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Quarry Scapes

Conservation of Ancient Stone Quarry Landscapes in the Eastern Mediterranean

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(given in texts)

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QuarryScapes: 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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Preface

The QuarryScapes Atlas is the initiation of a display of ancient quarry landscapes in the project region and outside. The purpose of the atlas is to display the great variations of quarry landscapes and introducing them with photos and few words. The atlas is primary designed for the www.quarryscapes.no web site, but it can also be downloaded as sheets or printed on demand and ordered from the Geological Survey of Norway.

The atlas will be further developed after the project, and will hopefully evolve to a comprehensive web-book with contributions from many researchers. In this first edition of the atlas we have picked 15 quarry landscapes; most of them in the project region, but also a few outside. Collectively, these 15 sites display a broad range of quarry landscapes; different periods and historical settings, different geology, morphology and climate. Also, they are in different stages of development as cultural heritage sites, from “unknown and remote” to outdoor museums.



An impressive ancient quarry partially submerged in the sea: The Aliki quarry on the southern shores of the island of Thassos (Greece) symbolises ancient stone work and trade, with the Mediterranean as the connecting link since time immemorial. It also symbolises how quarrying may shape the landscape over the centuries. A coarse-grained, white calcitic marble, Aliki was a highly prized stone in Antiquity, exported throughout the Eastern Mediterranean to places such as Thessalonica, Delphi, Ostia, Rome, Ephesos, Antioch and Cyrenaica. Extraction may have started in the 6th Century BC, and it ceased more than a thousand years later in the early 7th Century, perhaps due to an earthquake. The ancient quarrying techniques are well displayed by the bay of Aliki and the nearby shorelines of the island, and the quarries are easily accessible for tourists. *(Per Storemyr)*



Roman wedge holes



Marks from picks and chisels



Spoil from
quarrying
has turned
to solid rock



The oldest quarries: Palaeolithic tool floors



Grinding stone blanks for saddle-querns

The Aswan West Bank, Egypt, comprises a unique quarry landscape of great time depth. The main target for exploitation has been deposits of silicified sandstone ("quartzite") within the Cretaceous Nubian Group, but also non-silicified sandstone has been quarried, particularly for building stone. The earliest quarrying of silicified sandstone was in the Lower to Middle Palaeolithic, when it was used for hand-axes, cleavers and other tools. From the Late Palaeolithic and at least to the Roman Period, the stone was used for hand querns (grinding stone), leaving huge areas transformed by quarrying. Yellow and purple varieties of the silicified sandstone was, furthermore, quarried for sculpture and obelisks in the New Kingdom, and for columns and other ornamental stone products in the Roman Period (large photo). The latter two activities have left a significant ancient road network made for transporting stone blocks. In addition to features directly related to quarrying, the area is also rich in rock art and other features related to human interaction with the landscape for millennia. (Tom Heldal)



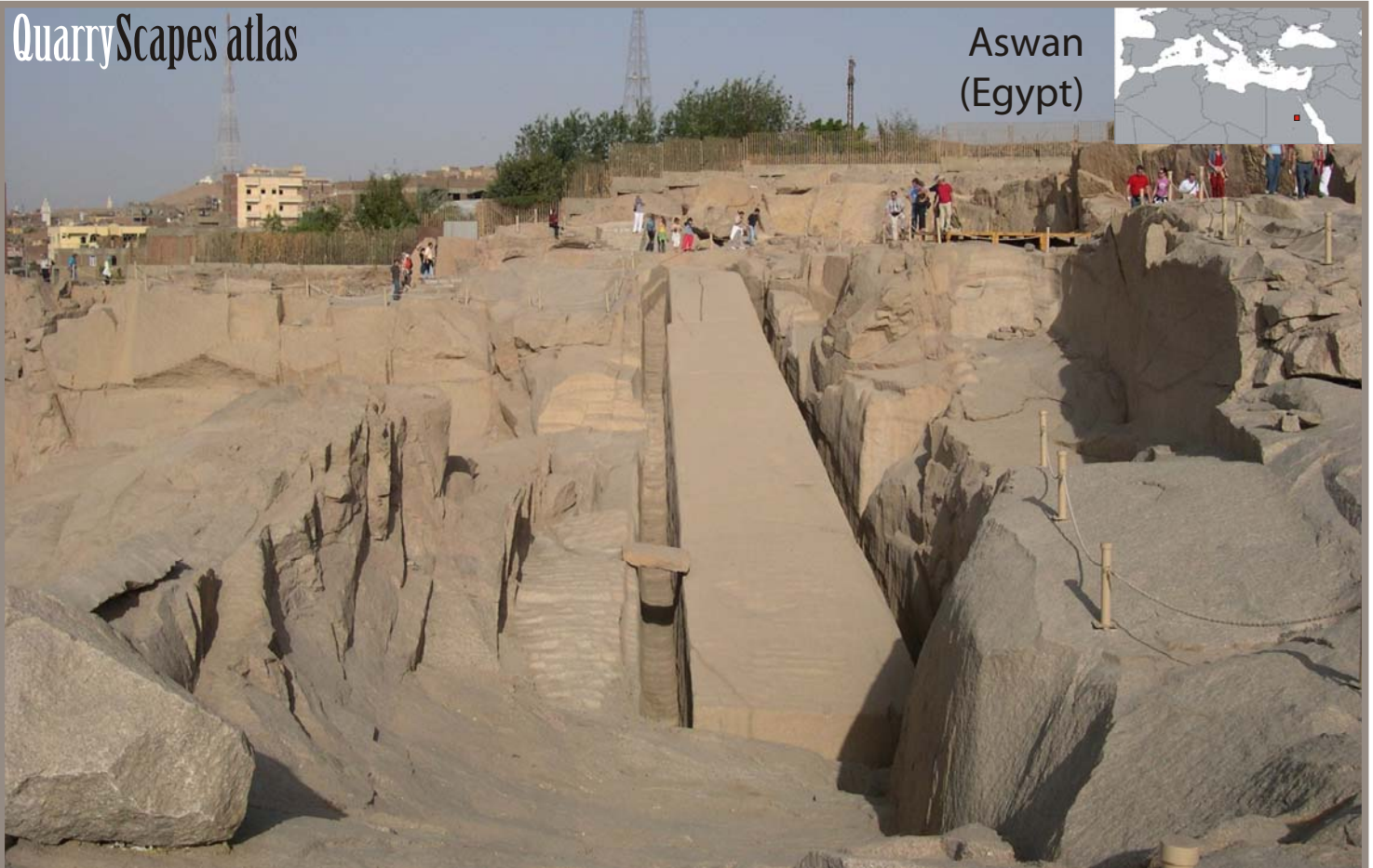
The tip of the Seti 1 obelisk, fully incised, was laying in the quarries until recently



An unfinished obelisk base

An extensive system of ancient quarry roads is preserved





Deep channels in the hard granite bedrock typical of New Kingdom quarrying



The area is scattered with small quarries

The granite quarries, located on the East Bank of the Nile at Aswan, are the most well-known and most visited ancient quarries in Egypt. Forming the 1st cataract at Aswan, exploitation, particularly of the red granite, is known from at least the 3rd millennium BC and continued throughout antiquity. Unsurpassed volumes of red granite were transported 800 km down the Nile to the Giza Plateau, particularly during the Pyramid Age of the Old Kingdom, when its use for monumental purposes linked to the construction of pyramids saw its use as wall linings for burial chambers, sarcophagi, columns and in some instances outer casings of pyramids. The qualities of the stone that made it much desired in antiquity are still sought after today, and so the quarry landscape has been continually transformed by quarrying. Although many ancient quarries are now destroyed, unfinished monumental objects largely dating to the New Kingdom (2nd millennium BC) can still be observed in places. Most famous is the 'unfinished obelisk' (large photo) that lies, still attached to bedrock, in its quarry. Excavations were recently carried out by the Supreme Council of Antiquities (SCA). A 'must see' on any tourist itinerary to Aswan, this World Heritage site has recently been transformed into an open-air museum where visitors can view the obelisk from a series of specially constructed platforms. The message of the extraordinary feats of ancient quarrying can be clearly given to the many thousands of tourists who visit the site.

(Elizabeth Bloxam)



Dolerite stone hammers



Typical "boulder-weathering" in the granite made easily accessible blocks

Roman quarrying of the granite is recognised by the use of wedge-lines for splitting the rock





Broken fragments of vessels in front of a "classic" deposit; lens-shaped serpentinite (dark) with a soapstone margin (light)

Situated between Marsa Alam by the Red Sea and the Nile Valley, Egypt, numerous soapstone quarries at Rod el-Baram constitute a fascinating quarry landscape; the terrain is scattered with hundreds of holes and caves from quarrying. Soapstone, a rock composed of talc and other soft minerals, was predominantly used for cooking vessels, in Egypt as well as several other places in the world. Soapstone is easy to carve due to its softness, it does not break when heated and has good heat storage capacity. The soapstone occurs in the margins of lens-shaped bodies of serpentinite, clearly visible on a large scale in the area. The quarries are predominantly small in size, but occur in large quantities. Semi-finished and broken vessels are found all over the area, witnessing long periods of production. The quarries have probably been active since the Late Roman Period and onwards, and soapstone vessels were used by the Bedouins in the area until recently. Investigations in the area have been carried out by Prof. James Harrell, Univ. of Toledo.

(Tom Høidal)

One of the quarries displaying rounded depressions from extraction of vessels

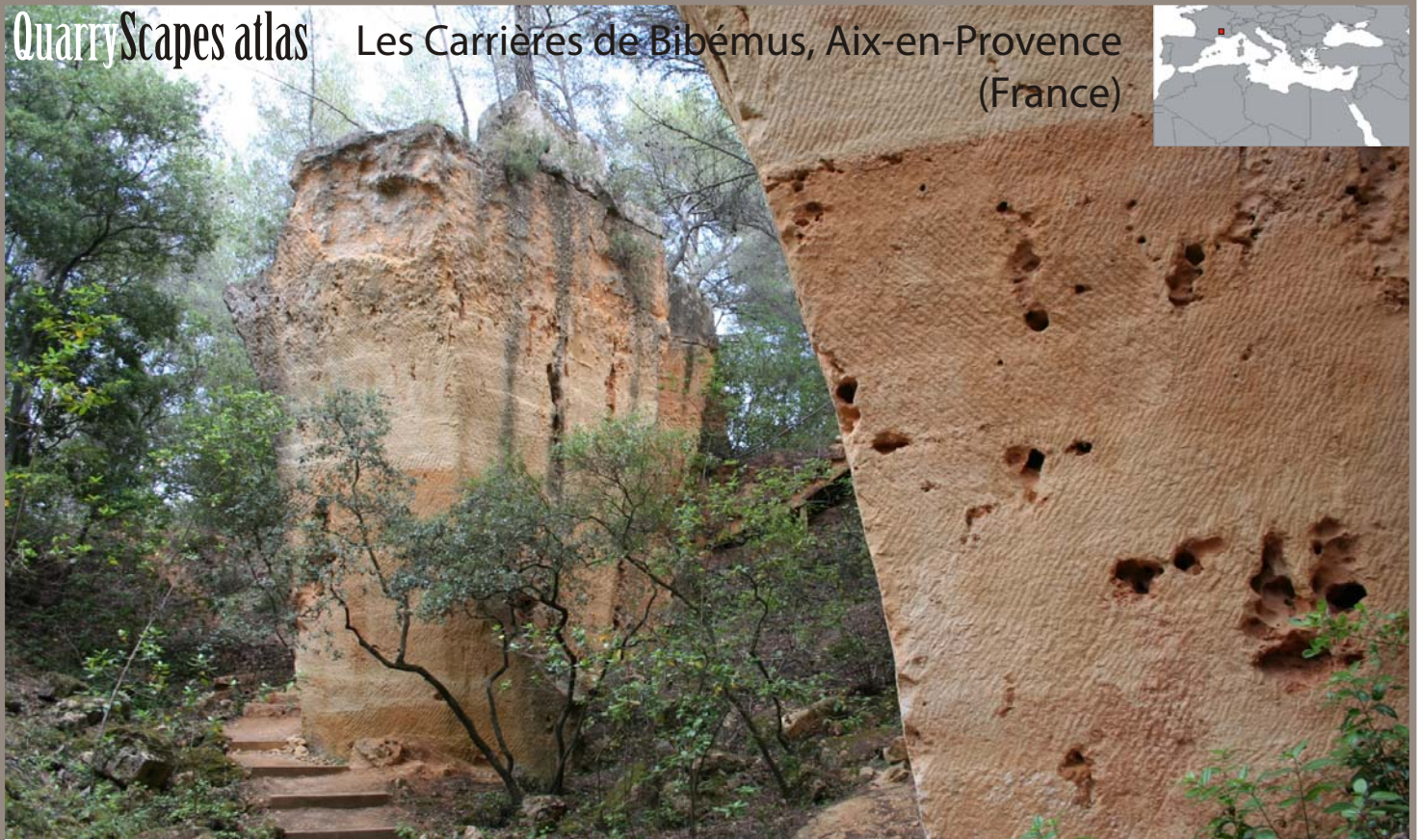


Broken fragment of soapstone cooking vessel



Tool marks (axe) from a quarry face





As evidence of past production, most ancient quarries and quarry landscapes are difficult to protect, difficult to manage and difficult to present to a lay audience. However, some successful examples of conservation and promotion exist, of which "les carrières de Bibémus" takes a prominent place. Bibémus is situated within a local nature reserve in the outskirts of Aix-en-Provence in Southern France. It delivered yellowish molasse sandstone for Aix and other places from the Roman period until the late 19th century. The quarries can be found on a forested plateau and feature an impressive "labyrinth" of quarry faces, pits and quarry roads. For professionals, the quarries are striking and incredibly interesting; for the lay person they might be exciting like old mines often are. What makes these quarries special today is the fact that the world-famous painter Paul Cézanne had an atelier here and used the quarries extensively as motifs for his paintings. This aspect is what has been taken advantage of in the current promotion of the quarries.
(Per Storemyr)



Underground quarry



How it looks today (above) and
Cézanne's impression (below)



Tool marks from quarry picks on the vertical
quarry faces

A labyrinth of quarries





Heavy stone hammers of diorite in front of an unfinished statue block



"Blanks" of funerary vessels stockpiled in front of a quarry

Chephren's Quarry is situated in the easternmost part of the Sahara and extends over 100 km of flat, hyper-arid desert, some 60 km west of Abu Simbel in southern Egypt. In the 3rd and 4th millennium BC, the quarry was used for extraction of stone for now world-famous sculptures and thousands of smaller funerary objects, especially vessels. Chephren's Quarry is situated in outcrops of a light banded anorthositic gneiss within a complex of Precambrian rocks. The quarrying of the Chephren Gneiss has uniformly targeted loose boulders of gneiss on the terrain surface, formed by in situ by spheroidal weathering over long periods of time. The gneiss boulders were worked with stone hammers and axes from local sources, leaving circular heaps of spoil. In addition to the extraction sites themselves, the quarry landscape displays roads, ramps for loading blocks, shelters, camps, wells, cairns and other features related to the logistical side of quarrying and maintenance of the labour force. The uniqueness of Chephren's Quarry is that it presents us with some of the earliest evidence for prestigious stone acquisition from remote areas in Antiquity, and (until recently) it is well preserved. As a physical landscape, the site may look "un-spectacular" at first sight, but when compiling the spatial distribution of quarries and ancient infrastructure, it reveals one of the supposedly largest 'industrial' landscapes of Early Antiquity in the world. Excavations were recently directed by the University of Liverpool. (Elizabeth Bloxam & Tom Heldal)



Ramp for loading heavy statue blocks before transporting them to the Nile



Camp and bakery excavated along the transport route to the Nile

Shallow quarries of various sizes are scattered all over the area





Wedging was the main method of quarrying; here, a "wedge line" with spaced holes for injecting wedges

Situated far out in the Eastern Desert in Egypt, Mons Claudianus is one of the most spectacular quarry landscapes in Egypt. The white tonalite gneiss was called *marmor claudianum* by the Romans, and in particular it was used for large objects such as columns and bathtubs. Giant columns of the stone can be seen in front of Pantheon in Rome, and it was also much used in the roman forum; in fact, another name of the stone is for this reason *granito del Foro*. Even larger columns was left in the quarries due to breakage or other failures, and one can see all steps in the Roman production of columns. The rock must have been of particular good quality for making columns, due to the planar foliation which contributed in giving the columns high strength. In addition to the quarries themselves, the site displays logistical features and a fort and living areas for the work force. Mons Claudianus was excavated in the 1990's by the University of Southampton. It is possible to visit Mons Claudianus through tourist agencies ("desert tourism") in Hurghada. (Tom Heldal)



Giant column left in the quarry



From one of the well preserved houses in the fort



Deep quarry displaying carved faces, and a large unfinished millstone at the bottom

The millstone quarries at Hyllestad are situated on the Norwegian west coast. From the Roman Period until the early 20th century, production of rotating millstones left behind huge quarry landscapes all over Europe. In Norway, the preferred rock for millstones was mica schist containing grains of garnet or staurolite. This bimodal distribution between hard and soft minerals proved ideal for the purpose of grinding. The Hyllestad quarry landscape is one of the largest and most long-lived quarry sites in the country, displaying more or less continuous production from the Pre-Viking Period until the last millstone was quarried in 1929. During the Viking Period and the Middle ages, the millstones were carved directly from the bedrock, leaving behind circular “negatives” on the quarry floors. Later on, the extraction techniques changed towards blasting with black powder when it was introduced into the Norwegian mining sector. Today, the Hyllestad quarry landscape remains as a well preserved testimony of quarrying through history. In addition to the many hundred quarries, there are also remnants of roads and harbors, from which the millstones were shipped. The Hyllestad quarry landscape is easily accessible for the interested traveler, thanks to the municipality and enthusiasts in the local community. There is an outside museum containing several of the most interesting quarries and in the summertime one can grind grains on handmills in a medieval camp just beside the museum. (Tom Heldal)



Unfinished millstone left in a quarry



Half-finished millstone blanks, still attached to the bedrock

A landscape of quarry faces, spoil heaps and roads, overgrown by dense vegetation





Columns of travertine

Jerash lies in the northwestern highlands of Jordan. In this place, a spectacular Greco-Roman provincial capital was built, largely out of stone. This stone was used for building blocks, columns, capitals, pavement stones among other uses. Examination of the stone at the site reveals that it mostly consists of limestone, predominantly two types, originating from the area north of the ancient city: near-surface caliche deposits from sites such as Majar and southern Asfour and Cretaceous marine limestones from the Naur and Wadi Sir Formations from northern Asfour and the Shawahid quarry sites. These and other sites display evidence of stone extraction and shaping, and unfinished columns can still be found in situ in the ancient quarries. Most of the quarries are situated on private agricultural land as well as in built-up areas and are thus subject to a number of immediate threats such as, construction, agriculture and use of the ancient quarry blocks for building. As a part of the wider Jarash city landscape, the quarries surrounding it tell an important part of the history of the city. (Nizar Abu-Jaber)



The ancient city of Jerash, built of limestone and travertine



Quarry face

Ashlar quarries along the road north of the ancient city





Quarry faces made by pick-axe



Quarries and spoil heaps are numerous



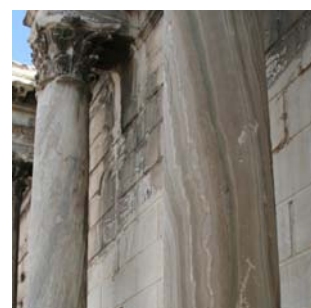
Inside a "dragon-house"

At the southern part of the island of Evia, Greece, large deposits of a unique type of marble are found - the Cipollino Verde. This was one of the most popular coloured marbles of the Roman Period and examples of its use have been found in almost every corner of the Empire as far north as Britain. Production probably started in the 2nd Century BC and continued through the Imperial Period until the 7th Century AD. The Romans called it Marmor Carystium after the small town Karystos on the southern tip of the Island. The Cipollino Verde is an impure calcite marble containing bands rich in silicate minerals, particularly chlorite, alternating with more pure white and grey calcite-rich layers. The marble displays a lively pattern of folded and sheared layers, giving associations to waves in the sea. This was an important reason for its popularity, but it is also technically strong and well suited for load-bearing columns - rough-outs of which can be observed in several quarries through which there are walking trails. The famous dragon houses of the area have by some researchers been interpreted as houses for the Roman legions guarding the quarrying activity. There are numerous ancient quarries on the island that are remarkably well preserved, suggesting that the quarry landscape is probably one of the least disturbed industrial landscapes of Roman antiquity in the Mediterranean.

Tom Heldal



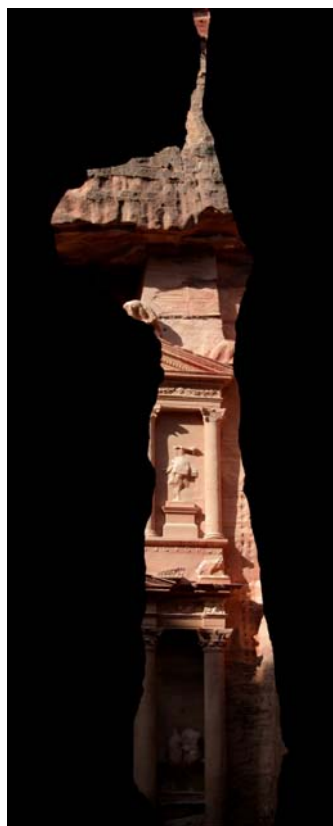
Quarry road - carved in bedrock



Columns in Hardian's Library, Athens

The banded and folded layers characterize the marble





The famous image of Petra: the "treasury"

Petra lies in southern Jordan near the eastern rim of the Jordan Valley rift. Near the edge of the rift, the Upper Cretaceous limestone of the high plateau of the Sharah mountains gives way to silvers of Paleozoic fluvial sandstones dated to the Cambrian and Ordovician periods. The hard nature of the sandstone led to the formation of a rugged terrain in which steep slopes and narrow valleys could form, providing a perfect setting for a city such as Petra. Despite the general image of Petra being carved into stone facades, a considerable portion of the ancient Nabatean city was actually built with locally derived sandstone. The intimate relationship between the nature of the city and stone used and the quarries from which it was extracted makes these quarries an integral part of the story of Petra. Until now, this story is poorly presented and the importance of the quarries has been marginalized. While the quarries are protected by default because they are located in the Petra national reserve, it is important to tell this story to reveal another interesting aspect of the history of this magnificent city.

(Nizar Abu-Jaber)



Tool marks from iron picks on the quarry face.



Sandstone carved out of steep and tall cliffs characterizes Petra

Rock-carved tombs in the rugged, sandstone landscape





Carved channel in limestone for separating blocks from the bedrock

The Hellenistic-Roman city of Sagalassos is situated high in the Taurus Mountains in south-western Turkey. The local geology, consisting of limestone, sandstone and volcanic materials, has been quarried intensively for the construction of the monumental town. Moreover, marbles and other precious stones were imported from far away into the city, to serve their purpose as luxury products to boast the city's richness. A keyword for local quarrying is proximity, as in the immediate vicinity of important stone buildings there are quarries, sometimes even integrated in the building itself. Hence, at Sagalassos, we are confronted with quarries in the town landscape. These stone extraction sites are an integral part of the cultural landscape due to the monumental purposes they served and are imperative to the story of the city of Sagalassos. When the quarries of Sagalassos are seen as an integral part of the monumental town, their conservation and protection becomes evident and so their significance can be clearly demonstrated to the public. At Sagalassos, guided tours already offered to visitors during the excavation season can include a presentation of the quarries in relation to the city as a means to raise the awareness of these non-monumental remains and how they form the fabric of the city.

(Patrick Degryse)

Sarcophagi, either free-standing or carved in the bedrock, were an important output from many small quarries



The ruins of Sagalassos, mostly made from local limestone



Weathered steps in the bedrock witness the ancient quarrying of ashlar blocks





Tool marks from chisels and graffiti of an obelisk

Gebel el-Silsila is situated in Upper Egypt near the town of Kom Ombo. Hills of the Nubian Sandstone (Cretaceous) occurring on both sides of the river Nile have been extensively quarried for monumental building stone through several millennia, from the Old Kingdom throughout the Greco-Roman Period. Many of the temples in Upper Egypt, particularly in Luxor and Aswan, are built of stone from this quarry landscape. Quarrying has completely transformed the landscape to a monumental landscape of tall quarry faces, underground gallery quarries and enormous spoil heaps or waste from the workings. Tool marks on the quarry faces display changes in extraction technology through time. The quarry landscape also comprises a richness of inscriptions and graffiti from different periods, and numerous features related to the transport of stone, such as roads, ramps and harbours. Unfinished products are frequently found, linking the quarries to specific building projects. Although not on the high profiled tourist track, a part of the quarry landscape has been facilitated for visitors. (Elizabeth Bloxam & Tom Heldal)



Gallery quarry



"Canyon"-like quarry, also used as a transport road to the Nile



Huge spoil heaps from the quarrying





One of the workshops, remains of pottery, gypsum debris and tools.



Crescent drill made from chert for working the gypsum vessels

Forty million years ago, the area now occupied by the Northern Faiyum desert in Egypt lay in a huge bay on the margin of the ancient Tethy's Sea. The area was crowded with life; oysters, fish and whales in the shallow sea, big mammals and lush forests on land. At one stage, parts of the bay evaporated, and large deposits of gypsum were formed. Practically untouched since they were excavated by Caton-Thompson and Gardner in the 1930s, the Umm es-Sawan gypsum quarries in the Northern Faiyum desert remain a well-preserved industrial landscape from the Old Kingdom Period. The vein-shaped gypsum formations were used for the manufacture of small vessels, predominantly used in funerary contexts. The shallow quarries (large photo), occupying a large, flat area of gypsum outcrops, are surrounded by gypsum workshops, shelters for the workers and chert-tool manufacturing areas. The gypsum was worked with stone tools (stone hammers, stone chisels, crescent chert drills), most of them originating from local sources, such as chert, petrified wood, basalt and silicified sandstone. Others are imported from Upper Egypt, which gives us important evidence of links between people and quarry landscapes across large distances during the same period. The gypsum quarries do not appear as a highly transformed quarry landscape, but as an example of ancient resource exploitation and spectacular geology. (Tom Helda)



A fragment of anorthosite gneiss, brought from Chephren's Quarry 1200 km to the south, witnesses contact between the quarry landscapes



"Malet and chisel" made from chert pebbles and rods of petrified wood

Blanks of gypsum vessels





The ancient, paved quarry road leading downslope from the quarries

The basalt quarries, 80 km south-west of Cairo, Egypt, are considered the source of stone used on the mortuary temple floors and walls of 4th and 5th Dynasty (c. 2575-2323 BC) pyramid complexes of the Old Kingdom. The tholeiitic flood basalt consists of several individual lava flows, of early Oligocene age, that cap the Gebel Qatrani escarpment at approximately 300 metres above sea level. Due to the highly fractured nature of the basalt, quarrying was primarily by levering of blocks to about a depth of 10 m into the upper layer of the flow, resulting in a series of shallow swales in the escarpment (foreground, large photo). Natural weathering and waste pushed down the escarpment presents a dramatic landscape of extensive dark scree slopes. Non-local dolerite stone axes and pottery dating to the 4th and 5th Dynasty attest to predominant Old Kingdom quarrying, although exploitation also occurred in the Roman Period. An encampment, comprising 5 basalt stone circles, is the only evidence of dwelling places for a small number of quarrymen. The 11 km quarry road, terminating at a quay on the extinct shores of ancient Lake Moeris at Qasr el-Sagha, is the oldest paved road in the world. Although the basalt appears extremely deteriorated due to weathering, the setting and logistics of the basalt quarrying appear spectacular also today. Modern quarrying has destroyed parts of the ancient quarries, and desert tourism represents a threat to the fragile material culture at the site. (Elizabeth Bloxam and Per Storemyr)



Block storage where the quarry road begins



Stone tools from southern Egypt

The basalt paving as seen in front of the Great Pyramid

