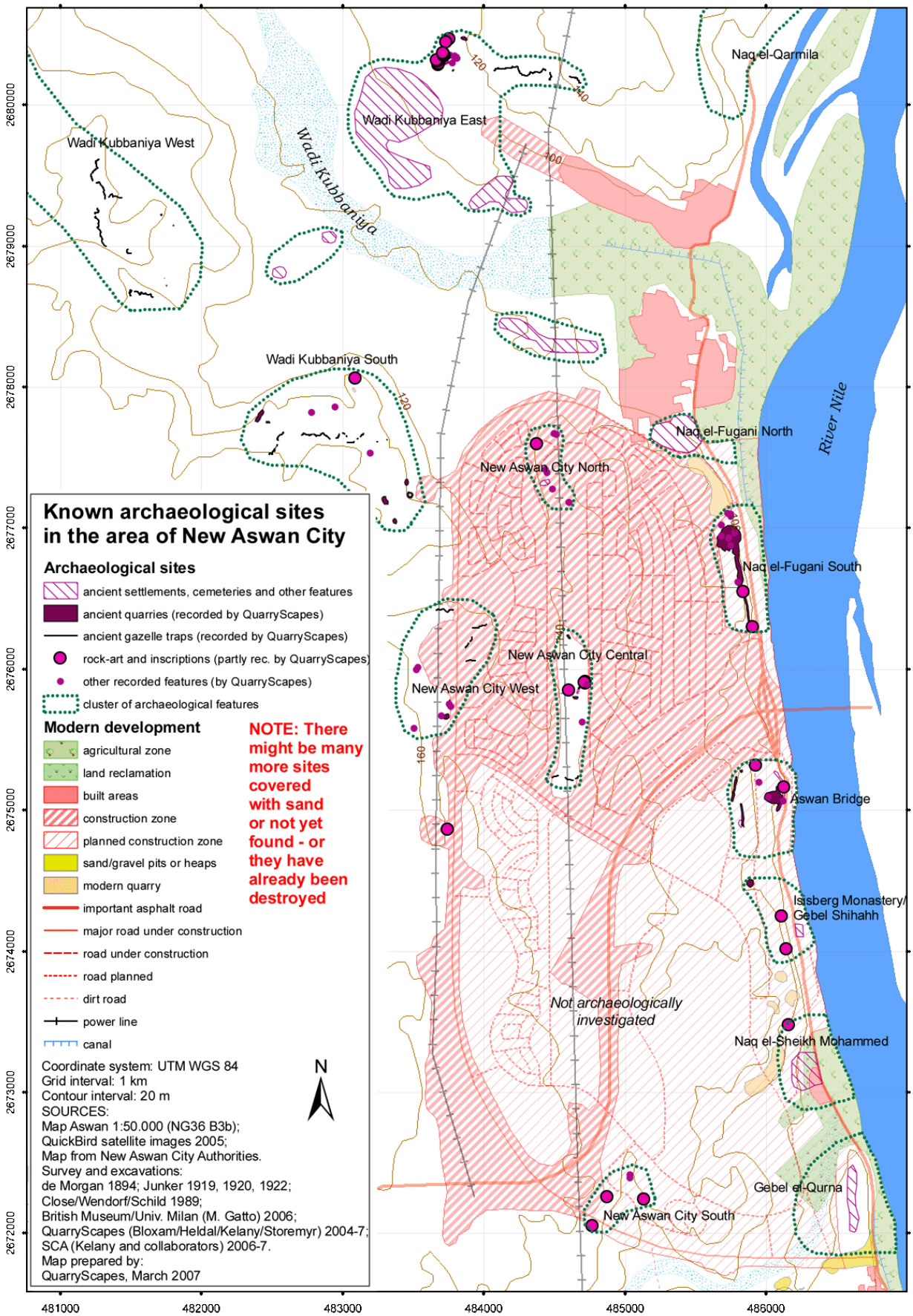

Figure 119: Preliminary survey map used to communicate the location of archaeological sites in the area of New Aswan City. Note that the southern part had not been investigated as the map was prepared. This area was surveyed in autumn 2007 and showed the presence of many ancient quarries. Map by QuarryScapes/Per Storemyr

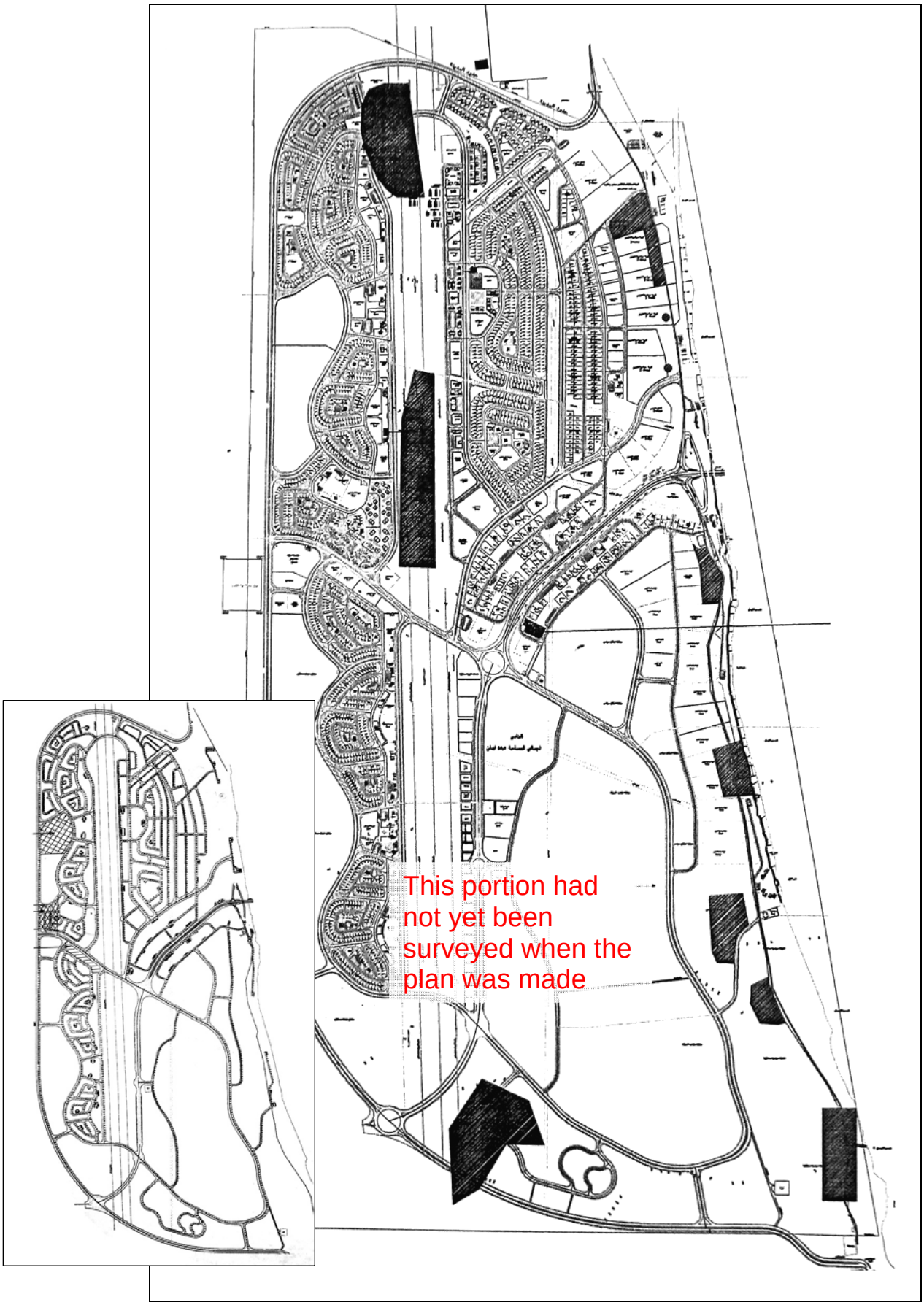

Figure 120: Plan of New Aswan City with archaeological areas designated for protection shown in black. The small plan is the original one without protected areas. Compare with Figure 119. Map courtesy: New Aswan City Authorities 2005 and 2007

Figure 121: View of construction work in the northern portion of New Aswan City from aircraft. The villages in Kubbaniya can be seen in the upper left corner (photo: Per Storemyr 2006)

Figure 122: View of construction work in the central portion of New Aswan City from aircraft (photo: Per Storemyr 2006)

Figure 123: Representatives of SCA Aswan and the New Aswan City Authorities discussing archaeological site borders in spring 2007. In the background the Graeco-Roman Naq el-Fugani sandstone quarry; compare with cover photo of this report (photo: Per Storemyr)

Figure 124: The first residential quarters in New Aswan City are currently being built in the northern section of the area (photo: Per Storemyr, autumn 2007)

Figure 125: The Unfinished Obelisk Quarry in Aswan after clearing and excavation work 2002-2005 (photo: Per Storemyr 2005)

Planning for promotion of ancient quarries

The centre of gravity for work on ancient Egyptian quarries is now the Unfinished Obelisk Quarry Museum in Aswan. In addition to Serabit el-Khadim and to some extent Gebel el-Silsila, it is also the only quarry site in Egypt that is promoted to visitors,[89] implying that tens of thousands, if not hundreds of thousands of people can enjoy this jewel of an ancient extraction site every year. After extensive excavation and clearing work from 2002 to 2005 the quarry now also features facilities for visitors and a souvenir market. Much could be said about the excavations, the new facilities and the daily management, but in this section the further plans for development of the site will be elucidated.

The technology, social aspects and shear volume of quarrying and mining in ancient Egypt do not form extensive themes at any Egyptian museum. Thus, what could be more natural than to develop the Unfinished Obelisk Quarry to address such and related topics? At the moment plans are underway to expand the existing features with an outdoor collection of unfinished objects that will elucidate the art of ancient stone working (Figure 126). Such objects will be collected from various sites in Aswan and elsewhere. Of course, the best is to leave/protect unfinished objects *in situ*, but as has been shown above, many quarry sites in the Aswan region (and elsewhere) are at so high risk from destruction that it is often necessary to remove valuable pieces. These collections will be supplemented by objects and tools used for stone working, and other items of interest, some to be collected from SCA storerooms.

[89] Or better: The site literally promotes itself due to its monumentality and fame

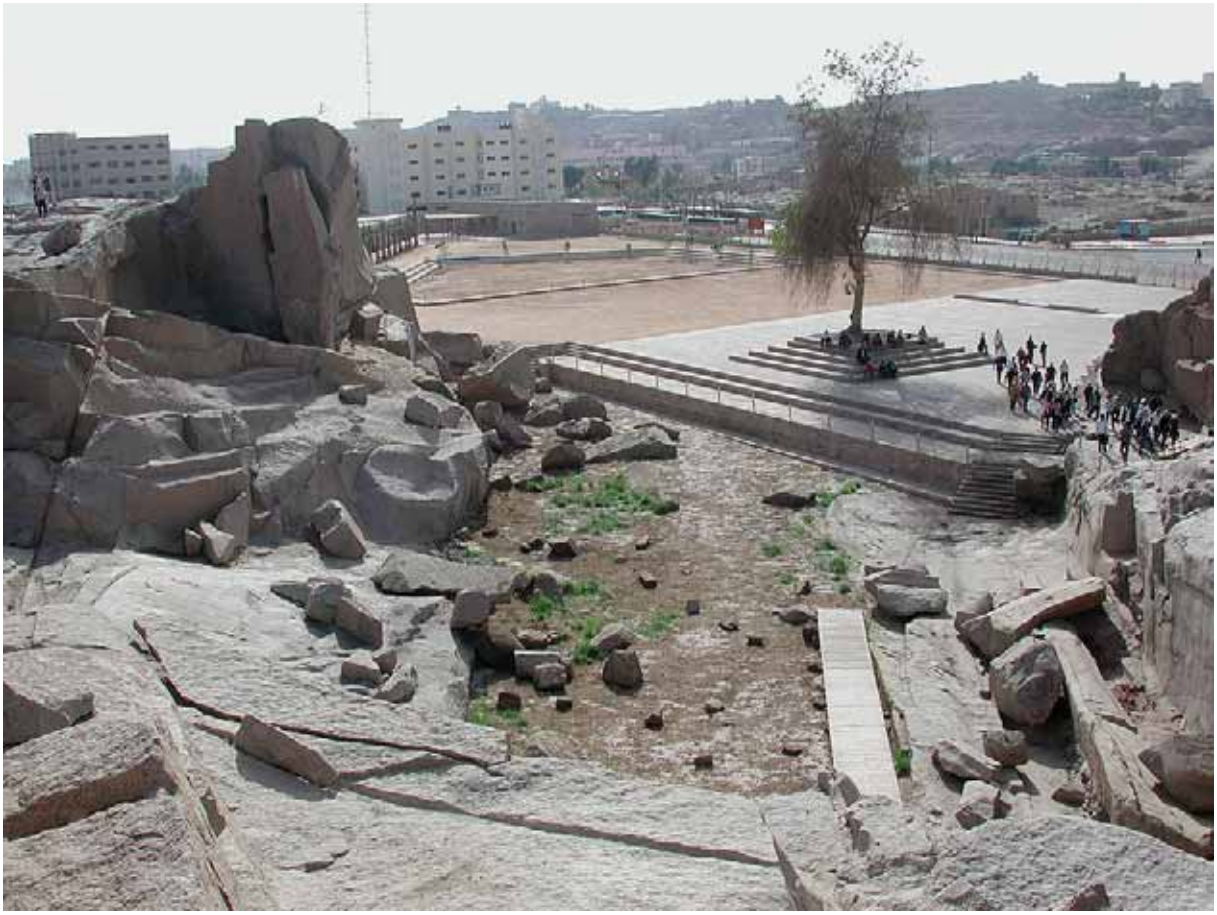

Figure 126: The Unfinished Obelisk Museum in Aswan as seen towards the new visitor facilities. The open area in the background is intended for hosting collections of unfinished stone objects and other items (photo: Per Storemyr 2005)

Another part of the quarry museum is planned to include models, posters and films related to stone working processes, for example extraction, transportation and erection of large objects such as obelisks and colossi, but also finer work on sculpture and relief. Also daily life in ancient quarry communities could form an important theme in this part of the museum.

In addition to such showcases for the average visitor, plans are also being made for building up a collection of stone samples from ancient Egyptian quarries, including polished pieces and information about their provenance, the quarries from where the stones were extracted and geological issues. Such a reference collection could become valuable for archaeologists and scientists working not only with quarries, but also with ancient Egyptian architecture and sculpture. A good library would also be essential to build up.

Whether these plans can be realised is of course dependent on hard work of dedicated individuals, support from SCA – and not least from foreign missions and funding bodies. In this respect it may become crucial to finally promote the Unfinished Obelisk Quarry as a World Heritage Site (WHS). As noted in Chapter 2, the site is part of the WHS called "Nubian Monuments from Abu Simbel to Philae", but this status has not yet been used in promotion. This status may not only enhance the significance of the museum for visitors and funding bodies, but may also be an important issue to put forward to interested quarry researchers, Egyptian and foreign alike. The Unfinished Obelisk Quarry could become a vehicle for general promotion of ancient quarries – and a key place for inspiration as to the badly needed development of additional ancient quarry World Heritage Sites.

Figure 127: Participants in the QuarryScapes field course in Aswan 2005 being explained the archaeology and geology of the Gebel Tingar silicified sandstone quarries on the West Bank (photo: Per Storemyr)

Education and training

As mentioned above, education and training of SCA inspectors and other professionals are needed to carry out many of the tasks described and recommended in this chapter, both as regards validation and updating of previously recorded sites and rescue work as is now done in Aswan. As a start, QuarryScapes has organised two field training courses, in Aswan 2005 and the Northern Faiyum (Widan el-Faras) 2006. Similar courses and archaeological field schools are now becoming popular in Egypt, with the field school of the Giza Plateau Mapping Project as the most well-known,[90] but there are also archaeological field schools in, for example, the Faiyum.[91] Moreover, long-term training in site management has been offered in Luxor, funded by the American Research Center in Egypt. The QuarryScapes field courses were much smaller than these; intended as introductory courses and as an aid in showing how SCA could further similar courses.

Three themes were central in the QuarryScapes courses: First, inspectors were trained how to recognise the special archaeological features of ancient quarries, such as extraction areas, secondary work areas, tool marks on quarry faces and object roughouts, roads and ramps, huts and shelters and anything else that constitutes a quarry landscape. Without such basic knowledge it is not possible that they undertake their own surveys. Second, training was given in reading maps and satellite images, as well as in placing archaeological features on such maps and images. Also, the use of GPS for marking small and large features, the latter by the application of track logs, was taught. Third, classroom education was given as to the

[90] See www.aeraweb.org/field_schools.asp
[91] See www.archbase.org/fayum

archaeological significance of ancient quarries. Inspectors need to communicate the value of their own survey findings and thus it is essential that they have knowledge of the broader aspects of ancient quarries, e.g. pertaining to the reasons why such sites should be protected.

The QuarryScapes courses have now been taken a step further by the SCA Ancient Quarry Department. In November 2007 Upper Egyptian inspectors assigned to the new department were invited to Aswan for a longer course. In addition to continued training in the fields mentioned above, this course also includes site management aspects and issues related to the process of official protection of a site, either as a SCA-supervised or a SCA-owned site. Moreover, the use of Google Earth will be introduced. Importantly, inspectors will also gain knowledge of how their survey data can be adapted and transferred to the central EAIS GIS databases in Cairo. As remarked above, this is a central issue for validation and updating of the site records of ancient Egyptian quarries produced in the QuarryScapes project. Relevant data, databases, maps and images produced in the QuarryScapes project are, of course, freely available as course material and as an aid in field survey. Several further courses are planned; another for Upper Egyptian inspectors will take place shortly, and subsequently a course for inspectors from Middle Egypt will commence.

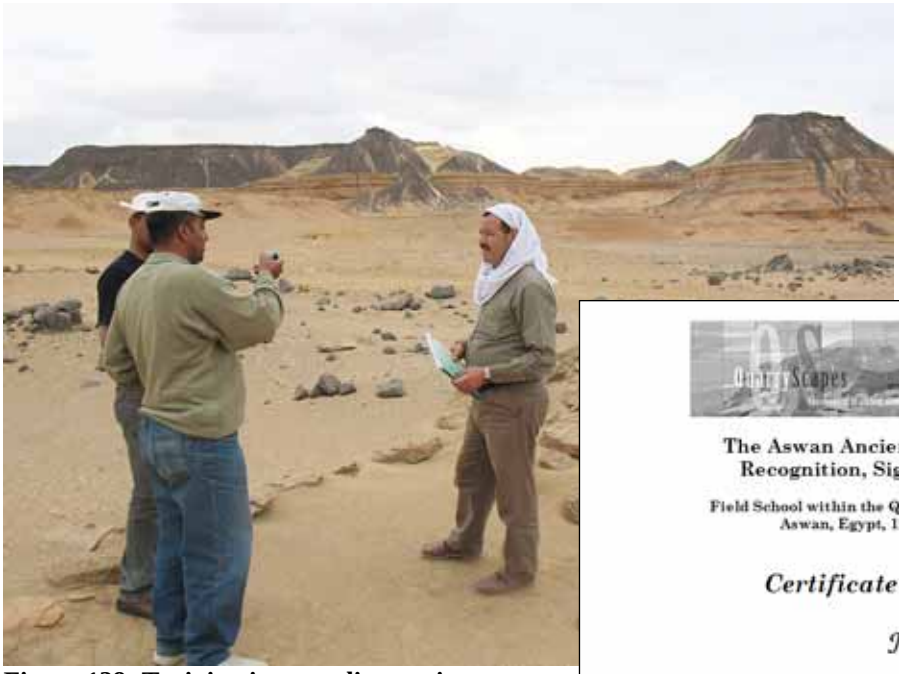

Figure 128: Training in recording ancient quarry features using GPS, Faiyum 2006 (photo: Per Storemyr)

The Aswan Ancient Quarry Landscape:
Recognition, Significance and Risks

Field School within the QuarryScapes Research Project
Aswan, Egypt, 19 – 24 November 2005

Certificate of Attendance

N. N.

The field school included the following training activities:

- Field excursions to the Gebel Gulab and Gebel Tingar ancient stone quarry landscapes, the East Bank of the Nile at Aswan, as well as the Aswan ancient granite quarries
- Introduction to survey and mapping using high-resolution satellite images and GPS (Global Positioning System)
- Introduction to detailed archaeological recording using non-destructive methods (drawing and photography) and find sheets
- Lectures on the significance of ancient stone quarry landscapes in Egypt

Course trainers:

Dr. Elizabeth Bloxam Inst. of Archaeology, University College London	Mr. Tom Heldal Geological Survey of Norway
Mr. Adel Kelany SCA Aswan	Dr. Per Storemyr Geological Survey of Norway

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Figure 129: Certificate of attendance for the participants in the 2005 Aswan field course

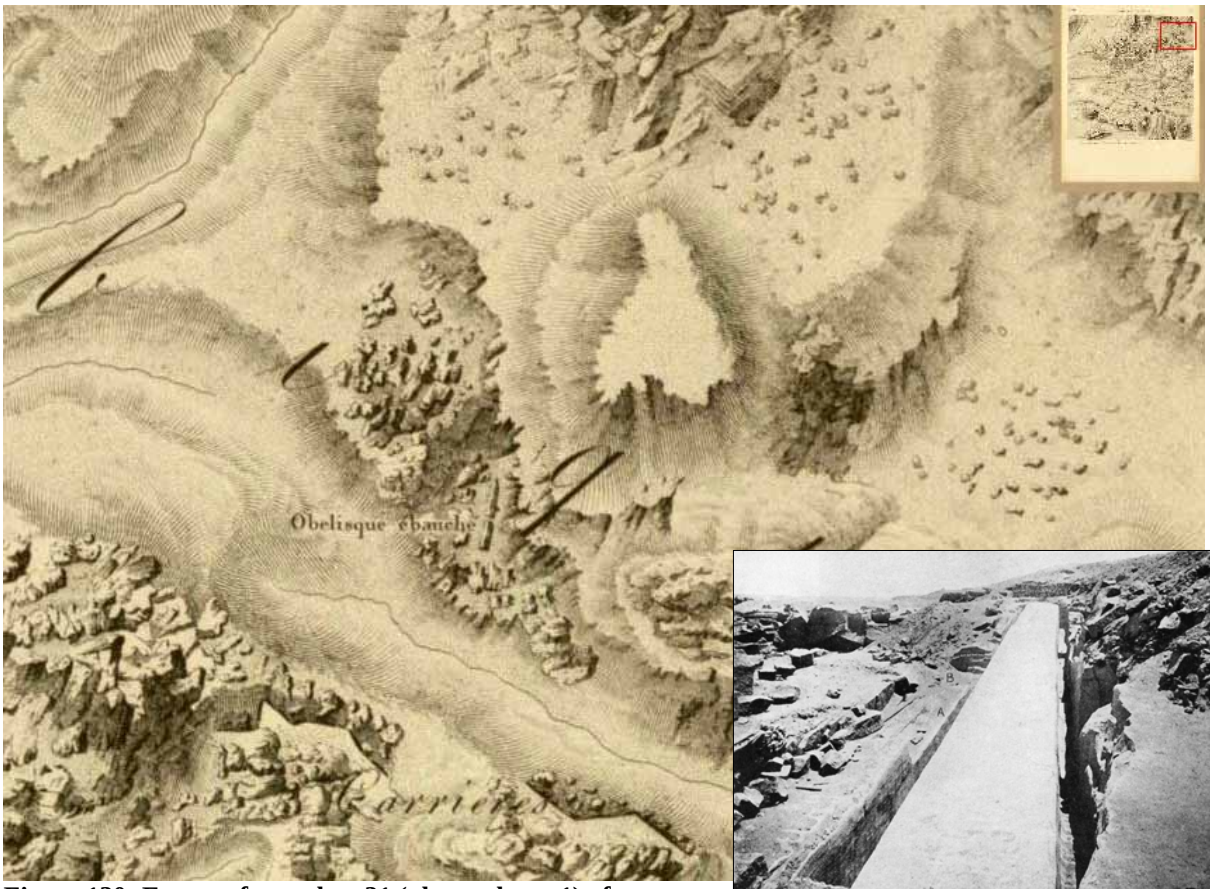

Figure 130: Excerpt from plate 31 (plate volume 1) of *Description de l'Egypte* (1820) showing the Unfinished Obelisk. Reproduced from the online version of *Description del'Egypte* by Bibliotheca Alexandrina (http://descegy.bibalex.org)

Figure 131: The Unfinished Obelisk c. 1920. Reproduced from Engelbach (1923)

Education and training should not be left without mentioning the importance of the rich literature on ancient Egyptian quarries. It is essential that inspectors assigned to the SCA Ancient Quarry Department are introduced to the basic works (see overview in Chapters 1 and 2), but also to papers and books related to specific places. In particular, the multitude of old and more recent maps, plans and photos of ancient quarries are very valuable for use in survey work (Figure 130, Figure 131).

Moreover, previous pictures and plans can be used for comparison with the current situation in order to understand changes and destruction (see also Chapter 4). Many such works are hard to come by in Egypt, also for antiquities inspectors. Thus, as mentioned in the previous section, building up a good library at the planned extension of the Unfinished Obelisk Museum is indispensable.

Likewise, the importance of modern development maps and plans cannot be underestimated. As the example from New Aswan City (see above, Figure 120) has shown, such plans may be readily available through relevant authorities and are of course key to assessment of risks for quarries within or close to the development zone (see also the example from Minya in Chapter 5). Such plans are also important insofar as developers often prefer to use their own maps in works related to zoning and protection of archaeological sites, as the example of New Aswan City has shown.

Figure 132: Modern granite quarries in the northern portion of the Aswan ancient granite quarry landscape. Gebel Gubbet el-Hawa and the West Bank quarry landscape in the background, across the Nile (photo: Per Storemyr 2007)

Discussion and concluding remarks

This chapter has reflected on issues related to monitoring on a national and regional scale, as well as local rescue surveys and protection and promotion of ancient quarries. Also education and training of Egyptian inspectors who are assigned to the new SCA Ancient Quarry Department have been described. The chapter has also shown examples of rescue surveys in the Aswan area and introduced the plans for the extension of the Unfinished Obelisk Museum

In a sense this chapter has verged between what McManamon & Hatton (2000) – on considering cultural resource management in modern society – call "The necessity of national systems" and "The importance of local support". On a national and regional level monitoring of ancient quarries, using indicators for easy communication of status, threats and risks to policy makers is one of the key aspects recommended in this chapter. Such monitoring can draw on work presented in this report, but there is a need for validating and updating information on a vast number of quarry sites; a work that can be carried out as cooperation between inspectors assigned to the new SCA Ancient Quarry Department and EAIS as the central body for site records in SCA. Moreover, it is of course essential that foreign missions working with ancient quarries cooperate with the Quarry Department and EAIS in sharing data and information that can be used for improving the records.

The expansion of the Unfinished Obelisk Museum is also a national issue in that the site may become the cornerstone for knowledge of ancient quarries. Adding that the quarry is a World Heritage Site, it has a great potential as a vehicle for promotion, a key to protection, of ancient quarries in general (cf. Storemyr 2006). A showcase like the Unfinished Obelisk is important for raising general public interest in ancient quarries, and with its World Heritage Status it is also essential that its managers comply with guidelines for management, monitoring and reporting as requested by UNESCO (see also Feilden & Jokilehto 1998).

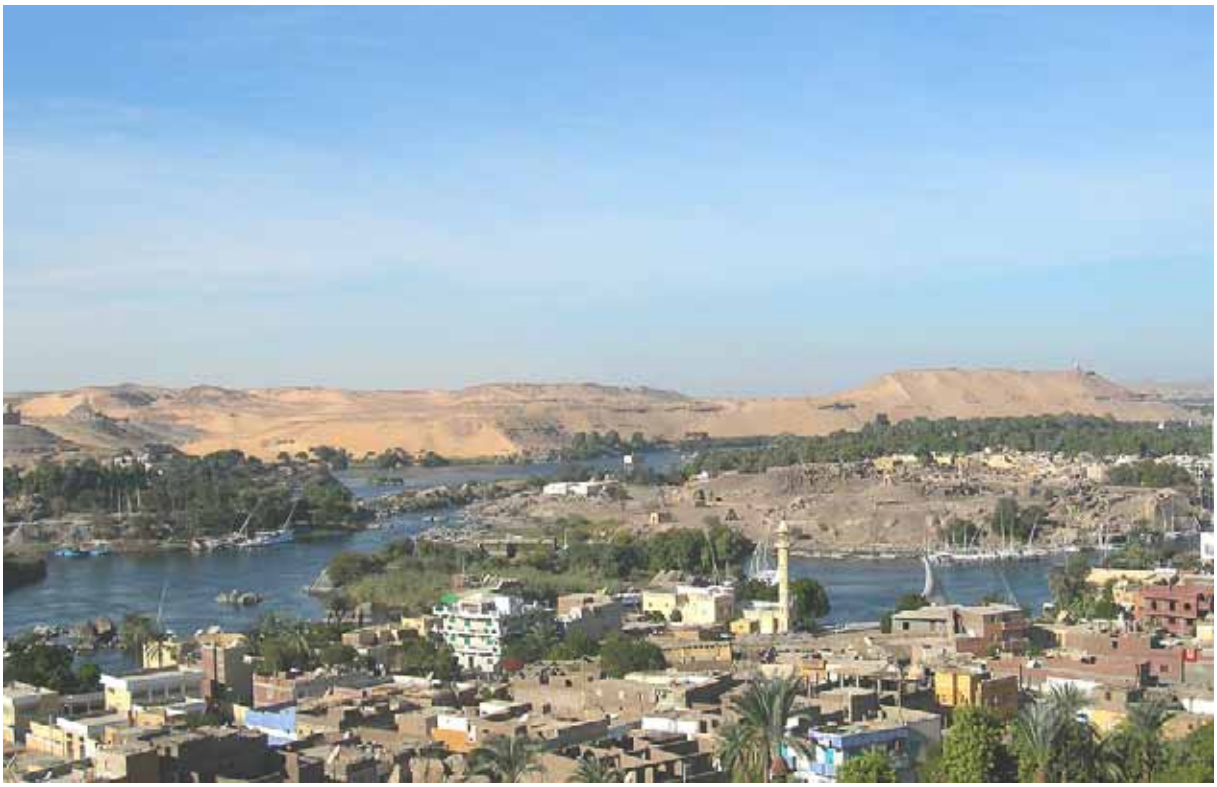

Figure 133: The First Cataract area in Aswan with Elephantine island in the middle and the West Bank with its serene desert and extensive and extremely long-lived quarry landscape in the background. Compare with Figure 132 (photo: Elizabeth Bloxam 2007)

The importance of local support in mitigating risks and protecting sites has been amply demonstrated in the examples from Aswan. In the case of both the granite quarries and the construction zone of New Aswan City support from and cooperation with modern quarry companies and the city authorities, respectively, have been essential in protecting ancient quarry remains and other archaeological features. Clearly, in these two cases it is impossible to consider conservation of the wider context of the quarry landscape and landscape values in general: The granite quarries are already too disturbed by modern quarrying and house building, whereas New Aswan City soon will become overbuilt. However, the fact that developers have ventured into communication about protection gives hope for the future.

In future protection and management work it is also important to draw on support not only from developers, but also local residents living within or close to ancient quarries. An example is the West Bank quarries in Aswan, where the local Nubian population uses the quarries as targets for tourist trips to generate small incomes, but apparently do not see themselves as "stewards of the landscape". With incentives and education, it is entirely possible that the people would welcome such "stewardship", which is a key to preventive conservation (cf. Bloxam 2007; Storemyr *et al*. in press). A similar programme has been proposed by Hobbs (2002:254-5) for archaeological sites in the Eastern Desert. He suggests that the Maaza Bedouin in the Mons Porphyrites-Mons Claudianus area would very much welcome incentive for a partnership with the heritage authorities in monitoring aimed at prevention of destruction, looting and vandalism, much like within the Bedouin Support Program for St. Katherine Natural Protectorate in Sinai. This kind of "public archaeology" does not have much tradition in Egypt, though another programme has been carried out in

Quseir at the Red Sea Coast.[92] Yet, it might be a long way to go before such programmes can be established also elsewhere.

There are still quite a few quarry landscapes in Egypt that have not been strongly influenced by modern development. Most are located in remote desert areas, but also in Aswan the part of the West Bank quarry landscape that is located to the south of New Aswan City is still well-preserved (Bloxam *et al*. 2007). Thus, this area can and should be protected as a coherent landscape, also because it is one of the few longer stretches of little-disturbed landscapes left along the entire Egyptian part of the Nile River. Moreover, it forms the serene desert backdrop of Aswan city, a factor not to be underestimated as regards the future of tourism in the Aswan region. Since the West Bank quarry landscape would qualify as World Heritage (Bloxam 2007; Storemyr *et al*. in press), it would also be an idea to explore the possibilities of expanding the "Nubian Monuments from Abu Simbel to Philae" WHS, of which the Unfinished Obelisk is part, to include a larger portion of the West Bank. The tombs at Gubbet el-Hawa and St. Simeon's monastery are already part of the same WHS (see Chapter 2).

Similarly, there are still possibilities for protection of coherent landscapes in the other QuarryScapes case study areas in the Northern Faiyum and Toshka (Chephren's Quarry) (see Chapters 3, 4 and 5), as well as throughout the Eastern Desert and at some places in the limestone and sandstone stretches of the Nile Valley.

In addition to rescue work such as undertaken in the Aswan granite quarries and within New Aswan City, which is a way of "saving what can be saved", there is a need for Egyptian Heritage Authorities in cooperation with knowledgeable institutions and individuals to select a number of representative quarry areas for protection that takes the landscape context into consideration. If this is not done, there is a high risk that in 50 years only fragments of ancient workings are left throughout Egypt, as today is the case in the Aswan granite quarries. Clearly, by far the best form of *risk preparedness* is to protect the quarry sites and landscapes as owned or supervised by SCA.

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Chapter 10

Concluding analysis

Per Storemyr, Elizabeth Bloxam and Tom Heldal

By the use of a wide variety of tools ranging from in-depth case studies and field work, field checks, archive and literature research, interpretation of satellite images, topographic maps and development plans, and contact with developers, authorities and residents, this report has attempted at showing the condition and legal status of ancient Egyptian quarries, as well as the risks facing this world-class heritage (Chapters 2, 4, 5, 6, 8 and 9). In addition to specific investigations and monitoring in QuarryScapes case study areas (Chapters 3, 4 and 9), the work has also drawn on previous records and expert knowledge gathered through two decades of research on ancient Egyptian quarries as a whole by James Harrell (Chapters 2 and 5).

In this concluding chapter the general status of the ancient quarries in Egypt will be reviewed, before turning to key theoretical aspects that may be used as a basis for furthering protection and conservation work: ancient quarries are large and complex – featuring multiple layers of use, re-use and consequently also of value and significance. They may be viewed as "dynamic landscapes"; in which protection and conservation must take account of the special narratives each of them convey (Chapters 3 and 7). On this basis, recommendations for protection and conservation can be given. Also, recommendations as to monitoring and improvement of official site records are forwarded (cf. Chapter 9).

The status of ancient Egyptian quarries

The most threatened ancient Egyptian quarries are located within or close to "hot" urban development areas, especially Cairo, Minya and Aswan. In these areas the ancient quarries are not only impacted on by the building of modern infrastructure, but also by modern quarrying and mining, and to some extent land reclamation.

In this work, the *tentative* status of all known (193) ancient quarry areas of mainly Pharaonic to Islamic date has been reviewed. The records show that 9% of the quarry areas are entirely or largely destroyed (of which 4% are under Lake Nasser), 20% are partially destroyed, 38% are largely intact, whereas 25% are still in good condition, although looting and vandalism may have taken place. The main reason for destruction is modern quarrying and mining, to which c. 40% have been subjected. A limited number have as of yet been destroyed or influenced by urban and rural development/-expansion (11%), whereas agricultural development is now threatening only 2% of the ancient quarry areas. For 45% of the quarries threats have not been specified, but the immediate (1-3 years) risk of destruction is considered rather low.

The main risk in the near future is considered to be modern quarrying and mining, also in areas that have not previously been influenced by such activities. This is because the modern Egyptian quarrying and mining industry is developing extremely fast and since it is anticipated that the industry may soon start to target some of the most special stone resources used in ancient Egypt. Also risks associated with the development of new cities and villages now being built to relieve the enormous population pressure are increasing, especially in greater Cairo, Minya and Aswan. Although agricultural development has not yet been a serious threat to Pharaonic and later quarries at large (except at Chephren's Quarry in the Toshka region), tentative overviews suggest that a large proportion of known Prehistoric quarries (chert) have been destroyed by land reclamation. Most Palaeolithic tool quarries along the Nile beyond Aswan are, moreover, below Lake Nasser.

Although natural hazards, weathering and erosion represent a minimal risk to Egypt's ancient quarries as compared to the actions of man, rainstorms and flash flood, especially in the Eastern Desert, may seriously contribute to rapid deterioration of quarry infrastructure. Collapse of quarry galleries and rock-fall is also a main risk in some areas.

Currently, only 5% of the ancient quarries have a secured legal status as owned or supervised by SCA. They may be protected due to their value as ancient quarries or be included in the protection zones of nearby archaeological sites. However, although official protection decrees are currently not available, several other areas are reported as registered with SCA. Some 50% appear be known to the SCA inspectorates, which are located in each of Egypt's 27 governorates (14 governorates are reported to feature ancient quarries). One quarry (the Unfinished Obelisk in Aswan) is part of a World Heritage Site because of its value as an ancient production site. The rest of the 2.6% that are part of World Heritage Sites have been included coincidentally. Some 3.6% are (coincidentally) part of existing nature protectorates, whereas an additional 7.8% may become included in proposed protectorates.

It seems that only three ancient quarry areas are promoted to the public: The Unfinished Obelisk in Aswan, Gebel el-Silsila and Serabit el-Khadim. These are probably also some of the few places that feature active management. Although not reported as specifically promoted, other ancient quarries that are protected with SCA, as part of World Heritage Sites or nature protectorates may enjoy some management. None of the Prehistoric quarries reviewed in this report seem to be subject to management.

Comparisons with the status of other types of cultural heritage in Egypt have not been undertaken in the course of this work, but monumental architecture and settlements clearly enjoy vastly better protection than production sites. Ancient quarries in many other countries may, however, be facing similar destinies as their Egyptian counterparts. In conclusion, significant proportions of Egypt's ancient quarries have already been destroyed or are at risk from destruction. Moreover, with some notable exceptions, official efforts as regards protection and management have until recently been limited.

The good news is that in the last two years SCA has addressed conservation of ancient quarries on two fronts: First, it has recently set up a new Department for Conservation of Ancient Quarries and Mines (short: Ancient Quarry Department). This department now carries out special rescue surveys and protection work in the Aswan area and such work is planned to expand to other regions, followed by education and training of assigned personnel. Second, as a part of the QuarryScapes work, EAIS has added all known ancient quarries (not including prehistoric quarries) to their official site records. This is a good start, but there is a long way to go from recording to official protection and active management.

Dynamic quarry landscapes

The notion of a "dynamic quarry landscape" has been forwarded as a concept that allows for the inclusion of the diverse range of material culture that can comprise such sites – often spread across large areas. This may be a crucial construct if the archaeological integrity of these sites is to be maintained

Significance and value are key to protection and conservation; there needs to be reasons and arguments for drawing up site borders, keeping large-scale modern development away, proposing official protection zones and undertaking management and promotion. These reasons and arguments need to be understood by heritage authorities and communicated to wider audiences.

Traditional criteria of assessing significance to ancient quarries have particularly relied on concepts related to technological achievements and trade. Also World Heritage criteria such as "outstanding universal value" can in many cases present an accessible and broad picture of significance, when simultaneously highlighting the special stories ancient quarries convey: it is, for example, clearly important that Widan el-Faras features "the world's first paved road" and that the Northern Faiyum quarry landscape is one of the "world's oldest industrial landscapes related to ornamental stone quarrying". Moreover, Chephren's Quarry may be regarded the "world's oldest hardstone statue quarry" and the Aswan West Bank may feature the "most long-lived quarry landscape in the world". Similar highlights may be constructed for many other ancient quarries, and in Egypt there are many for which "universal claims" could be made, though most will be significant in national and regional contexts.

Several of the most well-known ancient Egyptian quarries today appear "frozen" in time – at places like Chephren's Quarry, Widan el-Faras, Mons Porphyrites and Mons Claudianus stone procurement largely ceased at a specific point in history and activity was never really resumed (until modern exploitation commenced). Still, even such "frozen" places show interludes of re-use, for example as regards occupation by hermits and as places of importance for Bedouins and other local populations. Yet, the majority of ancient quarries have very complex histories of use and re-use; first of all repeatedly as quarries, but also as tombs, shrines, living quarters, hermitages and monasteries, – and in the modern era still as monasteries, but also as military magazines, cement and stone sources, as well as landmarks, hide-outs for fringe groups and in a few cases as tourist attractions.

Thus, supplementary to the rich archaeology left by the primary activities in the quarries, including those remains that give information of social life, there are additional layers of meaning, all related to the surrounding cultural and natural landscape. The notion of a "dynamic quarry landscape" may be a concept that can allow for the inclusion of the diverse range of material culture that can comprise such sites – often spread across large areas. This may be a crucial construct if the archaeological integrity of these sites is to be maintained.

The notion of a "dynamic quarry landscape" requires that the multiple layers of significance at specific places are searched for and interpreted by interdisciplinary investigation. In protection and conservation efforts the resulting narratives can be taken advantage of, not only as a means of communicating significance, but also in difficult decision-making processes when parts of an ancient quarry landscape have to give way for modern development. For example, it is not always the most monumental parts that convey the most significant narrative of a quarry (cf. Chapter 3)

Legal protection as risk preparedness

Legal protection never solves all problems, but it is a means to state the significance of an area, communicating that it is a non-renewable resource that should be accessible to the many and not consumed by the few within a short time.

Given the current pace of development in Egypt it is assumed that legal protection is the best form for future risk preparedness. As has been demonstrated in this report, the number of legally protected sites is very low, and although the Antiquities Law in theory restricts modern development in all archaeological areas – officially protected or not – it has not been widely applied for stopping neither wholesale destruction, nor minor destructive activities in ancient quarries. A legally protected area achieves an entirely different status in that borders and buffer zones are set, official decrees issued and maps will be available for developers. A consequence of using the notion of "dynamic quarry landscape" is that it would be absurd to ban all further development and activities in a quarry landscape, also in a protected area. However, modern activities, for example small-scale, artisan quarrying, should be restricted and controlled – and if they are too damaging they should be relocated. Legal protection never solves all problems, but it is a means to state the significance of an area, communicating that it is a non-renewable resource that should be accessible to the many and not consumed by the few within a short time

But where to begin? In addition to those few ancient quarries already protected (Chapter 2), a tentative list worked out on the basis of value aspects and the current risk pattern would certainly include the QuarryScapes case study areas Chephren's Quarry, Widan el-Faras, Umm es-Sawan and large parts of the greater Aswan quarry landscape. A broad range of limestone quarries in the Nile Valley would also "qualify", especially in "hot" development zones such as Cairo and Minya. Gebel el-Silsila and a range of Nubian sandstone quarries could be put forward, likewise several of the unique travertine (Egyptian alabaster) quarries, such as el-Qawatir. Moreover, areas in the Eastern Desert, for example Gebel Manzal el-Seyl, Mons Porphyrites, Mons Claudianus, the soapstone quarries around Barramiya, the emerald mines in the Sikait area and many others should be considered. Importantly, Prehistoric tool quarries are particularly endangered, often being located in agricultural development zones bordering the Nile Valley. Since they are so few, all the places mentioned in Chapter 2 should be considered.

And where to set borders? Relying on the notion of "dynamic quarry landscapes", it will be negligent to recommend any rough borders for areas that have not been studied in detail. However, throughout this report (Chapters 3, 4 and 9) issues relevant to setting of borders in QuarryScapes case study areas have been forwarded repeatedly. In summary: For *Widan el-Faras and Umm es-Sawan* in the Northern Faiyum it is our opinion that the sites themselves, as well as extensive areas around should be considered for SCA protection (total area in the order of 100 km^2). Around *Chephren's Quarry* the region that is planned to be soon consumed by modern canals and agricultural development of the Toshka project is so immense (c. 2,200 km^2) that although Chephren's quarry is very extensive (c. 100 km^2), it represents a very small portion of the whole development region (4.5%). It can therefore be argued that the whole quarry landscape should be protected. For the *Aswan West Bank* it has been shown that New Aswan City is about to consume a large proportion of archaeological land (c. 15 km^2), and although islets of ancient sites will be preserved within the new city, it is not unreasonable to suggest that the whole southern portion of the West Bank facing Aswan should be considered protected (c. 25 km^2).

At first glance it may seem that areas in the order of 100 km^2 are immense. In addition there are buffer zones, which, ideally, SCA measures at 3 km from the borders. It must be recalled, however, that these are desert lands and that other ancient quarry areas, when including elements of the surrounding landscape, may even be more extensive, for example in the Eastern Desert.

Monitoring and improvement of site records

Proactive monitoring also means knowledge of development plans and other planned activities in ancient quarry landscapes, so that action can be taken to stop, relocate or otherwise mitigate potential damaging activity.

Monitoring can be viewed from two perspectives, *proactive* and *reactive.* In the current situation, regular ("day-to-day") proactive monitoring to prevent damage and looting can potentially be undertaken by SCA inspectors and guards with knowledge of the area in question, and mainly in regions close to villages and cities. It is very difficult to carry out such monitoring in desert regions due to transportation problems. Especially in the Eastern Desert, but also along the Nile Valley, one would very much welcome partnership between the heritage authorities and local populations in monitoring ("stewardships"), but incentives and education are needed to establish such programmes. Proactive monitoring also means knowledge of development plans and other planned activities in ancient quarry landscapes, so that action can be taken to stop, relocate or otherwise mitigate potential damaging activity. Such information needs to be actively gathered, since it is still rare that developers seek permission from SCA to carry out e.g. quarrying activities. This may even hold for large-scale construction, as evidenced in the case of New Aswan City.

Yet, there is often a good reason for developers not seeking permission or advice, and that is that they simply don't know of any archaeological remains, not to mention "mundane", "invisible" quarries. As has been demonstrated, even the SCA inspectorates lack knowledge of perhaps 50% of the ancient quarries. Clearly, in this situation efficient, proactive monitoring is largely impossible in many regions. Thus, in addition to carrying out rescue programmes such as in Aswan, which target ancient quarry areas that are or will become heavily disturbed, the new SCA Ancient Quarry Department and the inspectorates need to come ahead of the development. This implies working on protection measures also for those quarry landscapes that are not yet heavily impacted on or even in excellent condition.

With the pace of development in Egypt, this is certainly extremely difficult, but a start has been made in QuarryScapes in that all known Pharaonic and later quarries now have their site records in the EAIS system. Such records need to be distributed and communicated to relevant authorities and developers – and they need to be updated through survey as planned by the SCA Ancient Quarry Department, in particular as to site extensions/borders and certainly also as regards legal protection measures. Education of inspectors is crucial if survey is to become efficient and give reliable results. Thus, it is a welcome development that the Ancient Quarry Department, on the basis of previous QuarryScapes field courses, now offers its own courses for inspectors assigned to the Department.

Egypts ancient quarry record is by no means complete. Although it never will be complete, it is of course essential that new finds by Egyptian and foreign missions and thorugh geological and other prospecting (but also by inspectorates), are reported. Such reports may, however, have the tendency to disappear in the bureaucracy. SCA and EAIS need to find ways to

streamline the handling of such issues, so that people are encouraged to report and records can be updated and communicated as fast as possible.

On the basis of the nation-wide, tentative overview of the status of ancient quarries worked out in QuarryScapes, a set of simple indicators have been suggested as to long-term reactive monitoring on a national or governorate level. The most important indicator is related to the number of quarry sites with a secured legal status, but also indicators showing general condition and threat patterns are proposed. These are not meant for the daily struggle in the field, but to be communicated to responsible authorities and policy-makers. They may be a means to achieve understanding for needs of support and necessary resources in order to safeguard the ancient quarries in the long term, but they can also be used for controlling if long-term goals are reached.

The need for information and cooperation

The stone industry in Aswan is generally willing to accept moving away from ancient quarries, especially if incentives, such as long-term licences, are given at new places.

SCA cooperates with a long range of authorities, institutions, organisations and private companies in order to safeguard and promote the archaeological heritage of the country. In primary efforts to protect and monitor ancient quarry landscapes, QuarryScapes has identified a few central partners, with whom cooperation should be considered intensified.

Modern quarrying and mining is the largest threat to ancient Egyptian quarries. As this report has demonstrated, there is an urgent need of informing governorate quarry departments (that issue quarrying licences), but also the Egyptian Mineral Resources Authority (that is responsible for mining permissions) and the industry at large of the location and significance of ancient quarries. Partnerships with the governorate quarry departments and modern companies, as has been attempted with success in Aswan, is obviously a way to proceed in order to relocate existing operations and direct new projects away from ancient remains. Importantly, the work in Aswan has shown that the industry is generally willing to accept moving away from ancient quarries, especially if incentives, such as long-term licences, are given at new places. Such licences will also reduce destructive *ad hoc* quarrying and promote investment in planning, which is generally needed in the Egyptian stone industry.

Usually planned long ago, large new urban development projects, such as New Aswan City and New Minya City, are severely impacting on a range of ancient quarries, but also expanding villages, towns and cities damage and destroy ancient remains. As has also been demonstrated in Aswan, the new urban community authorities are as uninformed of ancient quarries as the modern quarrying industry. There is thus a similar need for information and partnership, also attempted by SCA with success in New Aswan City. Similar partnerships should certainly be attempted with relevant authorities as regards large-scale land reclamation projects, which are a specific threat to a few ancient quarry areas (in particular Chephren's Quarry and Prehistoric tool quarries in the Nile Valley).

At the other end of the scale are the Environmental Authorities, which are responsible for the many nature protectorates in Egypt. A substantial amount of ancient quarries are or will be part of nature protectorates, especially in the Eastern Desert. Clearly, nature protectorates are a means of protection, but they do not guarantee that modern exploitation will not impact on ancient quarry landscapes, as has been demonstrated in the case of Widan el-Faras. Since both

SCA and protectorate authorities have limited resources for monitoring and management, cooperation should be matter of high priority. The Northern Faiyum, where the Lake Qarun Nature Protectorate encompasses Widan el-Faras, is currently considered for nomination as a World Heritage Site. It is of vital interest for the benefit of the region's cultural and natural heritage that cooperation is intensified in this area (Chapter 4).

This list of possible partnerships is by no means meant to be exhaustive. It does, for example, not include tourist authorities, which may be important in active management and promotion. Promotion of ancient quarry landscapes, communicating their significance to general and select audiences, is today of course the ultimate key to protection and conservation. If nobody is interested in such places, there will be few incentives for carrying out all the work needed to safeguard and present them.

Importantly, the now "refurbished" Unfinished Obelisk Quarry Museum in Aswan is a very famous place, visited by tens of thousands of people every year. Moreover, it already now works like a small "hub" for activities surrounding ancient quarries in the country, headed by the SCA Ancient Quarry Department. The further plans for development of the museum as a centre for knowledge and education related to ancient quarries at large are very welcome. Adding that the museum is in fact a World Heritage Site, this could attract national and international support and partnership needed to build up and sustain the museum – and thus in various ways support the protection and conservation of all Egypt's spectacular ancient quarry landscapes.

On meeting the objectives

The outcome of this work is slightly different than originally intended. Due to the fortunate turn of events that within QuarryScapes we were able to build tentative site records for all 193 known Pharaonic and later quarries, this record now being refined in the EAIS GIS database system, and that SCA established the Ancient Quarry Department (Chapter 1), it was possible to add goals to those initially proposed. In short: supplementary to developing tools applicable for risk assessment and monitoring of ancient quarry landscapes, Work Package 5 has also used these tools, as described in this report, both for in-depth risk assessment and monitoring in case-study areas and for carrying out a nation-wide analysis of the status of ancient Egyptian quarry landscapes. This has also enabled a broader analysis of what can be done in order to safeguard the ancient quarries.

Appendix 1

Database of ancient Egyptian quarries

Per Storemyr, James Harrell, Rawda Yousri and El Shaimaa Fathy

This appendix presents an extract of the database of ancient Egyptian quarries (Predynastic to Islamic) as originally produced by James Harrell.[93] It has been updated with information on legal status, condition, threats and other issues as described in Chapter 2. Moreover, it has been made ready for integration with the central site record databases of the Egyptian Antiquities Information System (EAIS). The database consists of an extensive table which has been made with Microsoft Access and thus can be used together with e.g. ESRI GIS for map-making purposes. Below follows a documentation of the database, overview maps of ancient quarries in different regions and an extract of the database itself.

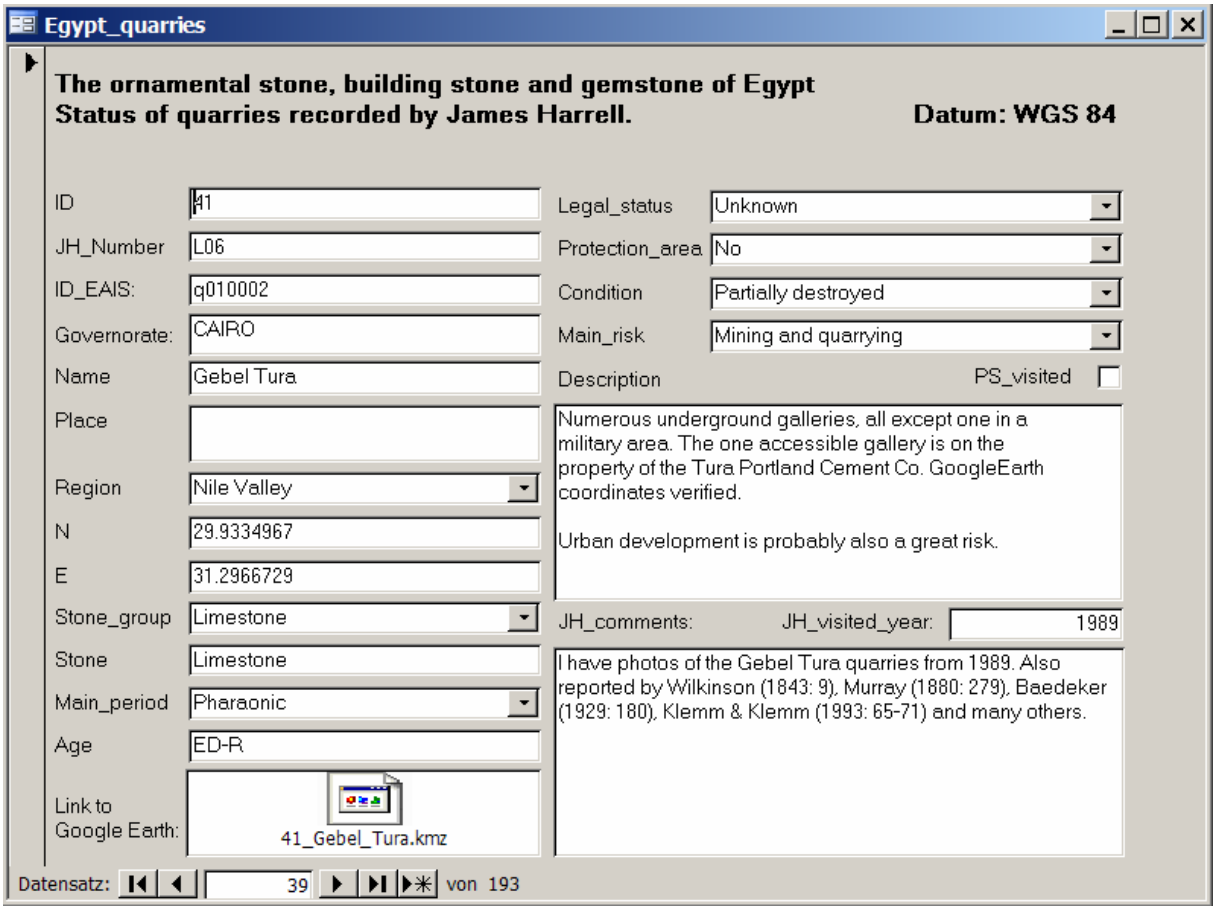


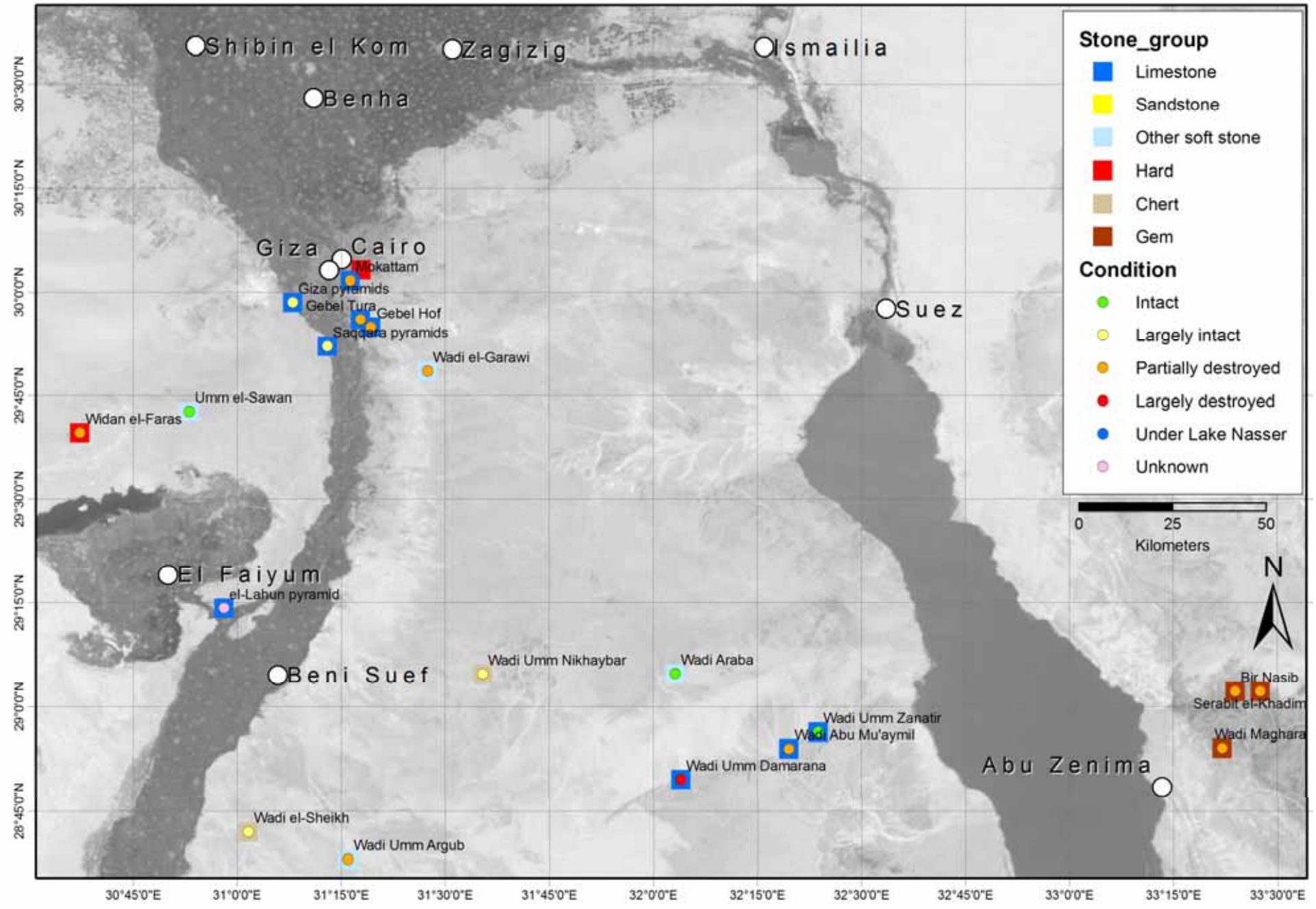
Figure 134: View of the form for data entry

[93] See www.eeescience.utoledo.edu/faculty/harrell/Egypt/AGRG_Home.html and Chapter 2 for further explanations

Documentation of the database

ID	Running ID code
JH_Number	Original number by James Harrell (Gxx=Gemstone, Hxx=Hard stone, Lxx=Limestone, Oxx=Other soft stone, Sxx=Sandstone, Txx=Travertine (Egyptian alabaster)
ID_EAIS	ID code as given by EAIS, for linking/integration with their central site record databases of archaeological sites in Egypt
Governorate	Location by governorate
Name	Name of the quarry. Normally the most common name for each quarry has been used (as also found in e.g. Klemm & Klemm 1993 – Steine und Steinbrüche im Alten Ägypten). In cases where this has not been possible the nearest well-known archaeological site, village or place has been used.
Place	Brief description of location. This description has sometimes been omitted, in particular in the case of very well-known quarries.
Region	Location by general region: Nile Valley, Eastern Desert, Western Desert, Red Sea Coast, Delta
N	Centre coordinates of the quarry area. Northing and Easting in decimal degrees. Datum: WGS84. Most of the coordinates have been updated using Google Earth as described in Chapter 2. However, for several quarries in the Nile Valley this task has not yet been undertaken.
E	
Stone_group	Major stone group: Gemstone, Hard, Limestone, Sandstone, Other soft stone, Chert
Stone	Geological name of the stone
Main_period	Period of predominant use: Prehistoric/Early Dynastic, Pharaonic, Pharaonic/Graeco Roman, Graeco-Roman, Byzantine, Islamic, Unknown
Age	Interpreted period of use (by abbreviations referring to the main periods in Egyptian history and prehistory)
Legal_status	As described in Chapter 2: Property SCA, Supervision SCA, Reg. process SCA, Unregistered, Unknown
Protection_area	As described in Chapter 2: Whether the quarry is part of a larger protected area: World Heritage Site, Nature protectorate, Proposed nature protectorate, No
Condition	As described in Chapter 5: Intact, Largely intact, Partially destroyed, Largely destroyed, Under Lake Nasser, Unknown
Main_threat	As described in Chapter 5: Urban development, Agricultural development, Mining and quarrying, Urban development - mining/quarrying, Not determined, Unspecified - low immediate risk, Not applicable
Descript	Brief description and references
PS_visited	Whether visited by Per Storemyr
JH_visited_year	Year visited by James Harrell
JH_comments	Comments and references by James Harrell
Kmz	Direct link to location in Google Earth (this feature has not yet been included for all quarries)

On the following pages maps and excerpt of the database are presented.


Shibin el Kom
Zagizig
Ismailia
Benha
Giza
Cairo
Mokattam
Giza pyramids
Gebel Tura
Gebel Hof
Saqqara pyramids
Wadi el-Garawi
Suez
Umm el-Sawan
Widan el-Faras
El Faiyum
el-Lahun pyramid
Beni Suef
Wadi Umm Nikhaybar
Wadi Araba
Bir Nasib
Serabit el-Khadim
Wadi Umm Zanatir
Wadi Abu Mu'aymil
Wadi Maghara
Wadi Umm Damarana
Abu Zenima
Wadi el-Sheikh
Wadi Umm Argub
Stone_group
Limestone
Sandstone
Other soft stone
Hard
Chert
Gem
Condition
Intact
Largely intact
Partially destroyed
Largely destroyed
Under Lake Nasser
Unknown
0
25
50
Kilometers
N
30°30'0"N
30°15'0"N
30°0'0"N
29°45'0"N
29°30'0"N
29°15'0"N
29°0'0"N
28°45'0"N
30°45'0"E
31°0'0"E
31°15'0"E
31°30'0"E
31°45'0"E
32°0'0"E
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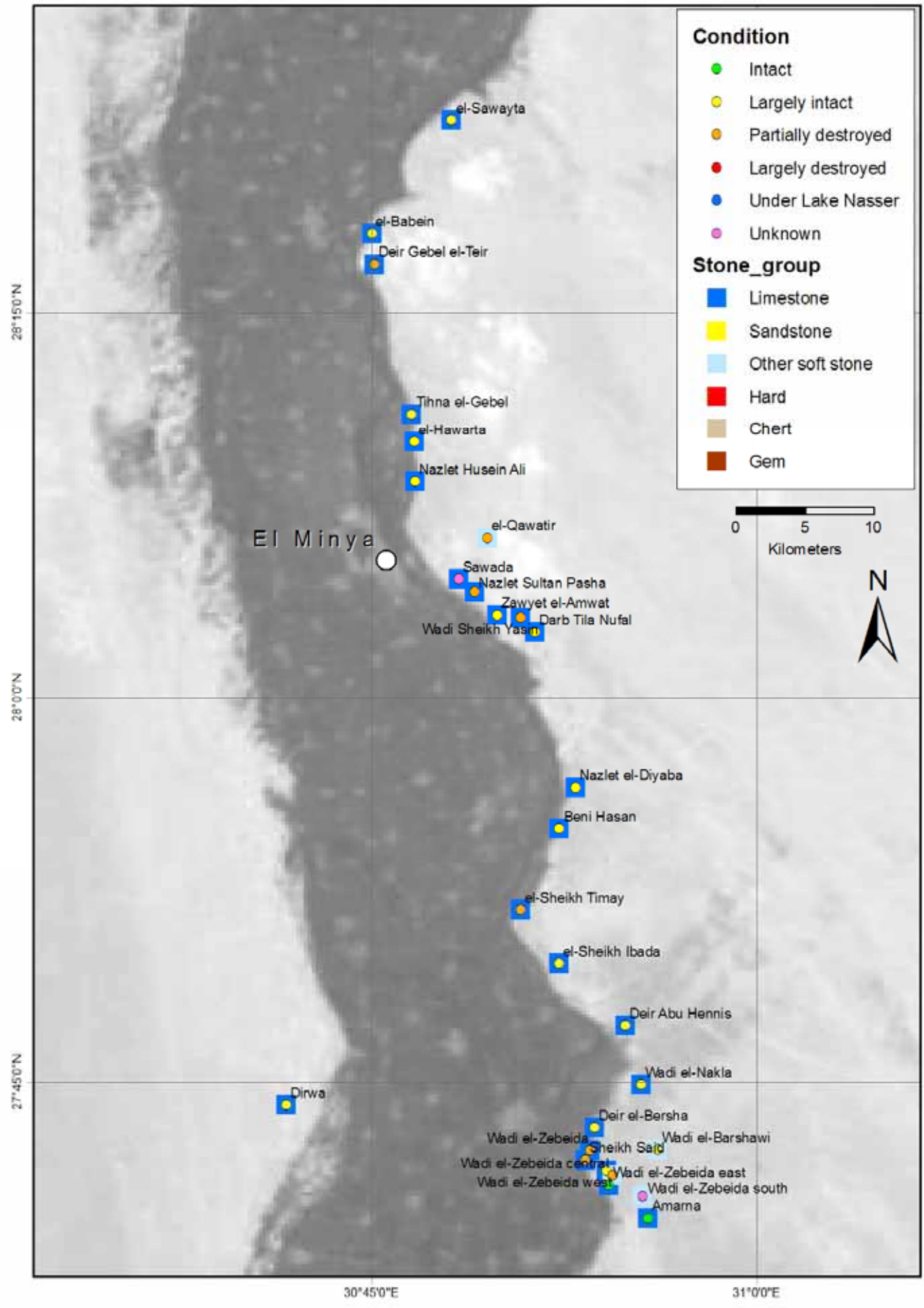
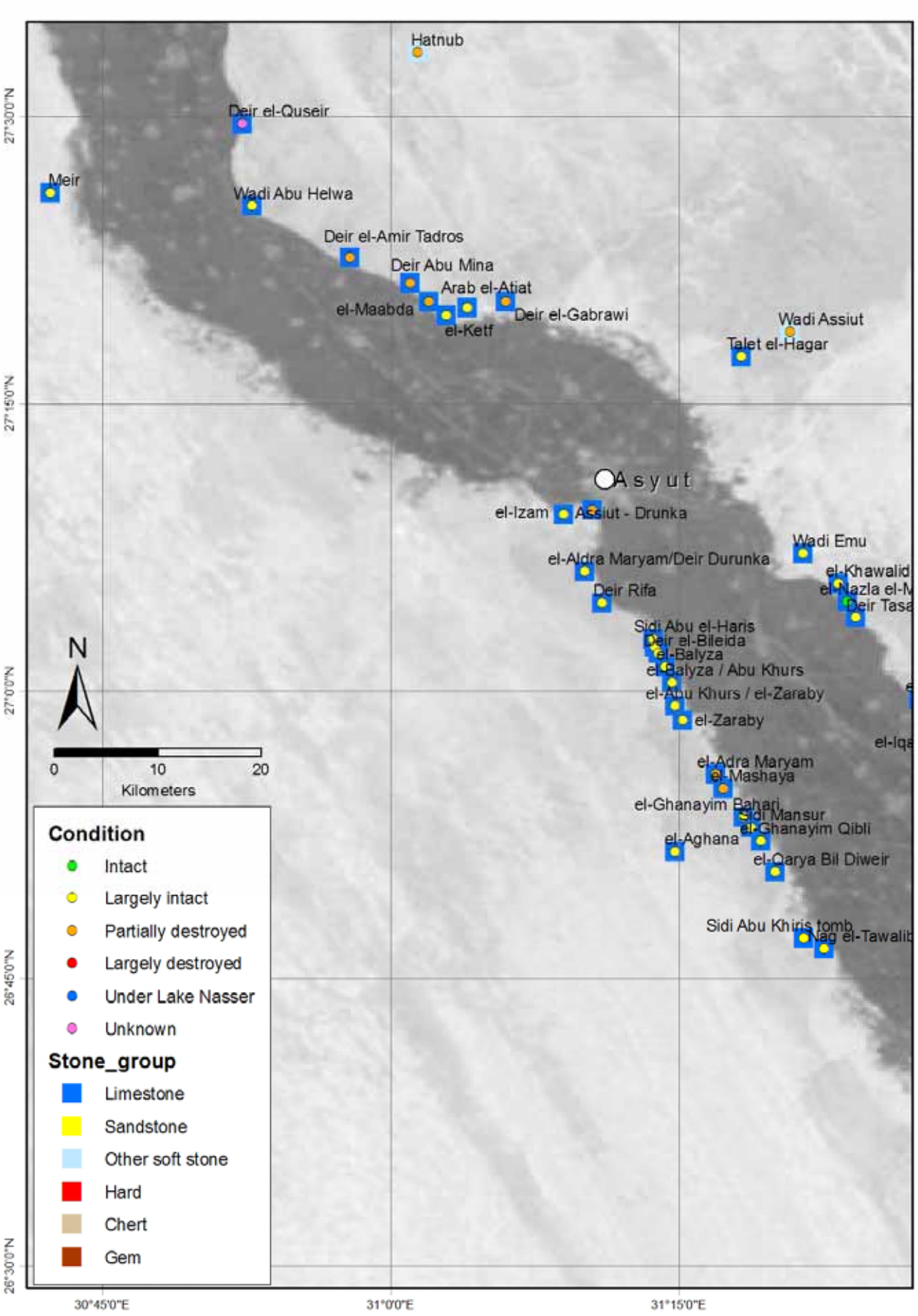
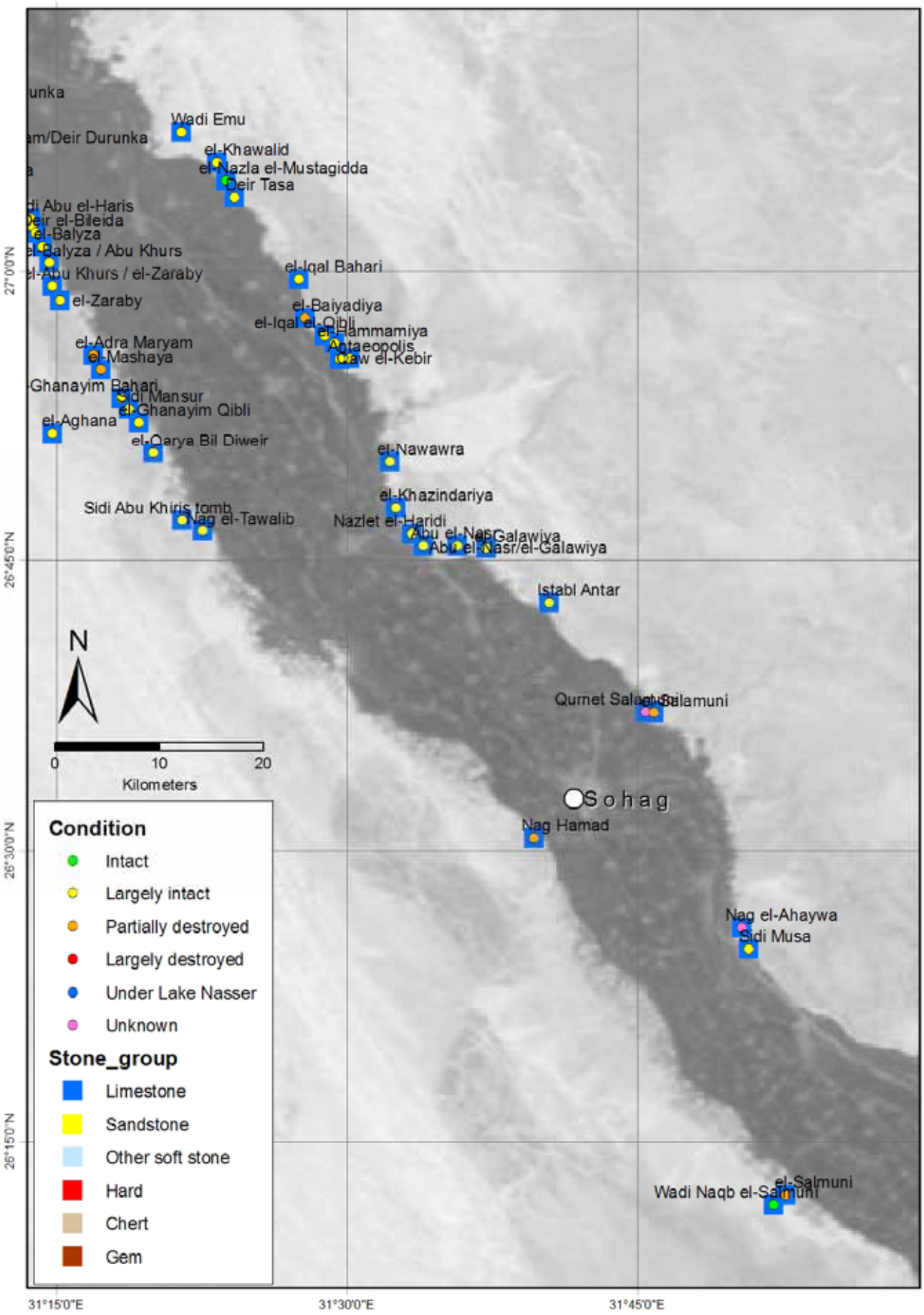
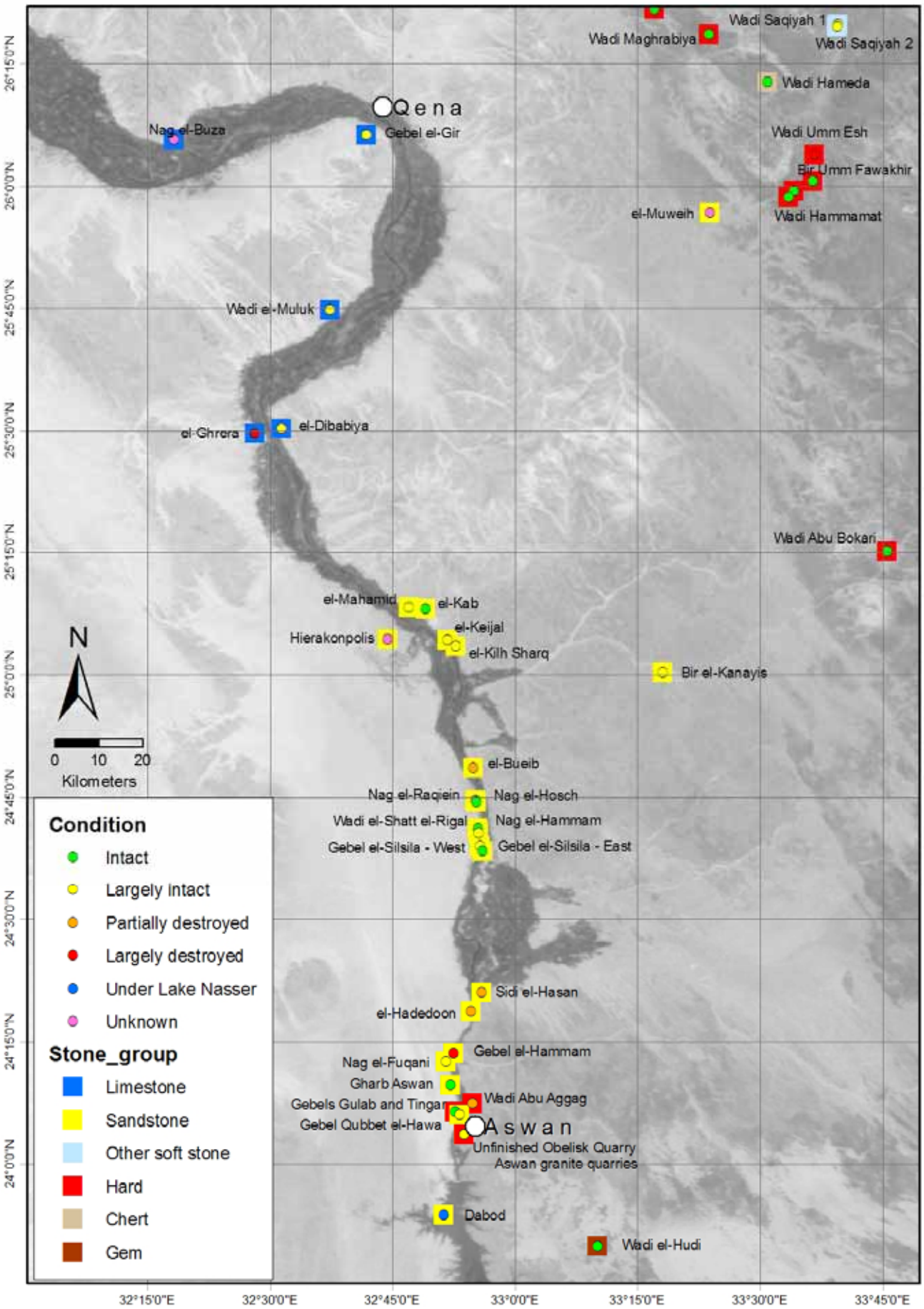
32°45'0"E
33°0'0"E
33°15'0"E
33°30'0"E


Condition
Intact
Largely intact
Partially destroyed
Largely destroyed
Under Lake Nasser
Unknown
Stone_group
Limestone
Sandstone
Other soft stone
Hard
Chert
Gem
0
5
10
Kilometers
N
el-Sawayta
el-Babein
Deir Gebel el-Teir
Tihna el-Gebel
el-Hawarta
Nazlet Husein Ali
El Minya
el-Qawatir
Sawada
Nazlet Sultan Pasha
Zawyet el-Amwat
Darb Tila Nufal
Wadi Sheikh Yasin
Nazlet el-Diyaba
Beni Hasan
el-Sheikh Timay
el-Sheikh Ibada
Deir Abu Hennis
Wadi el-Nakla
Dirwa
Deir el-Bersha
Wadi el-Zebeida
Sheikh Said
Wadi el-Barshawi
Wadi el-Zebeida central
Wadi el-Zebeida east
Wadi el-Zebeida west
Wadi el-Zebeida south
Amarna
28°15'0"N
28°0'0"N
27°45'0"N
30°45'0"E
31°0'0"E


Hatnub
Deir el-Quseir
Meir
Wadi Abu Helwa
Deir el-Amir Tadros
Deir Abu Mina
Arab el-Atiat
el-Maabda
el-Ketf
Deir el-Gabrawi
Wadi Assiut
Talet el-Hagar
Asyut
el-Izam
Assiut - Drunka
Wadi Emu
el-Aldra Maryam/Deir Durunka
el-Khawalid
Deir Rifa
Deir Tasa
Sidi Abu el-Haris
Deir el-Bileida
el-Balyza
el-Balyza / Abu Khurs
el-Abu Khurs / el-Zaraby
el-Zaraby
el-Adra Maryam
el-Mashaya
el-Ghanayim Bahari
Sidi Mansur
el-Ghanayim Qibli
el-Aghana
el-Qarya Bil Diweir
Sidi Abu Khiris tomb
Nag el-Tawalib
N
0
10
20
Kilometers
Condition
Intact
Largely intact
Partially destroyed
Largely destroyed
Under Lake Nasser
Unknown
Stone_group
Limestone
Sandstone
Other soft stone
Hard
Chert
Gem
27°30'0"N
27°15'0"N
27°0'0"N
26°45'0"N
26°30'0"N
30°45'0"E
31°0'0"E
31°15'0"E


Wadi Emu
el-Khawalid
el-Nazla el-Mustagidda
Deir Tasa
el-Balyza
el-Balyza / Abu Khurs
el-Zaraby
el-Iqal Bahari
el-Baiyadiya
el-Iqal el-Qibli
el-Hammamiya
Antaeopolis
el-Adra Maryam
el-Mashaya
Sidi Mansur
el-Ghanayim Qibli
el-Aghana
el-Qarya Bil Diweir
el-Nawawra
el-Khazindariya
Sidi Abu Khiris tomb
Nag el-Tawalib
Nazlet el-Haridi
Istabl Antar
Qurnet Salamuni
Sohag
Nag Hamad
Nag el-Ahaywa
Sidi Musa
el-Salmuni
Wadi Naqb el-Salmuni
N
0
10
20
Kilometers
Condition
Intact
Largely intact
Partially destroyed
Largely destroyed
Under Lake Nasser
Unknown
Stone_group
Limestone
Sandstone
Other soft stone
Hard
Chert
Gem
27°0'0"N
26°45'0"N
26°30'0"N
26°15'0"N
31°15'0"E
31°30'0"E
31°45'0"E


Wadi Saqiyah 1
Wadi Saqiyah 2
Wadi Maghrabiya
Wadi Hameda
Qena
Nag el-Buza
Gebel el-Gir
Wadi Umm Esh
Bir Umm Fawakhir
el-Muweih
Wadi Hammamat
Wadi el-Muluk
el-Ghrera
el-Dibabiya
Wadi Abu Bokari
el-Mahamid
el-Kab
el-Keijal
Hierakonpolis
el-Kilh Sharq
Bir el-Kanayis
N
0 10 20
Kilometers
el-Bueib
Nag el-Raqiein
Nag el-Hosch
Wadi el-Shatt el-Rigal
Nag el-Hammam
Gebel el-Silsila - West
Gebel el-Silsila - East
Sidi el-Hasan
el-Hadedoon
Gebel el-Hammam
Nag el-Fuqani
Gharb Aswan
Wadi Abu Aggag
Gebels Gulab and Tingar
Gebel Qubbet el-Hawa
Aswan
Unfinished Obelisk Quarry
Aswan granite quarries
Dabod
Wadi el-Hudi
Condition
Intact
Largely intact
Partially destroyed
Largely destroyed
Under Lake Nasser
Unknown
Stone_group
Limestone
Sandstone
Other soft stone
Hard
Chert
Gem
26°15'0"N
26°0'0"N
25°45'0"N
25°30'0"N
25°15'0"N
25°0'0"N
24°45'0"N
24°30'0"N
24°15'0"N
24°0'0"N
32°15'0"E
32°30'0"E
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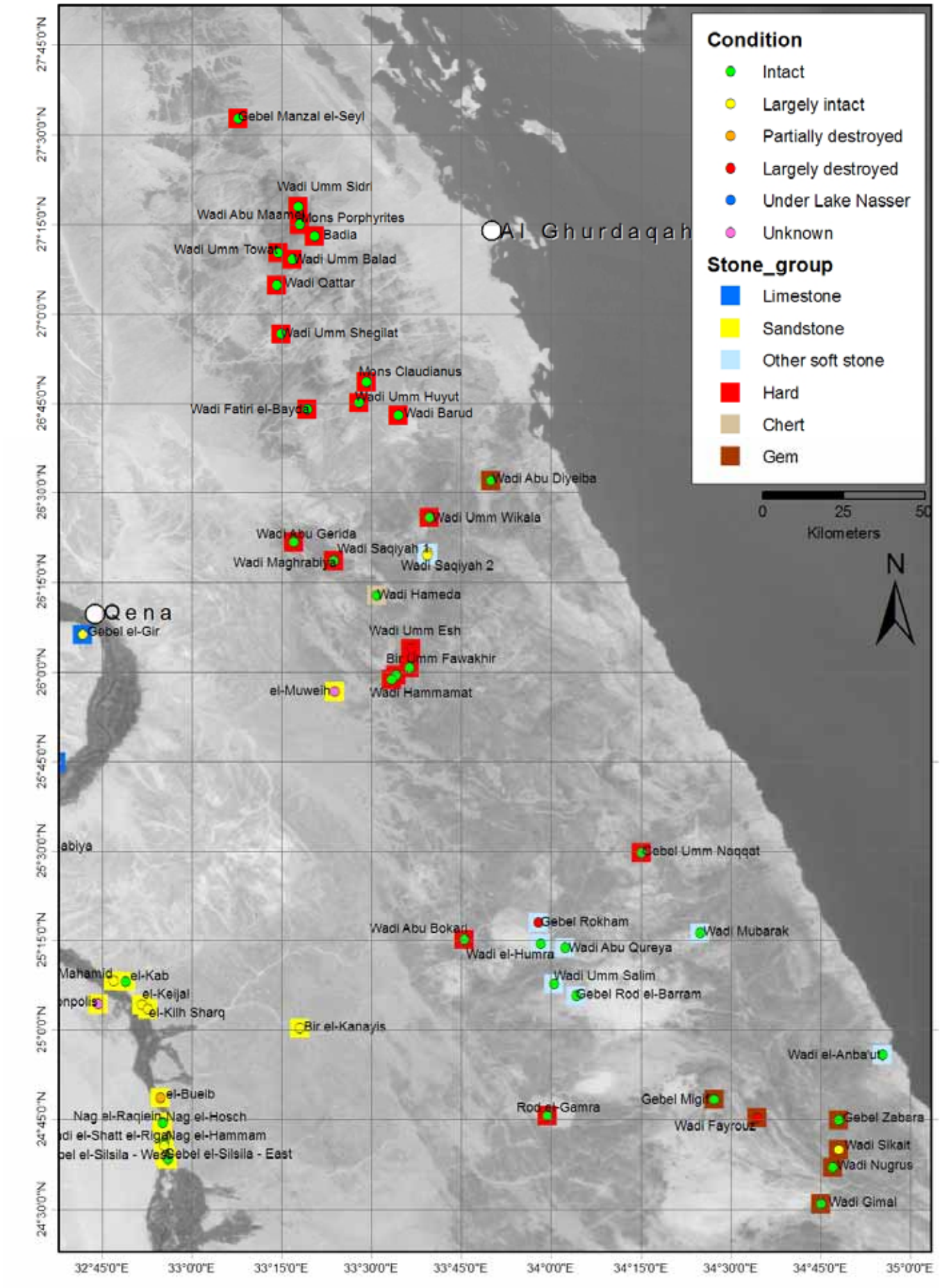
33°0'0"E
33°15'0"E
33°30'0"E
33°45'0"E


Condition
Intact
Largely intact
Partially destroyed
Largely destroyed
Under Lake Nasser
Unknown
Stone_group
Limestone
Sandstone
Other soft stone
Hard
Chert
Gem
0
25
50
Kilometers
N
Al Ghurdaqah
Qena
Gebel Manzal el-Seyl
Wadi Umm Sidri
Wadi Abu Maamel
Mons Porphyrites
Badia
Wadi Umm Towat
Wadi Umm Balad
Wadi Qattar
Wadi Umm Shegilat
Mons Claudianus
Wadi Umm Huyut
Wadi Fatiri el-Bayda
Wadi Barud
Wadi Abu Diyeiba
Wadi Umm Wikala
Wadi Abu Gerida
Wadi Saqiyah 1
Wadi Maghrabiya
Wadi Saqiyah 2
Wadi Hameda
Gebel el-Gir
Wadi Umm Esh
Bir Umm Fawakhir
el-Muweih
Wadi Hammamat
Gebel Umm Naqqat
Gebel Rokham
Wadi Abu Bokari
Wadi Mubarak
Wadi el-Humra
Wadi Abu Qureya
Wadi Umm Salim
el-Kab
el-Keijal
el-Kilh Sharq
Gebel Rod el-Barram
Bir el-Kanayis
Wadi el-Anba'ut
el-Bueib
Gebel Migif
Rod el-Gamra
Wadi Fayrouz
Gebel Zabara
Nag el-Raqiein
Nag el-Hosch
Nag el-Hammam
Gebel el-Silsila - East
Wadi Sikait
Wadi Nugrus
Wadi Gimal
32°45'0"E
33°0'0"E
33°15'0"E
33°30'0"E
33°45'0"E
34°0'0"E
34°15'0"E
34°30'0"E
34°45'0"E
35°0'0"E
27°45'0"N
27°30'0"N
27°15'0"N
27°0'0"N
26°45'0"N
26°30'0"N
26°15'0"N
26°0'0"N
25°45'0"N
25°30'0"N
25°15'0"N
25°0'0"N
24°45'0"N
24°30'0"N

ID	Number	Name	Region	N	E	Stone_group	Stone	Main_period	Legal_status	Protection_area	Condition	Main_threat
36	L1	Mallahet Mariut	Delta	30.9469	29.5017	Limestone	Limestone	Graeco-Roman	Unknown	No	Unknown	Urban development
188	G4	Wadi Abu Diyeiba	Eastern Desert	26.5334	33.8350	Gem	Amethyst	Pharaonic/Graeco Roman	Unknown	No	Intact	Unspecified - low immediate risk
189	G5	Gebel Zabara	Eastern Desert	24.7501	34.8016	Gem	Emerald	Islamic	Unknown	Nature Protect.	Intact	Unspecified - low immediate risk
190	G6	Wadi Sikait	Eastern Desert	24.6667	34.8016	Gem	Emerald	Graeco-Roman	Unknown	Nature Protect.	Largely intact	Unspecified - low immediate risk
191	G7	Wadi Nugrus	Eastern Desert	24.6167	34.7850	Gem	Emerald	Graeco-Roman	Unknown	Nature Protect.	Intact	Unspecified - low immediate risk
192	G8	Wadi Gimal	Eastern Desert	24.5167	34.7516	Gem	Emerald	Graeco-Roman	Unknown	Nature Protect.	Intact	Unspecified - low immediate risk
193	G9	Wadi el-Hudi	Eastern Desert	23.8334	33.1683	Gem	Amethyst	Pharaonic	Unknown	No	Intact	Unspecified - low immediate risk
194	G10	Gebel Migif	Eastern Desert	24.8068	34.4550	Gem	Amazonite	Unknown	Unregistered	No	Intact	Unspecified - low immediate risk
195	G11	Wadi Fayrouz	Eastern Desert	24.7551	34.5750	Gem	Amazonite	Unknown	Unregistered	Nature Protect.	Largely destroyed	Unspecified - low immediate risk
10	H10	Gebel Manzal el-Seyl	Eastern Desert	27.5435	33.1317	Hard	Tuff	Prehistoric/Early Dynastic	Unregistered	No	Intact	Unspecified - low immediate risk
11	H11	Wadi Umm Sidri	Eastern Desert	27.2984	33.2983	Hard	Syenite porphyry	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
12	H12a	Mons Porphyrites	Eastern Desert	27.2518	33.3016	Hard	Andesite-dacite porphyry	Graeco-Roman	Property SCA	Prop. nature Protect.	Intact	Unspecified - low immediate risk
13	H12b	Wadi Abu Maamel	Eastern Desert	27.2501	33.3016	Hard	Granite	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
14	H13	Badia	Eastern Desert	27.2168	33.3441	Hard	Granite	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
15	H14	Wadi Umm Towat	Eastern Desert	27.1701	33.2416	Hard	Trachyandesite porphyry	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
16	H15	Wadi Umm Balad	Eastern Desert	27.1518	33.2808	Hard	Quartz diorite	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
17	H16	Wadi Qattar	Eastern Desert	27.0793	33.2375	Hard	Granodiorite	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
18	H17	Wadi Umm Shegilat	Eastern Desert	26.9434	33.2500	Hard	Pegmatitic diorite	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
19	H18	Mons Claudianus	Eastern Desert	26.8093	33.4866	Hard	Tonalite gneiss	Graeco-Roman	Property SCA	Prop. nature Protect.	Intact	Unspecified - low immediate risk
20	H19	Wadi Barud	Eastern Desert	26.7176	33.5766	Hard	Quartz diorite	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
21	H20	Wadi Umm Huyut	Eastern Desert	26.7514	33.4675	Hard	Tonalite gneiss	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Unspecified - low immediate risk
22	H21	Wadi Fatiri el-Bayda	Eastern Desert	26.7334	33.3233	Hard	Quartz diorite	Graeco-Roman	Unregistered	Prop. nature Protect.	Intact	Mining and quarrying
23	H22	Wadi Umm Wikala	Eastern Desert	26.4309	33.6633	Hard	Gabbro	Graeco-Roman	Unregistered	No	Intact	Unspecified - low immediate risk
24	H23	Wadi Abu Gerida	Eastern Desert	26.3621	33.2845	Hard	Syenite porphyry	Graeco-Roman	Unregistered	No	Intact	Unspecified - low immediate risk
25	H24	Wadi Maghrabiya	Eastern Desert	26.3109	33.3966	Hard	Metagabbro	Graeco-Roman	Unregistered	No	Intact	Unspecified - low immediate risk
26	H25	Wadi Hameda	Eastern Desert	26.2129	33.5158	Chert	Chert	Byzantine	Unregistered	No	Intact	Unspecified - low immediate risk
27	H26	Wadi Umm Esh	Eastern Desert	26.0651	33.6116	Hard	Serpentinite	Graeco-Roman	Unregistered	No	Largely destroyed	Mining and quarrying
28	H27	Bir Umm Fawakhir	Eastern Desert	26.0109	33.6083	Hard	Granite	Graeco-Roman	Property SCA	No	Intact	Unspecified - low immediate risk
29	H28a	Wadi Hammamat - E Quarry	Eastern Desert	25.9901	33.5691	Hard	Graywacke etc	Pharaonic/Graeco Roman	Property SCA	No	Intact	Unspecified - low immediate risk

ID	Number	Name	Region	N	E	Stone_group	Stone	Main_period	Legal_status	Protection_area	Condition	Main_threat
30	H28b	Wadi Hammamat - W Quarry	Eastern Desert	25.9778	33.5583	Hard	Metaconglomerate	Pharaonic/Graeco Roman	Unknown	No	Intact	Unspecified - low immediate risk
31	H29	Gebel Umm Naqqat	Eastern Desert	25.4968	34.2533	Hard	Pegmatitic diorite	Prehistoric/Early Dynastic	Unregistered	No	Intact	Unspecified - low immediate risk
32	H30	Wadi Abu Bokari	Eastern Desert	25.2526	33.7601	Hard	Granodiorite	Graeco-Roman	Unknown	No	Intact	Unspecified - low immediate risk
33	H31	Rod el-Gamra	Eastern Desert	24.7621	33.9901	Hard	Dolerite porphyry	Pharaonic	Unregistered	No	Intact	Unspecified - low immediate risk
34	H32	Wadi Umm Nikhaybar	Eastern Desert	29.0780	31.5905	Chert	Chert	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
35	H33	Wadi el-Sheikh	Eastern Desert	28.7002	31.0267	Chert	Chert	Pharaonic	Unknown	No	Largely intact	Unspecified - low immediate risk
43	L92	Wadi Umm Zanatir	Eastern Desert	28.9385	32.3967	Limestone	Calcareous dolostone	Islamic	Unknown	Prop. nature Protect.	Intact	Unspecified - low immediate risk
44	L93	Wadi Abu Mu'aymil	Eastern Desert	28.8985	32.3267	Limestone	Gray and black limestones	Islamic	Unknown	Prop. nature Protect.	Partially destroyed	Mining and quarrying
45	L94	Wadi Umm Damarana	Eastern Desert	28.8251	32.0667	Limestone	Limestone	Islamic	Unknown	Prop. nature Protect.	Largely destroyed	Mining and quarrying
175	O2a	Wadi Saqiyah 1	Eastern Desert	26.3308	33.6593	Other soft stone	Soapstone	Graeco-Roman	Unregistered	No	Largely intact	Mining and quarrying
176	O2b	Wadi Saqiyah 2	Eastern Desert	26.3261	33.6571	Other soft stone	Soapstone	Graeco-Roman	Unregistered	No	Largely intact	Mining and quarrying
177	O3	Gebel Rokham	Eastern Desert	25.2993	33.9658	Other soft stone	Marble	Pharaonic/Graeco Roman	Unregistered	No	Largely destroyed	Mining and quarrying
178	O4	Wadi Mubarak	Eastern Desert	25.2713	34.4168	Other soft stone	Soapstone	Pharaonic/Graeco Roman	Unregistered	No	Intact	Mining and quarrying
179	O5	Wadi Abu Qureya	Eastern Desert	25.2291	34.0415	Other soft stone	Soapstone	Islamic	Unregistered	No	Intact	Mining and quarrying
180	O6	Wadi el-Humra	Eastern Desert	25.2401	33.9716	Other soft stone	Soapstone	Islamic	Unregistered	No	Intact	Mining and quarrying
181	O7	Wadi Umm Salim	Eastern Desert	25.1296	34.0100	Other soft stone	Soapstone	Islamic	Unregistered	No	Intact	Mining and quarrying
182	O8	Gebel Rod el-Barram	Eastern Desert	25.0958	34.0723	Other soft stone	Soapstone	Islamic	Unregistered	No	Intact	Mining and quarrying
184	O10	Wadi Kamoyid	Eastern Desert	22.5984	34.9783	Other soft stone	Soapstone	Islamic	Unregistered	Nature Protect.	Intact	Unspecified - low immediate risk
172	S33	el-Muweih	Eastern Desert	25.9451	33.3983	Sandstone	Sandstone	Graeco-Roman	Unknown	No	Unknown	Not determined
173	S34	Bir el-Kanayis	Eastern Desert	25.0043	33.3016	Sandstone	Sandstone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Unspecified - low immediate risk
130	T1	Wadi el-Garawi	Eastern Desert	29.8085	31.4583	Other soft stone	Travertine	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
131	T2	Wadi Araba	Eastern Desert	29.0793	32.0533	Other soft stone	Travertine	Graeco-Roman	Unknown	No	Intact	Unspecified - low immediate risk
132	T3	Wadi Umm Argub	Eastern Desert	28.6352	31.2667	Other soft stone	Travertine	Pharaonic/Graeco Roman	Unknown	No	Partially destroyed	Mining and quarrying
137	T8	Hatnub	Eastern Desert	27.5551	31.0233	Other soft stone	Travertine	Pharaonic/Graeco Roman	Reg. process SCA	No	Partially destroyed	Urban development - mining/quarrying
138	T9	Wadi Assiut	Eastern Desert	27.3126	31.3466	Other soft stone	Travertine	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
1	H1	Gebel Ahmar	Nile Valley	30.0527	31.2983	Hard	Silicified sandstone	Pharaonic	Unknown	No	Largely destroyed	Urban development
4	H4	Wadi Abu Aggag	Nile Valley	24.1251	32.9133	Hard	Silicified sandstone	Pharaonic/Graeco Roman	Unregistered	No	Partially destroyed	Urban development - mining/quarrying
5	H5	Gebels Gulab and Tingar	Nile Valley	24.1068	32.8783	Hard	Silicified sandstone	Pharaonic/Graeco Roman	Unregistered	No	Intact	Urban development - mining/quarrying
6	H6	Aswan granite quarries	Nile Valley	24.0618	32.8966	Hard	Granite	Pharaonic/Graeco Roman	Unregistered	No	Partially destroyed	Urban development - mining/quarrying

ID	Number	Name	Region	N	E	Stone_group	Stone	Main_period	Legal_status	Protection_area	Condition	Main_threat
198	H6a	Unfinished Obelisk Quarry	Nile Valley	24.0618	32.8966	Hard	Granite	Pharaonic/Graeco Roman	Property SCA	World Heritage Site	Largely intact	Urban development
37	L2	Giza pyramids	Nile Valley	29.9752	31.1342	Limestone	Limestone	Pharaonic	Property SCA	World Heritage Site	Largely intact	Unspecified - low immediate risk
38	L3	Saqqara pyramids	Nile Valley	29.8693	31.2167	Limestone	Limestone	Prehistoric/Early Dynastic	Property SCA	World Heritage Site	Largely intact	Unspecified - low immediate risk
39	L4	el-Lahun pyramid	Nile Valley	29.2368	30.9683	Limestone	Limestone	Pharaonic	Unknown	No	Unknown	Not determined
40	L5	Mokattam	Nile Valley	30.0268	31.2717	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Urban development
41	L6	Gebel Tura	Nile Valley	29.9335	31.2967	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
42	L7	Gebel Hof	Nile Valley	29.9152	31.3217	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
46	L8	el-Sawayta	Nile Valley	28.3752	30.8016	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Not determined
47	L9	el-Babein	Nile Valley	28.3018	30.7500	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Urban development - mining/quarrying
48	L10	Deir Gebel el-Teir	Nile Valley	28.2818	30.7516	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Urban development - mining/quarrying
49	L11	Tihna el-Gebel	Nile Valley	28.1843	30.7758	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Unspecified - low immediate risk
50	L12	el-Hawarta	Nile Valley	28.1660	30.7775	Limestone	Limestone	Graeco-Roman	Unknown	No	Largely intact	Not determined
51	L13	Nazlet Husein Ali	Nile Valley	28.1402	30.7783	Limestone	Limestone	Graeco-Roman	Unknown	No	Largely intact	Unspecified - low immediate risk
52	L14	Sawada	Nile Valley	28.0768	30.8066	Limestone	Limestone	Pharaonic	Unknown	No	Unknown	Not determined
53	L15	Nazlet Sultan Pasha	Nile Valley	28.0685	30.8166	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Partially destroyed	Urban development - mining/quarrying
54	L16	Zawyet el-Amwat	Nile Valley	28.0535	30.8316	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Urban development - mining/quarrying
55	L17	Wadi Sheikh Yasin	Nile Valley	28.0518	30.8466	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Partially destroyed	Urban development - mining/quarrying
56	L18	Darb Tila Nufal	Nile Valley	28.0427	30.8558	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Not determined
57	L19	Dirwa	Nile Valley	27.7352	30.6941	Limestone	Limestone	Graeco-Roman	Unknown	No	Largely intact	Unspecified - low immediate risk
58	L20	Nazlet el-Diyaba	Nile Valley	27.9418	30.8825	Limestone	Limestone	Graeco-Roman	Unknown	No	Largely intact	Not determined
59	L21	Beni Hasan	Nile Valley	27.9152	30.8716	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Unspecified - low immediate risk
60	L22	el-Sheikh Timay	Nile Valley	27.8618	30.8466	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Urban development
61	L23	el-Sheikh Ibada	Nile Valley	27.8268	30.8716	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Mining and quarrying
62	L24	Deir Abu Hennis	Nile Valley	27.7868	30.9150	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Unspecified - low immediate risk
63	L25	Wadi el-Nakla	Nile Valley	27.7485	30.9250	Limestone	Limestone	Pharaonic/Graeco Roman	Property SCA	No	Largely intact	Unspecified - low immediate risk
64	L26	Deir el-Bersha	Nile Valley	27.7208	30.8945	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
65	L27	Wadi el-Zebeida	Nile Valley	27.7061	30.8916	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
66	L28	Sheikh Said	Nile Valley	27.6998	30.8886	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
67	L29	Wadi el-Zebeida west	Nile Valley	27.6930	30.9025	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying

ID	Number	Name	Region	N	E	Stone_group	Stone	Main_period	Legal_status	Protection_area	Condition	Main_threat
68	L30	Wadi el-Zebeida central	Nile Valley	27.6896	30.9066	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
69	L31	Wadi el-Zebeida east	Nile Valley	27.6836	30.9038	Limestone	Limestone	Pharaonic	Unknown	No	Intact	Mining and quarrying
70	L32	Amarna	Nile Valley	27.6621	30.9296	Limestone	Limestone	Pharaonic	Unknown	No	Intact	Unspecified - low immediate risk
71	L33	Deir el-Quseir	Nile Valley	27.4935	30.8716	Limestone	Limestone	Unknown	Unknown	No	Unknown	Unspecified - low immediate risk
72	L34	Wadi Abu Helwa	Nile Valley	27.4218	30.8800	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Unspecified - low immediate risk
73	L35	Meir	Nile Valley	27.4335	30.7050	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Unspecified - low immediate risk
74	L36	Deir el-Amir Tadros	Nile Valley	27.3768	30.9650	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Unspecified - low immediate risk
75	L37	Deir Abu Mina	Nile Valley	27.3551	31.0166	Limestone	Limestone	Unknown	Unknown	No	Partially destroyed	Unspecified - low immediate risk
76	L38	el-Maabda	Nile Valley	27.3385	31.0333	Limestone	Limestone	Unknown	Unknown	No	Partially destroyed	Unspecified - low immediate risk
77	L39	Deir el-Gabrawi	Nile Valley	27.3385	31.1000	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
78	L40	el-Ketf	Nile Valley	27.3268	31.0483	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
79	L41	Arab el-Atiat	Nile Valley	27.3335	31.0666	Limestone	Limestone	Graeco-Roman	Unknown	No	Largely intact	Mining and quarrying
80	L42	Talet el-Hagar	Nile Valley	27.2910	31.3041	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
81	L43	el-Izam	Nile Valley	27.1535	31.1500	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
82	L44	Assiut - Drunka	Nile Valley	27.1568	31.1750	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
83	L45	el-Aldra Maryam/Deir Durunka	Nile Valley	27.1035	31.1683	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
84	L46	Deir Rifa	Nile Valley	27.0760	31.1833	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
85	L47	Sidi Abu el-Haris	Nile Valley	27.0451	31.2275	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
86	L48	Sidi Abu el-Haris tomb	Nile Valley	27.0385	31.2291	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
87	L49	Deir el-Bileida	Nile Valley	27.0326	31.2325	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
88	L50	el-Balyza	Nile Valley	27.0210	31.2383	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
89	L51	el-Balyza / Abu Khurs	Nile Valley	27.0068	31.2441	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
90	L52	el-Abu Khurs / el-Zaraby	Nile Valley	26.9868	31.2466	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
91	L53	el-Zaraby	Nile Valley	26.9743	31.2533	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
92	L54	el-Adra Maryam	Nile Valley	26.9276	31.2816	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Unspecified - low immediate risk
93	L55	el-Mashaya	Nile Valley	26.9151	31.2883	Limestone	Limestone	Unknown	Unknown	No	Partially destroyed	Mining and quarrying
94	L56	el-Ghanayim Bahari	Nile Valley	26.8901	31.3058	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
95	L57	Sidi Mansur	Nile Valley	26.8810	31.3125	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
96	L58	el-Ghanayim Qibli	Nile Valley	26.8693	31.3208	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying

ID	Number	Name	Region	N	E	Stone_group	Stone	Main_period	Legal_status	Protection_area	Condition	Main_threat
97	L59	el-Aghana	Nile Valley	26.8601	31.2466	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
98	L60	el-Qarya Bil Diweir	Nile Valley	26.8426	31.3333	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
99	L61	Sidi Abu Khiris tomb	Nile Valley	26.7843	31.3583	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
100	L62	Nag el-Tawalib	Nile Valley	26.7751	31.3758	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
101	L63	Nag Hamad	Nile Valley	26.5110	31.6608	Limestone	Limestone	Graeco-Roman	Unknown	No	Partially destroyed	Unspecified - low immediate risk
102	L64	el-Salmuni	Nile Valley	26.2043	31.8775	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
103	L65	Wadi Naqb el-Salmuni	Nile Valley	26.1960	31.8675	Limestone	Limestone	Pharaonic	Unknown	No	Intact	Unspecified - low immediate risk
104	L66	Wadi Emu	Nile Valley	27.1193	31.3575	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
105	L67	el-Khawalid	Nile Valley	27.0935	31.3883	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Urban development
106	L68	el-Nazla el-Mustagidda	Nile Valley	27.0776	31.3958	Limestone	Limestone	Unknown	Unknown	No	Intact	Mining and quarrying
107	L69	Deir Tasa	Nile Valley	27.0635	31.4033	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
108	L70	el-Iqal Bahari	Nile Valley	26.9926	31.4583	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Mining and quarrying
109	L71	el-Baiyadiya	Nile Valley	26.9593	31.4641	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
110	L72	el-Iqal el-Qibli	Nile Valley	26.9443	31.4808	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Mining and quarrying
111	L73	el-Hammamiya	Nile Valley	26.9376	31.4891	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
112	L74	Antaeopolis	Nile Valley	26.9243	31.4941	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Not determined
113	L75	Qaw el-Kebir	Nile Valley	26.9251	31.5025	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Mining and quarrying
114	L76	el-Nawawra	Nile Valley	26.8351	31.5366	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Not determined
115	L77	el-Khazindariya	Nile Valley	26.7951	31.5425	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Not determined
116	L78	Nazlet el-Haridi	Nile Valley	26.7726	31.5558	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Unspecified - low immediate risk
117	L79	Abu el-Nasr	Nile Valley	26.7626	31.5658	Limestone	Limestone	Graeco-Roman	Unknown	No	Largely intact	Not determined
118	L80	Abu el-Nasr/el-Galawiya	Nile Valley	26.7626	31.5950	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Not determined
119	L81	el-Galawiya	Nile Valley	26.7601	31.6200	Limestone	Limestone	Unknown	Unknown	No	Largely intact	Not determined
120	L82	Istabl Antar	Nile Valley	26.7135	31.6741	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
121	L83	Qurnet Salamuni	Nile Valley	26.6193	31.7566	Limestone	Limestone	Unknown	Unknown	No	Unknown	Not determined
122	L84	el-Salamuni	Nile Valley	26.6185	31.7641	Limestone	Limestone	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
123	L85	Wadi el-Muluk	Nile Valley	25.7476	32.6233	Limestone	Limestone	Pharaonic/Graeco Roman	Property SCA	World Heritage Site	Largely intact	Unspecified - low immediate risk
124	L86	el-Ghrera	Nile Valley	25.4943	32.4700	Limestone	Limestone	Pharaonic	Unknown	No	Largely destroyed	Not determined
125	L87	Nag el-Ahaywa	Nile Valley	26.4335	31.8400	Limestone	Limestone	Unknown	Unknown	No	Unknown	Not determined

ID	Number	Name	Region	N	E	Stone_group	Stone	Main_period	Legal_status	Protection_area	Condition	Main_threat
126	L88	Sidi Musa	Nile Valley	26.4151	31.8458	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Unspecified - low immediate risk
127	L89	Nag el-Buza	Nile Valley	26.0960	32.3033	Limestone	Limestone	Unknown	Unknown	No	Unknown	Not determined
128	L90	Gebel el-Gir	Nile Valley	26.1051	32.6966	Limestone	Limestone	Pharaonic	Unknown	No	Largely intact	Mining and quarrying
129	L91	el-Dibabiya	Nile Valley	25.5043	32.5233	Limestone	Limestone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Mining and quarrying
139	S1	Hierakonpolis	Nile Valley	25.0734	32.7399	Sandstone	Sandstone	Pharaonic/Graeco Roman	Unknown	No	Unknown	Mining and quarrying
140	S2	el-Mahamid	Nile Valley	25.1380	32.7834	Sandstone	Sandstone	Pharaonic/Graeco Roman	Unknown	No	Largely intact	Urban development
141	S3	el-Kab	Nile Valley	25.1346	32.8179	Sandstone	Sandstone	Pharaonic/Graeco Roman	Unknown	No	Intact	Unspecified - low immediate risk
142	S4	el-Keijal	Nile Valley	25.0718	32.8624	Sandstone	Sandstone	Unknown	Unknown	No	Largely intact	Unspecified - low immediate risk
143	S5	Nag el-Raqiein	Nile Valley	24.7434	32.9199	Sandstone	Sandstone	Unknown	Unknown	No	Unknown	Not determined
144	S6	Nag el-Hosch	Nile Valley	24.7403	32.9209	Sandstone	Sandstone	Graeco-Roman	Unknown	No	Intact	Unspecified - low immediate risk
145	S7	Wadi el-Shatt el-Rigal	Nile Valley	24.6855	32.9246	Sandstone	Sandstone	Pharaonic	Unknown	No	Intact	Unspecified - low immediate risk
146	S8	Nag el-Hammam	Nile Valley	24.6775	32.9252	Sandstone	Sandstone	Pharaonic	Unknown	No	Largely intact	Urban development
149	S9a	Gebel el-Silsila - West	Nile Valley	24.6506	32.9290	Sandstone	Sandstone	Pharaonic	Unknown	No	Largely intact	Unspecified - low immediate risk
152	S9b	Gebel el-Silsila - East	Nile Valley	24.6401	32.9341	Sandstone	Sandstone	Pharaonic/Graeco Roman	Unknown	No	Intact	Unspecified - low immediate risk
147	S10	el-Kilh Sharq	Nile Valley	25.0593	32.8799	Sandstone	Sandstone	Graeco-Roman	Unknown	No	Largely intact	Urban development
148	S11	el-Bueib	Nile Valley	24.8101	32.9149	Sandstone	Sandstone	Pharaonic	Unknown	No	Partially destroyed	Unspecified - low immediate risk
150	S12	Nag el-Fuqani	Nile Valley	24.2088	32.8588	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Largely intact	Urban development
151	S13	Gharb Aswan	Nile Valley	24.1618	32.8691	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Intact	Unspecified - low immediate risk
153	S14	Sidi el-Hasan	Nile Valley	24.3505	32.9321	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Partially destroyed	Urban development
154	S15	el-Hadedoon	Nile Valley	24.3111	32.9111	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Partially destroyed	Mining and quarrying
155	S16	Gebel el-Hammam	Nile Valley	24.2268	32.8749	Sandstone	Sandstone	Pharaonic	Unregistered	No	Largely destroyed	Mining and quarrying
156	S17	Gebel Qubbet el-Hawa	Nile Valley	24.1009	32.8874	Sandstone	Sandstone	Unknown	Reg. process SCA	World Heritage Site	Largely intact	Unspecified - low immediate risk
157	S18	Aswan	Nile Valley	24.0618	32.8966	Sandstone	Sandstone	Unknown	Unregistered	No	Largely destroyed	Urban development
158	S19	Dabod	Nile Valley	23.8968	32.8549	Sandstone	Sandstone	Pharaonic/Graeco Roman	Unregistered	No	Under Lake Nasser	Not applicable
159	S20	Qertassi	Nile Valley	23.7001	32.8866	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Under Lake Nasser	Not applicable
160	S21	Tafa	Nile Valley	23.4651	32.8633	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Unknown	Not determined
161	S22	Kalabsha	Nile Valley	23.5509	32.8649	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Under Lake Nasser	Not applicable
162	S23	Abu Hor / Merowa	Nile Valley	23.4834	32.8849	Sandstone	Sandstone	Graeco-Roman	Unregistered	No	Under Lake Nasser	Not applicable
163	S24	Qurta	Nile Valley	23.0418	32.6683	Sandstone	Sandstone	Pharaonic/Graeco Roman	Unregistered	No	Under Lake Nasser	Not applicable

ID	Number	Name	Region	N	E	Stone_group	Stone	Main_period	Legal_status	Protection_area	Condition	Main_threat
164	S25	Agayba	Nile Valley	22.8501	32.5599	Sandstone	Sandstone	Unknown	Unregistered	No	Under Lake Nasser	Not applicable
165	S26	Tumas	Nile Valley	22.7518	32.1482	Sandstone	Sandstone	Pharaonic	Unregistered	No	Under Lake Nasser	Not applicable
169	S30	Qasr Ibrim	Nile Valley	22.6484	31.9932	Sandstone	Sandstone	Pharaonic	Unregistered	No	Unknown	Not determined
170	S31	Nag Deira	Nile Valley	22.5068	31.8932	Sandstone	Sandstone	Pharaonic	Unregistered	No	Under Lake Nasser	Not applicable
133	T4	el-Qawatir	Nile Valley	28.1035	30.8250	Other soft stone	Travertine	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
134	T5	Wadi el-Barshawi	Nile Valley	27.7063	30.9360	Other soft stone	Travertine	Pharaonic	Property SCA	No	Largely intact	Unspecified - low immediate risk
135	T6	Wadi el-Zebeida central	Nile Valley	27.6896	30.9066	Other soft stone	Travertine	Pharaonic	Unknown	No	Partially destroyed	Mining and quarrying
136	T7	Wadi el-Zebeida south	Nile Valley	27.6760	30.9263	Other soft stone	Travertine	Pharaonic	Unknown	No	Unknown	Mining and quarrying
196	G12	Zabargad (St. John's) Island	Red Sea coast	23.6501	36.1683	Gem	Peridot	Unknown	Unknown	No	Largely destroyed	Unspecified - low immediate risk
183	O9	Wadi el-Anba'ut	Red Sea coast	24.9302	34.9235	Other soft stone	Gypsum	Graeco-Roman	Unregistered	No	Intact	Unspecified - low immediate risk
185	G1	Bir Nasib	Sinai	29.0368	33.4000	Gem	Turquoise	Pharaonic	Supervision SCA	No	Partially destroyed	Mining and quarrying
186	G2	Serabit el-Khadim	Sinai	29.0368	33.4600	Gem	Turquoise	Pharaonic	Property SCA	No	Partially destroyed	Unspecified - low immediate risk
187	G3	Wadi Maghara	Sinai	28.9001	33.3683	Gem	Turquoise	Pharaonic	Property SCA	No	Partially destroyed	Unspecified - low immediate risk
197	G13	Stela Ridge	Western Desert	22.9001	31.3182	Gem	Carnelian	Pharaonic	Unregistered	No	Partially destroyed	Agricultural development
2	H2	Widan el-Faras	Western Desert	29.6602	30.6217	Hard	Basalt	Pharaonic	Unregistered	Nature Protect.	Partially destroyed	Mining and quarrying
3	H3	Tilal Sawda	Western Desert	28.5202	30.5500	Hard	Basalt	Graeco-Roman	Unregistered	No	Partially destroyed	Mining and quarrying
7	H7	Chephren's Quarry	Western Desert	22.8068	31.2266	Hard	Chephren gneiss	Pharaonic	Reg. process SCA	No	Largely intact	Agricultural development
174	O1	Umm el-Sawan	Western Desert	29.7118	30.8850	Other soft stone	Gypsum	Pharaonic	Unregistered	No	Intact	Agricultural development
171	S32	Gebel el-Teir	Western Desert	25.5168	30.4849	Sandstone	Sandstone	Pharaonic/Graeco Roman	Property SCA	No	Unknown	Not determined

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