

# Granite quarry survey in the Aswan region, Egypt: shedding new light on ancient quarrying

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In the QuarryScapes project, a detailed survey of granite quarries east of the Aswan region was made by the Supreme Council of Antiquities (SCA), Egypt, being one of the partners in the project. Localising and recording the ancient granite quarries were the main goals of the survey work. During the survey, key material remains associated with ancient quarrying were found and studied, such as inscriptions, graffiti, unfinished objects, roads, shelter areas and transportation ramps. In addition, a detailed investigation to define the boundaries of the remaining parts of the ancient granite-quarry areas was made as a necessary step in preparing plans for their immediate protection. Due to the urgent threats to the ancient quarries, some of the modern dimension stone quarries have to relocate to other granite-deposit areas, in particular in the Alaki region further to the south.

## Introduction

The ‘Aswan Granite’ was the third most important stone used in Egyptian civilisation, after sandstone and limestone. Its use for vases, stelae, statues, sarcophagi and buildings commenced from at least the Early Dynastic Period (Aston et al. 2000). In terms of quantities, its largest use was during the Old Kingdom, par-

ticularly associated with the 4<sup>th</sup> Dynasty pyramid complexes at Giza, and again during the New Kingdom for obelisks and colossal statues (Röder 1965, Habachi 1984). The stone was also extensively used during the Graeco–Roman Period, and even today several companies are exploiting different varieties as dimension stone.

Although ‘granite’ often is used as

a collective, ‘industrial’ term for the plutonic rocks in the area, it is slightly misleading. They constitute a range of granitoid rocks, varying from granitic to tonalitic in composition (Brown and Harrell 1998, Klemm and Klemm 1993, 2008, Harrell and Storemyr 2009). The most widely used type is the Aswan red or pink granite, which is essentially coarse grained to very coarse grained,

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but porphyritic and gneissic varieties are occasionally found. The so-called 'black granite' is essentially of granodioritic to tonalitic composition, medium- to coarse grained and commonly porphyritic, containing large, pink to white phenocrysts. A third type is red to grey, fine-grained granite ('Younger granite' by Klemm and Klemm 2008). In-between these types there are transitional varieties, making the outcrop area a source of a wide range of different subtypes. For simplicity, we have, however, chosen to apply 'granite' as a collective term when speaking of such quarrying in general.

The ancient Egyptians called the pink granite

𓄎𓄏 *m3t*,

which was the general term for this stone throughout all periods. Later it was used as a special term for the red granite after the word

𓄎𓄏𓄑𓄒 *m3t rwdt*.

On the other hand, the black granodiorite and tonalite were called

𓄎𓄏𓄑 *inr km*.

Sometimes the Egyptians added the place name to the term of the stone. For example, the granite from Elephantine was called

𓄎𓄏𓄑 𓄓𓄔𓄕 *m3t 3bw* (Harris 1961).

The importance of the quarrying activity over such a long period has given Aswan its unique character. Key locations of granite quarrying can be found along the east bank of Aswan and islands within the First Cataract (Figure 1). The publication from the Napoleon Campaign refers to these large areas of quarries, starting from the modern town to Philae and thus covering most of the east bank of Aswan (Jomard 1809). Over the last four years the Joint Swiss and Egyptian Archaeological Mission has discovered some new extensions of the ancient quarries, dated to the Old and Middle Kingdoms, to the north of the ancient city of Aswan (von Pilgrim, in press).

### Previous research of the Aswan granite quarries

The Unfinished Obelisk and the colossal statue at Shallal are the most attractive sites in the granite quarries on the east bank of Aswan. Many researchers and travellers have paid attention to these two sites, in particular Engelbach (1922, 1923) who was the first person to exca-

vate the Unfinished Obelisk quarry. He turned the direction of the archaeologists and Egyptologists to become more interested in ancient quarry sites, especially after his work at the Unfinished Obelisk and at Chephren's quarry in Lower Nubia (Engelbach 1933, 1938). Important research in the Aswan region was also undertaken by De Morgan et al. (1894), who described the quarries and

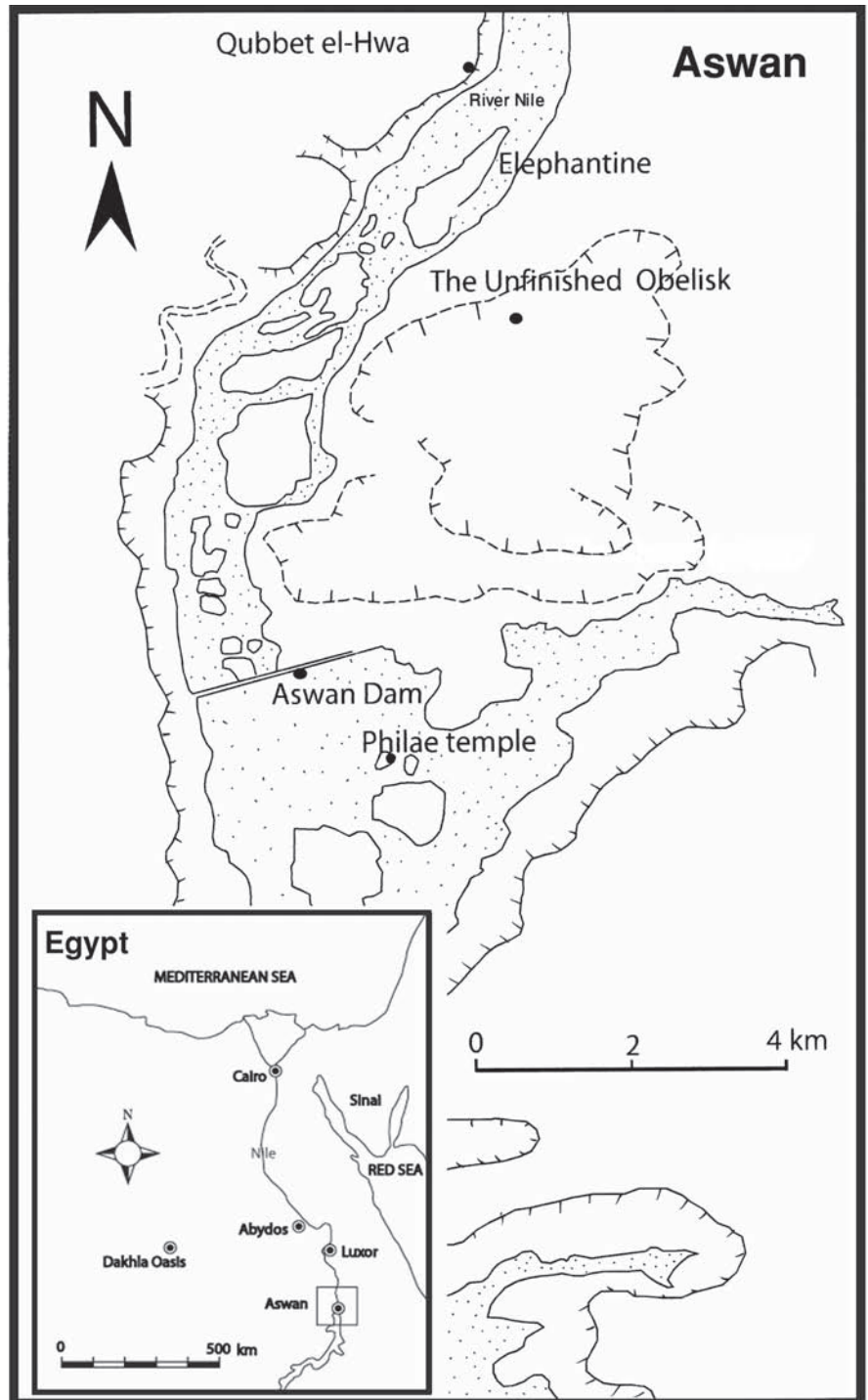


Figure 1. Map of the Aswan area.

the inscriptions, as well as Ball (1907), who published several studies of the first cataract region, including the ancient quarries.

More recently, important studies of the Aswan granite quarries include Röder (1965) and Klemm and Klemm (1993, 2008), providing the most comprehensive geological and archaeological surveys of the granite quarries. Many archaeological features were found, from inscriptions to ancient fortifications that have subsequently attracted many researchers. Although not directly connected with quarrying activity, the study of such diverse material culture has been needed to understand the greater story of the Aswan region (Jaritz 1981, 1993).

In 2002, the Egyptian Supreme Council of Antiquities carried out an extensive excavation of the Unfinished Obelisk quarry. This has enabled us to gain a greater understanding of ancient techniques used in the quarrying of granite (Kelany 2003). This, in turn, encouraged us to commence the demanding task of surveying the rest of the granite quarries as discussed in the present paper.

## Surveying the quarries

In recent years, modern quarrying and urbanisation have caused destruction of a large number of ancient quarry sites (Storemyr 2009), even many of which were described by Klemm and Klemm (1993). The main objectives for the survey of the granite quarries were thus to identify remaining quarry areas, characterise them and delineate them on the map, in order to ensure future protection of the last remains. Our survey first focussed on the high-risk areas in the northeastern part of the quarries. This was later extended to the central and southern parts. The area under investigation is located between the southern parts of the modern houses of Aswan city in the north, to the southern part of Shallal village in the south. The Nile River borders the survey area to the west, and the road between Mohmoudiya and Shallal to the east (Figure 2).

As developed during the Quarry-Scapes survey of the Aswan west bank (Bloxxam et al. 2007) we used hand-held GPS (with an accuracy of approximately 5 m) together with satellite images such as IKONOS and QUICKBIRD to locate the quarries. In addition, we used survey maps of Aswan no. NG 36 B3b (scale 1:50,000), Aswan map sheet 15/810 and 15/795 (scale 1:25,000), compiled by the Egyptian Geological Survey 2007, as well as maps made by Klemm and Klemm (1993), to locate the sites.

Data recorded during the survey will be put into the main database of all ancient quarries of Egypt, as developed by EAIS (Egyptian Antiquities Information System, see Shawarby et al. 2009) and subsequently into a GIS system to use for both analysis and as a planning tool in terms of protecting ancient quarries from modern activities. This work aims to demonstrate a transferable method of documenting and protecting sites of archaeological significance, in terms of conservation strategies.

## Geology and quarries

The geology of the Aswan area and the connection between the geology and ancient quarrying have been the subject of numerous studies since the early 20<sup>th</sup> century by scholars such as Ball (1907), Engelbach (1923), El-Shazly (1954), Röder (1965), Klemm and Klemm (1993), and Brown and Harrell (1998). The outcrops of igneous rocks are found where the younger, sedimentary rocks of the Nubian Group (Whiteman 1970) have been removed by erosion, essentially on the east bank of the Nile (between Aswan and the Shallal district) as well as on the islands in the river. Spheroidal weathering of the granitoid rocks caused the formation of so-called woolsack morphology, where the terrain is covered with a layer of in situ, rounded boulders of various sizes. Such morphology is a common phenomenon in the region, and the boulders, which can measure up to hundreds of cubic metres, are considered to be valuable sources for granite blocks even

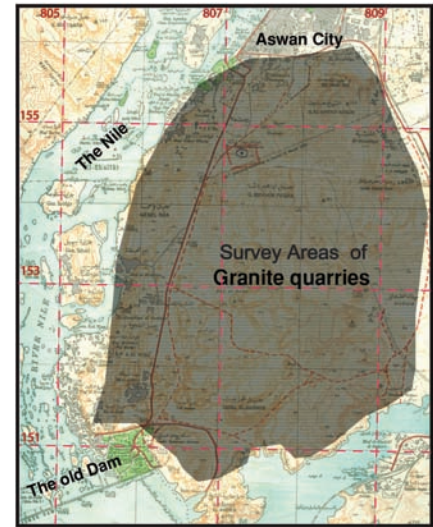


Figure 1. Map of the Aswan area.

by the modern stone industry. At present time, such morphology is seen only in parts of the Aswan outcrop area. As mentioned by Klemm and Klemm (1993) it is likely that these 'missing' boulders were the main source for the ancient quarrying. Only when they were too small (as in the case of the obelisks) or when the quarrying technology became more efficient for bedrock quarrying (as in the Roman Period) was it favourable to target the solid bedrock. Hence, the natural terrain has been strongly modified by the ancient quarrying, but largely this modification implied removal of surface boulders, leaving few and scattered remains from the quarrying activity. In modern times, quarrying and urbanisation have demolished many of these remains, and more are under urgent threat.

The chemical and mechanical weathering causing the formation of the boulders initiates along natural joints in the rock mass, commonly occurring in granitic rocks in three directions perpendicular to each other. Thus, the spacing of such joints determines the size of the boulders. Similarly, the spacing of joints is important when quarrying in bedrock, determining the maximum achievable block size. The main quarrying areas were therefore most likely situated in places where the jointing was most favourable, whilst outcrops displaying more closely spaced joints were left. This could also explain why the finer-grained 'younger' granite was rarely used,

due to closely spaced fractures (Engelbach 1923, Arnold 1991, p. 37, Aston et al. 2000, p. 36).

### Quarrying techniques

During the Pharaonic Period, quarrying largely involved the extraction of loose boulders. They were worked with hammer stones (pounders) of dolerite originating from dykes in the granitoids, or (less common) aplitic granite. Such pounding is among most scholars considered to be the only technique involved until the stone block reached the rough shape of a statue or other object. In the Unfinished Obelisk quarry (S1 in Figure 3), channels were made directly into the granitic bedrock. The massive amounts of dolerite hammer stones found in the quarry lead Röder (1965) to the conclusion that the channelling was made by pounding only. However, in recent excavations (Kelany 2003) massive amounts of charcoal, ash and burned mud bricks were found, suggesting that heat must have been an important agent in one or more steps of the quarrying process. Later, from the Ptolemaic Period onwards, iron tools took over in the granite quarrying. According to Klemm and Klemm (2008) chiselled channels were introduced in the Ptolemaic Period, whilst splitting with iron wedges quickly became the dominant extraction method in the Roman Period.

### Transport of granite objects

There were two aspects in the transportation of granite objects from the quarries to their places of use: land transport and river transport. Here, the discussion mainly concerns land transport, in terms of transporting objects from the quarries to the Nile.

Transport of large objects from the granite quarries usually involved two steps: first, from the quarry pits out of the actual extraction area, and second, from the quarry areas to the main branch of the Nile. The first step was relatively

easy when the quarrying targeted stone boulders which were normally close to the surface.

But when quarrying deep into the granite bedrock, it became more difficult to remove large stones from the quarry pit. Evidence from the excavations un-

dertaken at the 'Unfinished Obelisk quarry' suggested that another large quarry operation was needed to remove remaining granite on the north side of the Unfinished Obelisk, before the actual piece could be moved (1168 tons). When clear, a pillow of sand would

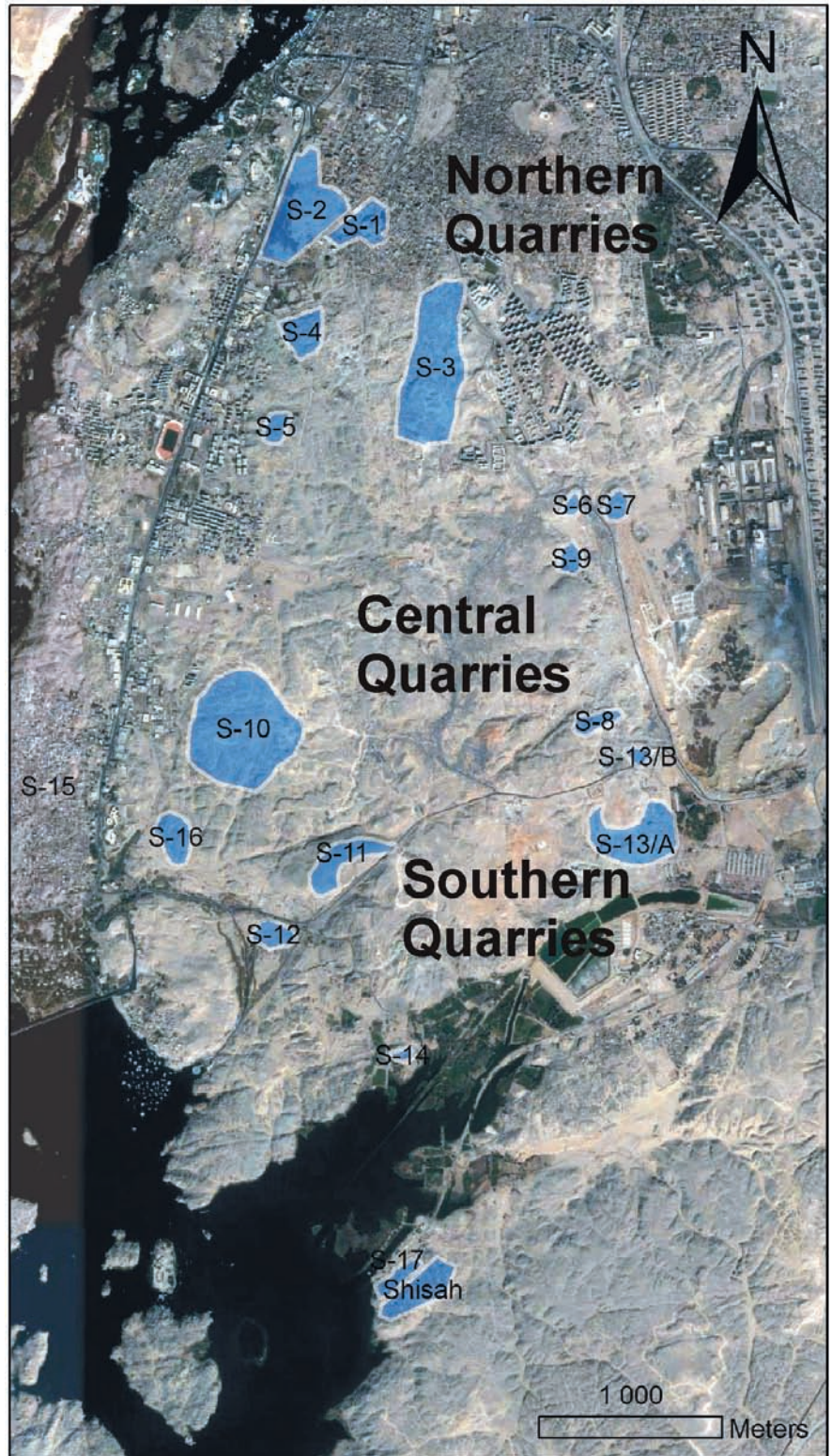


Figure 3. The quarry areas, S1–S17 as described in the text. Background satellite image from Google Earth.

probably have been used to protect it from hard surfaces and for evening out the slope. Sand, probably from dry wadis nearby and from wind action, was found within the quarry debris (Kelany 2003). In other cases, ramps were built to transport stones from the quarries down to lower levels. In the quarries at the Aswan west bank, there are many well-preserved examples of this type of ramp, connected to stone-paved roads, creating a wide stone transportation network (Heldal et al. 2005, Bloxam et al. 2007). Many similar ramps were documented in the granite quarries, although limited in comparison with the west bank. The reason for this may be poor preservation of most of the Northern quarries, which was the main area for the production of large objects, or the prevalence of dry wadis in-between ancient quarries which were used as canals for the transport of stones (Kelany et al. 2007).

Many kilometres of paved quarry roads were made using local rubble stones in one or several layers, similar to the roads found at the Aswan west bank quarries. These roads are largely built in quarries located deep into the granite hills, or on the plateau, where they are far away from wadis or canals. Most of these roads were made in connection with the New Kingdom quarries and later reused during Roman times.

The longest known road in the granite quarries, constructed with local granite, is 350 m long and leads from a New Kingdom quarry on the top of the plateau to a lower level towards the northwest (Figure 4a–c). Another paved road was found in the eastern part of the Northern quarries, built of 2 to 4 levels of rubble stones (Figure 4d–f) and associated with an area of large-object quarrying. A short, paved road, comprising only built stone edges with nothing in-between, was found in the western part of the Northern quarries (Figure 4g), crossing a small, sandy wadi, leading to a small work area. The same type of cleared tracks aligned with stones on both sides is found at the Aswan west bank, but the function of the alignments is not yet completely understood.



Figure 4. Different types of stone transportation roads (New Kingdom and Roman Periods) in the granite quarries. (a,b,e) paved roads, (c,d) built-up roads, (d) track with stone alignments, (g) footpath, (h) ramp.

Another type of transport method used for small objects from granite quarries, in the New Kingdom and Roman Period, was via footpaths or animal paths. There are only a few places where these ancient paths can be clearly seen (Figure 4h), given the overprinting by modern quarry activities.

## The Northern quarries

Most of the Northern quarries (Figure 3) have been heavily affected by modern activities, except the Unfinished Obelisk

site (S-1) and the quarries at the Fatimid cemetery (S-2), which are under the protection of the Egyptian SCA. The rest of the ancient quarries now remain as islands surrounded by modern activity (Figure 3). Our survey identified three main quarry areas (S3, S4 and S5, Figure 3) in addition to the above mentioned. Essentially, the boulder layers have been the target for extraction. Numerous large and small objects were quarried from this area during the New Kingdom and Graeco–Roman Period, as well as in small scale during Islamic times.

Ashy layers with charcoal mixed with

the quarry debris suggest that fire setting was widely applied in the quarrying process during the Pharaonic Period, also outside the Unfinished Obelisk quarry. In addition, dolerite stone tools were found scattered across these areas, suggesting their use in pounding and trimming of extracted blocks. Pottery shards found in the quarries dated to both the New Kingdom and Graeco–Roman times.

Many large unfinished objects were found inside the quarries, probably left behind because of cracks or other features that made the blocks unusable. These included a circular base from the New Kingdom (according to the quarrying techniques and pottery shards found in the quarry debris) (Figure 5h) and a large square base, probably of an obelisk (Figure 5c). Several reused, unfinished granite stelae were found inside a modern blacksmith's workshop (Figure 5a). Unfortunately, we could not find out from which quarry they were extracted. Column capitals and bases, as well as large millstones, all from the Graeco–Roman Period, were found at several locations in the area (Figure 5b, d, f, g).

In the northwestern corner of the Northern quarries (S–3) there are several trenches in the granite bedrock, in particular connected to dykes of dolerite and/or aplite. Beside these trenches there are roughly shaped pieces of rock mixed with quarry debris. These pieces have a more or less uniform size, compatible with the sizes of discarded pounders found in the quarries. Thus, these trenches seem to represent quarries for the production of stone tools in the Pharaonic Period. Pottery shards around the trenches indicate more specifically a New Kingdom age. Such tool quarries have previously been documented by Klemm and Klemm (2008) in the western and southern part of the granite outcrop area. However, the ones in the Northern quarries are the first to be found in this area, and so far the closest ones to the Unfinished Obelisk quarry. Thus, the area may be of significant importance for revealing more knowledge about the Pharaonic stone technology.

In the southern part of the area, a granite quarry (100x100 m) designated

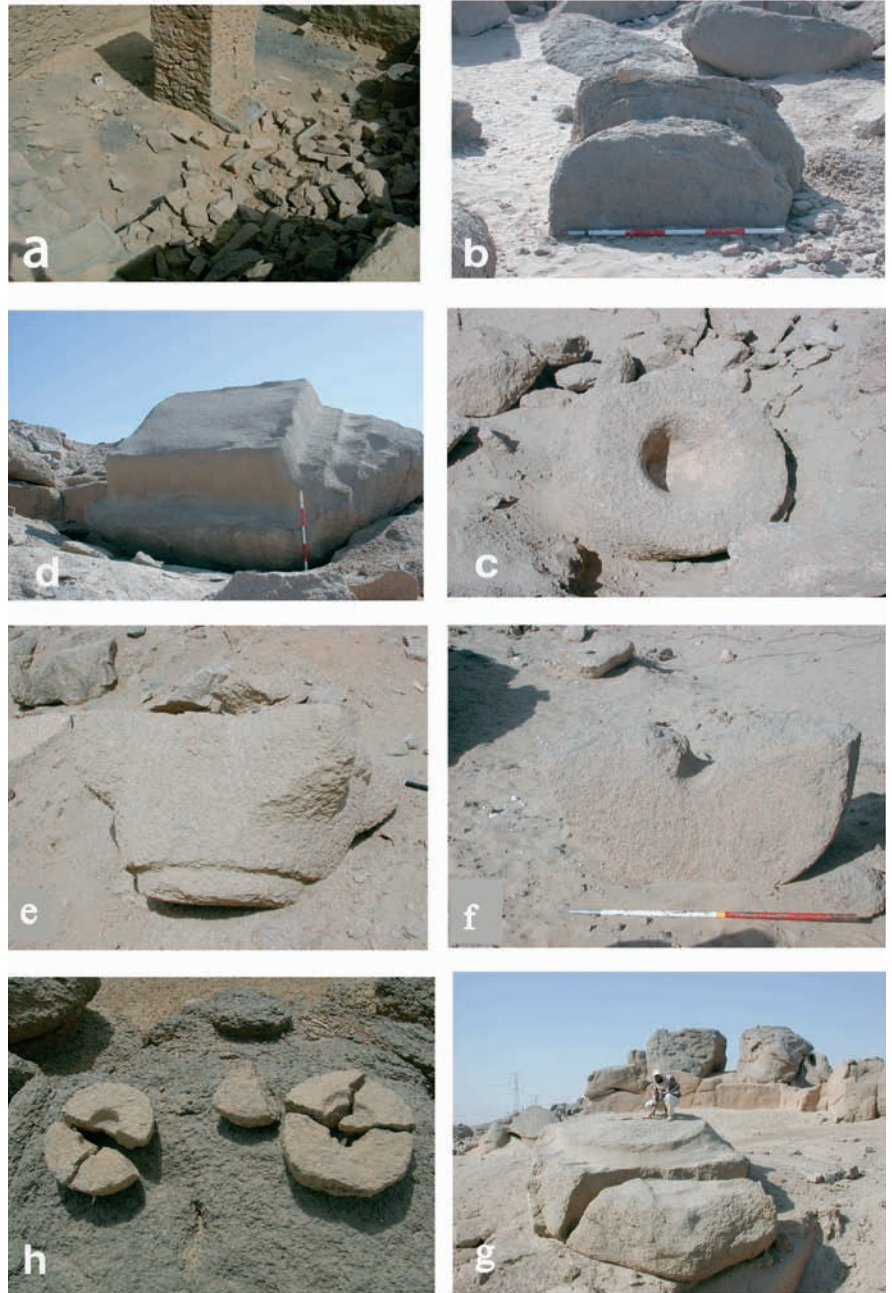


Figure 5. Unfinished objects from the Northern quarries. (a) Unfinished granite stela reused in modern blacksmith's room, (b, d, f, g) different types of unfinished rotary millstones, (c) unfinished granite object base, (e) granite-column capital, (h) large circular granite object base.

for the extraction of rotating millstones was found. Many pieces of discarded millstones are found in the quarry (Figure 5g). The rotary hand mills came into use in the Roman Period in the area, and are commonly found in settlements from that period.

We documented a few stone shelters inside the ancient quarries, although these are probably not associated with the large ancient quarrying activities. The absence of shelters or dwellings for the ancient quarries may be because places of

more permanent settlement, for instance at Elephantine Island and Aswan, were very close by. Hence, the workmen may have travelled daily from these places to the quarries. A similar situation is also found in the quarries at the Aswan west bank (Bloxam and Kelany 2007).

## The Central quarries

This quarry area is located south of the Northern quarries (Figure 3) and includes

five identified quarry sites (S6–S10). Some of the quarries have previously been described by Klemm and Klemm (1993, Map 355). The survey work started from the northern part of these quarries, which is located directly south of the Mahmoudiya Houses (S–6).

There are two sandstone hills on top of the granite at quarry sites S6 and S7. Quarries within the sandstone unit most likely date to the Roman Period (based on pottery shards and marks from typical Roman wedging techniques) and the target for quarrying was probably ashlar blocks for buildings in Aswan. Some small granite quarries were also found in the same areas (S9), which were mainly for extraction of small granite objects in the Pharaonic Period, such as stelae and stone tools.

The *Hatshepsut quarry* (S8) correspond to Quarry No. 11 of Klemm and Klemm (1993, Map 355). The name of the quarry relates to inscriptions found above it (see below). Two unfinished baths from the Roman Period are found here, left in the quarries because of flaws in the stone blocks (Figure 6b, c). One of these baths is of particular interest, as it shows us how the quarrymen split and shaped large granite boulders (Figure 6b). Although the most visible objects are from the Roman Period, these quarries were clearly heavily exploited also in the New Kingdom, illustrated by massive layers of quarry debris containing stone-tool fragments and ash as well as pottery shards from that period.

Of particular interest in these quarries is the occurrence of numerous pounders of coarse-grained granite (Figure 7). Such are not common in any of the other quarry areas, and in general one believes that the granite was less suitable for pounders than dolerite and aplite. The reasons for the common occurrence of such pounders in this particular area is, however, not clear. The surfaces of these tools clearly show marks and wear from their use as pounders.

The most important discoveries made in these quarries were the hieroglyphic inscriptions. These were found on a sandstone cliff, quite high above the granite quarries (Figure 8). Stone walls from pos-



Figure 6. Unfinished Roman Period granite baths, Southern quarries.

sibly a small shrine or chapel, built for a high official, were also found beside these inscriptions. Beside the walls we observed a large area of quarry debris containing fragments of dolerite tools and pottery shards dating to the New Kingdom.

There are a total of seven small inscriptions found on this sandstone cliff. Importantly, one of these inscriptions can be clearly identified as giving the name of Queen Hatshepsut of the New Kingdom (Figure 9). This is a highly



Figure 7. Used granite pounders, Central quarries.



Figure 8. The location of the hieroglyphic inscription (red arrow) in sandstone cliff, Central quarries.



Figure 9. Hieroglyphs giving the name of Queen Hatshepsut of the New Kingdom, Central quarries.

significant finding in terms of locating where quarrying of granite was undertaken during her reign (Porter and Moss 1937, Habachi 1984).

The other inscriptions found on the sandstone cliff are still under study, but it is important to mention that they mostly contain titles linked to quarry activities. Graffiti of obelisks and ostriches were also found here. These inscriptions and graffiti will be published in detail after further study.

The location of the inscriptions and the small shrine is significant. From this point, one can get a good view of the granite-quarry landscape. This situation is quite similar to the inscriptions and graffiti found in the Khnum Quarry on the west bank of Aswan (Bloxam and

Kelany 2007). Possibly it had a function as a place of worship, and/or a site for overseeing the quarrying activity.

To the west of the Roman-bath quarries and the New Kingdom inscriptions many small quarries were recorded. In one of them, two unfinished objects are found. One looks like an unfinished granite statue (Figure 10f), whilst the other may represent an intended altar or boat base from the New Kingdom (Figure 10e). The other small quarries display evidence of limited, Roman activities.

Beside the cliff edge at el-Aquad, a paved road, 350 m long, leads to a small quarry area—the *long-road quarry* (S10 in Figure 3, see also Figure 4a and b). This paved road is the longest we have seen in the granite quarries in Aswan and

is discussed further below. The quarry area displays evidence of the extraction and removal of at least some large blocks, and numerous smaller, initial workings on others. On the quarry face in front of the site, where the largest block was extracted, there is a hieroglyphic inscription, which could have been a mark for the quarry team (Figure 11a). The debris from quarrying here contains pottery shards dating to the New Kingdom and Roman Periods, many dolerite pounder fragments, charcoal and ashy debris. In addition, we observed many oval-shaped stone tools which came from aplitic veins in the granite, and several small quarries for such. This type of tool is characteristic of the area.

Many stone shelters were found in these quarries. Some of them were highly deteriorated, others better preserved. This may suggest the same as the pottery shards, namely the presence of people in the area both in the New Kingdom and in the Roman Period.

The *Karor Quarry* and the surrounding area as mapped by Klemm and Klemm (1993, quarry number VII, p. 307, Map 355) is now largely destroyed by modern development (Figure 3, S–15). Out of its original quarrying context, the only object remaining in this quarry area is a Roman bath (Figure 5d). To the north, several small quarries were located in an area largely disturbed by modern development. Production remains here suggest that large objects were extracted. This makes sense logistically due to their proximity to the main road from Aswan to Philae.

## The Southern quarries

This is the richest quarrying area in terms of archaeological evidence related not only to ancient quarrying, but also to an ancient wall (see below) and many rock inscriptions. The quarry landscape is generally well preserved and can be divided into several small sites.

The *Shallal Quarry* (S13, Figure 3) is one of the most famous quarrying areas after the Unfinished Obelisk quarry. Egypt-



Figure 10. Colossus and large unfinished granite objects of the New Kingdom from the Southern quarries. (a) Shallal colossus, (b) Tlaina colossus, (c) possible base of Tlaina colossus, (d) tool quarry on the top of Tlaina colossus mountain, (e) unfinished block, possible altar or boat base, (f) unfinished seated statue.



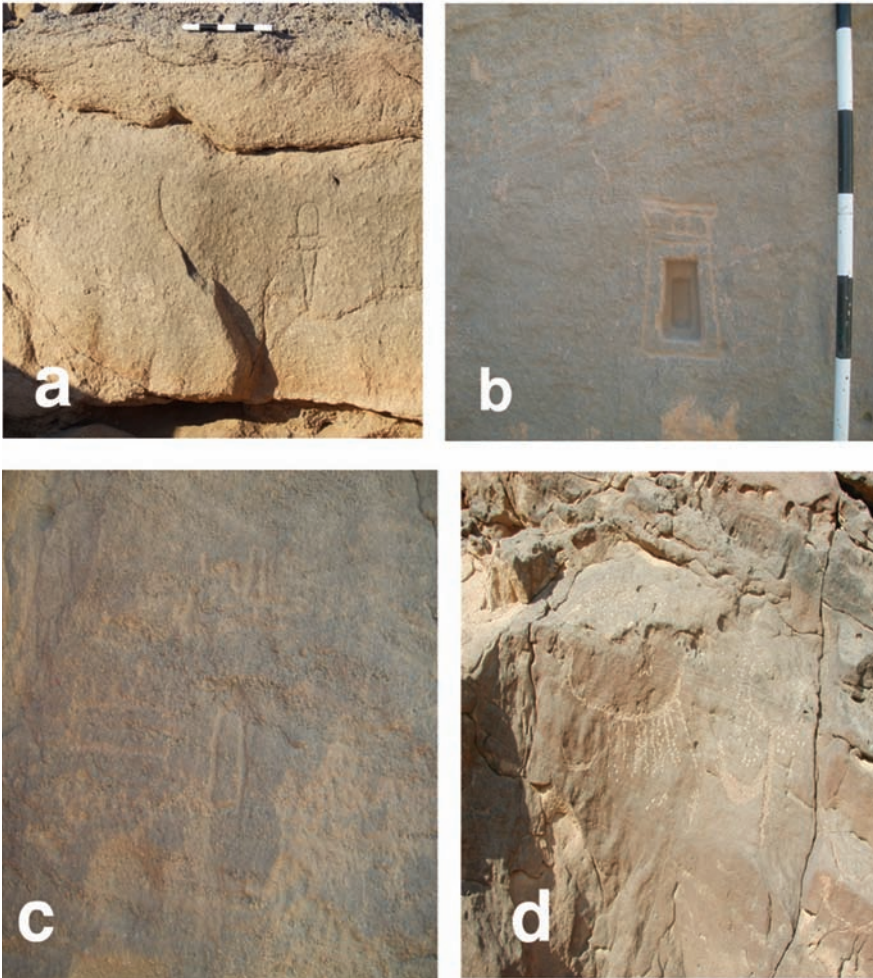


Figure 11. Epigraphic data from granite quarries. (a) Inscribed hieroglyphic mark, (b) hieroglyphic signs depicting a shrine façade, (c) inscription on stone boulder with name of Imn, (d) Predynastic rock art of a boat.

tologists usually call this area ‘The Southern Quarry’ or ‘Ramses II Statue Quarry’ given the large statue that is lying here. Yet, there is no specific archaeological evidence that confirms such a connection with the reign of Ramses II. Today, this area of quarrying is now split in two by a modern asphalt road. In addition to the statues, many other unfinished objects, such as four Roman baths, are found across the landscape. Encroaching modern quarrying is gradually eating away these quarries, with the loss of archaeological remains that were earlier described by de Morgan (1894).

During our recent archaeological survey many new findings were made, such as inscriptions and graffiti and elements of the infrastructure related to the ancient quarrying here. A small sandstone quarry was found located just to the north of the unfinished statue in the sandstone layers that cap the granite.

A limited number of sandstone blocks were quarried here, probably used for building the large transport road beside the unfinished statue and for building workers’ shelters.

On the quarry face of the sandstone quarry there is some graffiti depicting the hieroglyphic sign *cnh* and a stone jug with a handle sign which refers to the god Khnum—one of the local triad of cataract gods. This type of sign has been found in many other places in west bank quarries (Bloxam et al. 2007, p. 212). Another graffiti found beside these hieroglyphic signs depicts a shrine façade, this type of shrine being found on New Kingdom papyrus (Clark and Engelbach 1930, Badawy 1968). In the sandstone quarries at Gebel el-Silsila, a similar graffiti of a rock-cut shrine was made on a quarry face dating to the New Kingdom reign Amenhotep III (Klemm and

Klemm 1993, p. 247). The purpose of such shrines in ancient Egyptian quarries, especially during the New Kingdom, was worship and commemoration (Caminos 1963, p. 2).

Another inscription, although difficult to interpret, was found just beside the unfinished statue. Inscribed on a boulder that has fallen down from a sandstone layer capping the top of a hill, only the name of *Imn* could be read (Figure 11c). The location of this inscription and the methods by which it was engraved suggest it was the work of a lower rank of craftsman. In addition, two small shelters that utilised existing natural holes in the sandstone cliff were documented. Many small dolerite fragments were found on the floors of these shelters, with one unfinished (but broken) dolerite stone bowl. The type and technique of manufacturing this bowl indicate that it dates to the Roman Period, when the quarry was reopened for producing granite baths.

*The Tlaina Quarry* is located to the west of the Shallal quarry and approximately 100 m north of the SCA magazine, which was the earlier camp of the Italian mission who relocated the Philae temple (Figure 3, S–14). It is a small quarry with an abandoned colossus left close to the top of a granite hill (Figure 10b) (Klemm and Klemm 1993). Between the foot of this hill and the colossus, a cleared ramp has been made for transporting the colossus down from the quarry. Close investigation of the colossus shows a crack in the shoulder region, suggesting that this could have been why the object was abandoned.

At the foot of the granite hill, about 75 m from the colossus, an unfinished, square granite base was found during our survey work which was not documented by Klemm and Klemm (1993) (Figure 10c). The size, shape and location of this granite base may suggest that it was intended to be the base for the colossus. This is suggested particularly because we have not seen any other quarrying activities here, except for a limited amount related to the roughing out of small granite blocks and tool making (Figure 10d).

*The Shisab Quarry* (Figure 3) is located at the southern part of the Shallal area. The position and function of Shallal village has made it difficult to save archaeological remains here, especially the ancient quarries. It seems likely that the small Roman Period quarries, located between the modern houses, were used for the production of building stone and other granite objects associated with the Philae temples opposite (Arnold 1999). One important unfinished object, a stele, was found at the foot of the granite hills (Figure 12). This type of stele was usually used for funerary, votive and commemorative purposes and found all over Egypt in a range of dynastic contexts (Shaw and Nicholson 2002).

A sandstone quarry was also located close to the southern boundary of the Central quarries, on the top of a hill (Figure 3, S-11). Chisel marks, pottery shards and graffiti suggest this to be a Roman Period quarry. In addition, on the northeastern slope of the hill, we found what we believe to be the first recorded Predynastic rock art in the granite quarry area, a depiction of a boat (Figure 11d).



Figure 12. Unfinished granite stele from the Shisab quarry.



Figure 13. Section of the ancient fortification wall between old Aswan city and Philae temple (built late Middle Kingdom and reused/rebuilt during Graeco-Roman times) showing granite and dolerite stone interior.

## Quarries along the ancient wall

In the southern part of the quarries, the famous ancient fortification wall, which dates to the Middle Kingdom, crosses the granite outcrops. (Figure 13 and Figure 3, S16) The outer face of the wall is built with mud bricks, with the interior filling comprising granite pieces probably quarried from nearby outcrops. These quarries probably represent the earliest quarrying in this particular area. Considering the length of the ancient wall, starting from the opposite side of Philae temple to the ancient Aswan city, this type of construction would have needed massive quarrying nearby. The recent investigation of the wall shows three phases of development and repairing. The last two phases belonging to Graeco-Roman times (von Pilgrim, in press). This later quarrying has largely destroyed evidence with respect to determining where the Middle Kingdom quarries might be.

## Dolerite tool quarries

The dolerite tool quarries mentioned by Klemm and Klemm (1993) on the Aswan east bank have been extremely difficult to locate. In the Northern quarries, these have been completely destroyed by modern building, and in the Southern quarries, it was difficult to find traces of where the tools were manufactured. In addition, the dolerite dykes here did not appear to be of suitable quality for making such tools. However, a possible new tool quarry was found very close to the entrance of Philae temple (S-12), where a dolerite layer of high-quality stone is located. The quarries are represented by small stone heaps with associated New Kingdom and Roman pottery (Figure 14a-d). In the lower area of the quarry, chisel and wedge marks on stone flakes suggest these being representative of Roman Period or later activities (Figure 14c) (Kelany et al, in press).

## Risks and threats

In the last 20 years, the ancient granite quarries have suffered much from urbanisation and modern quarrying, but most of all from ignorance; not recognising the significance of these quarry landscapes and the rich archaeological remains therein. Many modern granite quarries are situated in ancient quarries, especially in the area with the best quality of granite (Northern quarries). Not surprisingly, the modern stone industry has the same quality measures as the ancient quarrymen—uniform colour and large blocks. Most of the ancient quarry landscape in these northern areas has been obliterated by modern quarrying as well as house building. Hence, our main survey work in this area focussed on investigating and protecting the last ‘surviving’ ancient sites left in-between these activities. The Middle and Southern quarries are, however, still in a relatively good condition, and our focus here is to relocate and/or stop modern quarrying activities in order to protect the quarry landscape. In addition, we are working on the last phase of setting up a site-management plan for the Southern quarries so that they can be opened to visitors.

The building of houses has greatly affected the Northern quarries, especially around the ‘Unfinished Obelisk quarry’. Most of the buildings were erected in the last 15 years, without any control or intervention from the SCA. Learning from this, the SCA now supervises the area with respect to new building and other activities. Other areas affected by house building linked with the growth of Aswan city can especially be seen in the Nubian areas close to the Nile on the east bank, such as at Karor Tagog, Soheil island and others close by.

## Conclusions

The purpose of the presented survey was to investigate the remains of the ancient granite-quarry landscape in Aswan, in order to get an idea about their signifi-



Figure 14. Possible dolerite tool quarry, New Kingdom and Roman Periods. (a–b) Work area in the dolerite layers, (c) wedge mark on stone fragment, (d) stone heap, perhaps tool blanks.

cance and preservation. Moreover, to obtain knowledge of how much of the quarry landscape described by previous scholars has actually been destroyed over the last 20 years. For obvious reasons, the Unfinished Obelisk quarry is a site of tremendous importance, being one of the most impressive quarries in the world and a monument over ancient Egyptian technology, yet not completely understood. The other remaining sites are at first sight far less impressive, but on the other hand also less disturbed, and may provide the largest potential for future research, also for obtaining better knowledge about the obelisk site itself. Thus, the survey has helped in highlighting the significance of all these smaller quarry sites and uncovered many questions for future research.

Unfortunately, the survey also revealed an alerting degree of destruction of quarry sites, particularly in the Northern quarries. Urbanisation and modern quarrying have demolished most of the ancient quarry landscape in a short period of time. On the other hand, the Southern quarries are still in relatively good condition, but in desperate need of protection, representing the last ‘unbro-

ken’ part of the ancient granite quarries in Aswan. The first step towards long-term protection of the sites has now been taken, and in the continuation we see that with such a survey, delineating the most important sites, a fruitful cooperation with the many stakeholders in the area may take place.

The newly found inscriptions and other new features of the granite quarries, described above, have also shown how easy it is to miss important elements of such sites, even in an area that has been crowded with scholars for the last centuries. Clearly, the future will reveal more discoveries in the same areas. Another important outcome of this work, in terms of professional development, was the building of our experience, knowledge and practices for SCA inspectors (inside and outside Aswan) in the recognition and documentation of ancient quarries through training courses given during this fieldwork.

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