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Digital Reconstruction of the Archaeological Landscape in the Concession Area of the Scandinavian Joint Expedition to Sudanese Nubia (1961–1964)


Lake Nasser, Lower Nubia: photography by the author

Degree project in Egyptology/Examensarbete i Egyptologi

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Abstract

The Scandinavian Joint Expedition to Sudanese Nubia (SJE) was one of the substantial contributions of crucial salvage archaeology within the International Nubian Campaign which was pursued in conjunction with the building of the High Dam at Aswan in the early 1960's. A large quantity of archaeological data was collected by the SJE in a continuous area of northernmost Sudan and published during the subsequent decades.

The present study aimed at transferring the geographical aspects of that data into a digital format thus enabling spatial enquires on the archaeological information to be performed in a computerised manner within a geographical information system (GIS). The landscape of the concession area, which is now completely submerged by the water masses of Lake Nasser, was digitally reconstructed in order to approximate the physical environment which the human societies of ancient Nubia inhabited. Information on the nearly 500 indexed archaeological sites of the SJE was classified and imported into the GIS. The potential of the system thereby established, validated against modern remote sensing data and aerial photography, was then demonstrated by a number of spatial analyses at an inter-site level. The resuls of those analyses contribute to discussions on various topics already raised within the SJE publication or elsewhere and includes issues on Nile palaeochannel reconstructions, seasonal habitation patterns and dedicatory orientation of elite tombs.

The system hereby developed is intended to be used in further studies of the relevant and information-rich research fields of ancient Nubia for applications similar to those demonstrated in the present project or for educational and research purposes hitherto unpredicted.

Sammanfattning

Den Samnordiska Expeditionen till Sudanska Nubien (SJE) var en av de omfattande insatser av avgörande räddningsarkeologi inom den Internationella Nubienkampanjen som bedrevs i samband med byggandet av Höga Dammen i Aswan i början av 1960-talet. En stor mängd arkeologisk data samlades in av SJE i ett kontinuerligt område i nordligaste Sudan och publicerades under de efterföljande årtiondena.

Denna studie ämnade överföra de geografiska aspekterna av den datan till ett digitalt format och därmed möjliggöra att rumsliga förfrågningar på den arkeologiska information kan utföras på ett datoriserat tillvägagångssätt i ett geografiskt informationssystem (GIS). Landskapet i koncessions-området, vilket nu är helt översvämmat av Nassersjöns vattenmassor, återskapades digitalt med syfte att approximera den fysiska omgivningen vilken de mänskliga samhällena i det forna Nubien bebodde. Information om de nära 500 indexerade fyndplatserna tillhörande SJE klassificerades och importerades in i detta GIS. Potentialen av det system som därmed skapats, validerat mot modern fjärranalysdata och flygfotografi, demonstrerades genom ett antal rumsliga analyser på en mellan-fyndplats-nivå. Resultaten av dessa analyser bidrar till diskussioner om diverse ämnen som redan tagits upp inom SJE-publikationen eller annorstädes och inkluderar frågor kring Nilens äldre dragningar, säsongsmässiga bosättningsmönster och avsiktlig orientering av elitgravar.

Systemet som härvid har utvecklats är ämnat att användas i vidare studier av de relevanta och informationsrika forskningsområden som rör det forna Nubien för tillämpningar liknande de som demonstrerats i detta projekt eller för undervisnings- och forsknings-syften som hittills ej förutsetts.

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2D	two-dimensional
3D	three-dimensional
BCE	before common era
CE	common era
CPE	Combined Prehistoric Expedition
DEM	Digital Elevation Model
m.a.s.l.	meters above sea level
p.	page
SJE	Scandinavian Joint Expedition
SRTM	Shuttle Radar Topography Mission
UNESCO	United Nations Educational, Scientific and Cultural Organization
WGS84	World Geodetic System 1984

1. Introduction

Nubia[1], as a geographical term, is usually defined by the extent of the Nubian speaking population[2] inhabiting the area of the Middle Nile (Wenig, 1982; Säve-Söderbergh, 1987; Welsby, 2001; Edwards, 2004). However, the word is most commonly used to denote the location for a complex range of ancient and historical societies, spread in time and situated in different topographical settings across a wide region (Edwards, 2004), regardless of the relatively late appearing Nubian language. Adams (1977:21) suggests instead a definition based on the relation with foreign culture: "...it [Nubia] is the land of the Nile cataracts: that part of the Nile Valley, directly south of Egypt, which is occupied by peoples African in origin and speech but strongly influenced by Egyptian and Mediterranean culture."[3]. The area encompassed by the term has grown in later usage in order to include, in addition to Egypt south of the First Cataract, "all of the modern Sudan north of the equatorial provinces, including the adjacent Sahara and eastern deserts to the Red Sea" (Kendall, 2010:401).

Traditionally treated in the context of the ancient kingdoms of its neighbour, Egypt, the archaeology of Nubia has slowly become a focus of study on its own right (Edwards, 2004), accelerated in the second half of the last century in the aftermath of the International Nubian Campaign (see Kendall, 2010:401 and below, section 1.3). Favourable environmental conditions have contributed to relatively good preservation of archaeological remains[4] and the cultural importance of ancient Nubia is attributed to Nubia's strategic position with regards to long-distance trade and military control, functioning as a gateway between the interior of Africa to the South and Egypt (and the rest of the Mediterranean world) in the North[5]. Still, *Nubiology*, a loosely defined term focusing on the primarily archaeologically based scientific study of the societies of ancient Nubia[6], is usually considered as a sub-discipline of Egyptology and Egyptian Archaeology.

1.1. Nubia – The Geographical Setting

Ancient Nubia was, as its neighbour Egypt, to a large degree dependent on the River Nile and its regular inundations, a feature that greatly dominated the landscape. The different regions of riverine Nubia is effectively divided by the impassable or nearly-impassable cataracts of the Nile consisting of

[1] The name *Nubia* is first attested in the first century CE *Geographica* of Strabo (book 17, chapter 1.2) as *Νοῦβαι,* describing a large population living to "the left of the course of the Nile (...) They begin from Meroë, and extend as far as the bends (of the river). They are not subject to the Ethiopians, but live independently, being distributed into several sovereignties." (Hamilton & Falconer, 1857:785-786). The word is sometimes believed to originate from the Egyptian word for gold  (*nbw* or *nwb*), because Nubia was ancient Egypt's primary source of gold (Emery, 1965:16). However, there is *only a single* known historical primary source originating from ancient Egypt where the region in question might be referred to as *t3-nbw*, that is, "the Land of Gold" (Grimm, 1988).

[2] The advent of Nubian as a language is correlated to events, usually described as migrations, in the first centuries AD (Adams, 1977:420–421).

[3] This definition is also problematic since it uses the highly unspecific term "African" meanwhile implying that the same adjective does *not* apply to the inhabitants of ancient Egypt, of which (incorrectly) all the Nubian cultures would have been influenced by.

[4] The relatively poor agricultural potential of the Nubian Nile Valley has in many areas kept population growth down and has thus saved many archaeological remains from human-induced erosion (Trigger, 1976:12).

[5] Cf. the title of the comprehensive work of Adams (1977): *Nubia: Corridor to Africa*.

[6] *Nubiology* as an archaeological science was initiated by the polish archaeologist Michałowski (Rybicki, 1982).

series of rapids interrupted by igneous boulders. The Nile has six cataracts (see the map in figure 1)[7] which are formed where the igneous or metamorphic Pre-Cambrian basement complex has been up-lifted through the layers of Nubian sandstone[8]. These constitute natural boundary points in the landscape for the regional societies, both with regards to trade and foreign policy.

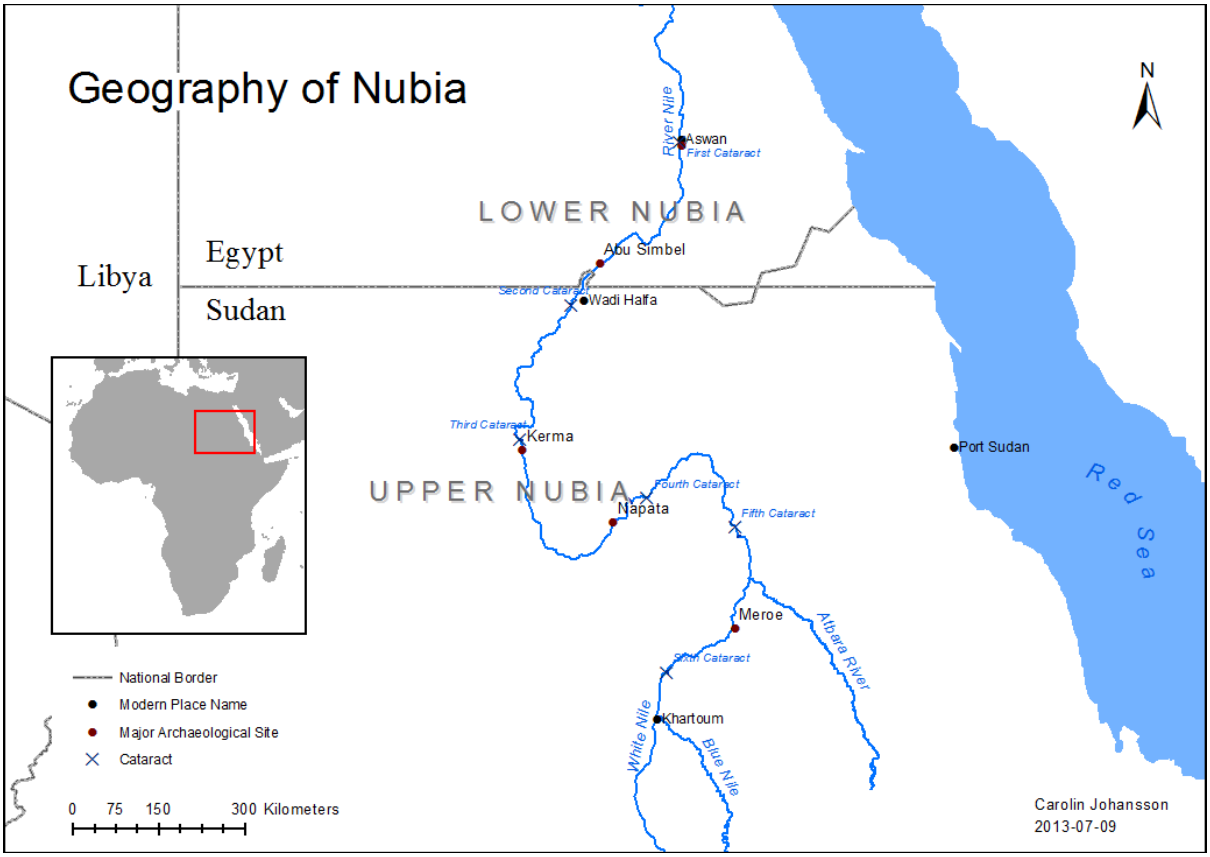


Figure 1. Map illustrating the general geography of Nubia. Note the division into Lower Nubia and Upper Nubia. The inset orients the map onto the continent of Africa.

1.1.1. Lower Nubia

Figure 2. Photographic panorama of the First Cataract. The view is oriented towards its northern part and observed from the eastern shore of the Nile, Aswan, Egypt. Photography by the author.

The exact extent of Nubia as a geographical term differs between authors. However, its northern boundary is generally accepted as the vicinity of the first Nile cataract and the present day city of Aswan in the southern part of the contemporary Arab Republic of Egypt. Indeed, the ancient town of  (*3bw*), on Elephantine, an island in the very northern end of the First Cataract (see figure 2), was an important settlement from at least the middle of the fourth millennium BCE and throughout the pharaonic time periods (Kaiser, 1999).

[7] Excluding several minor cataracts such as the so-called *Dal Cataract*, situated between the second and the Third Cataracts.

[8] Cf. the map in Adams p. 23 (1977).

Lower Nubia is then considered as that northerly part of Nubia, starting at the First Cataract and stretching upstream the Nile, crossing the national border of the modern republics of Egypt and Sudan and ending at the Second Cataract or slightly upstream of it, in the area of the Sudanese town Wadi Halfa (see the map in figure 1). The region between those first two Nile cataracts is relatively uniform with an extremely dry desert landscape fringing the shores of the Nile. However, it has periodically been wetter and less hostile explaining the continuous re-habitation of the area in ancient times (Welsby, 2001). Today, the Nile Valley in this region is to a large extent submerged under the water masses of Lake Nasser but up until the second half of the last century, the Nile in this region made a slow and steady course though the Nubian sandstone, falling not more than 28 meters from the Second to the First Cataract (Hinkel, 1978:11). At the mouths of the larger wadis[9] alluvial deposits resulted in irregularly spread agricultural villages along the wide and calm river. In the geographical sense, this was the Nubian region that was most similar to the landscape of the Egyptian Nile Valley (Adams, 1977:24–25). Today, most of Lower Nubia lies within modern Egypt and constitutes its very southerly part along the river.

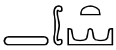
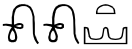
1.1.2. Upper Nubia

The region of the Nile Valley from the Second Cataract extending upstream towards the southern border of Nubia, however defined, is much larger and much more diverse than Lower Nubia. The region immediately south of the Second Cataract is called the Batn el-Hagar[10] and is a very narrow and swift stretch of the Nile, full by granite boulders that interrupts the flow. The region is barren and desolate, soil and vegetation is scarce and thus has human activity in the region been limited. Rather, the area has acted more as a barrier between cultures and a shield for various expansions in the past (Adams, 1977:27). The characteristic region of Batn el-Hagar ends at the Dal Cataract upstream of which the Abri-Delgo Reach begins as a wider and more fertile stretch of the Nile Valley (Säve-Söderbergh, 1987:16) where the floodplain is able to sustain agricultural villages (Adams, 1977:29). Some distance south of the Third Cataract, the Nile makes a great bend (see the map in figure 1) where the flow is no longer roughly south to north oriented but meanders in a big S-shape, caused by tectonic uplift of the Precambrian bedrock of northern Sudan during the Pleistocene (Abdelsalam & Stern, 1996). The first part of this bend, namely the region between the Third and the Fourth Cataract, is called the Dongola Reach. Here, the Nile is wide and placid and the surrounding valley is broad and plain. Abundance of enriched alluvial makes this area the most productive of the Nubian regions. Rare precipitation even keeps some vegetation in the desert wadis alive. After the Dongola Reach and the Fourth Cataract, the Nile flow is again impeded by a rocky stretch up until the Fifth Cataract, this is the region known as the Abu Hamed Reach. As the similar Batn el-Hagar downstream, this desolate area functioned in ancient times as a barrier zone where transportation was further complicated by the fact that the prevailing direction of the wind coincides with the water current (Adams, 1977:31–32). A road through the desert was used as the mean way of travelling through this region (Morkot, 2000). Thus it is hardly surprising that this region was less densely occupied in ancient times (Adams, 1977:31–32). South of the Fifth Cataract, the Atbara River joins the Nile. This is one of the Nile's major tributaries and contributes with approximately 20 % percent of its water (Hinkel, 1978:11). This area of the Nile, up until the confluence of the White and the Blue Nile in the vicinity of the capital Khartoum and just south of the Sixth Cataract, is called the Shendi Reach and constitutes the uppermost (southerly) part of what is usually designated as Nubia

[9] Ancient, dried-up, tributary flood-beds originating from the desert plateaus on both sides of the river.
[10] Arabic for "the Stone Belly".

(Adams, 1977:32). Sometimes the term “Southern Nubia”, or “Central Sudan” for the uppermost part of the Middle Nile is used in addition to “Upper Nubia” in order to reserve the latter term to the area between the Second and Fourth Cataracts, alternatively called “Central Nubia” (O'Connor, 1993; Kendall, 2010). After the break of the barren Abu Hamed Reach, a more prosperous region is found in the Shendi Reach, resembling of the area of Dongola. The area is well-populated and provides farming opportunities along most of the two river banks as well as in areas more distantly located from the Nile (Adams, 1977:32–33).

1.1.3. Ancient Terminology

The ancient Egyptians had a general term for the land immediately south of its own,  (*t3 sty*), meaning “the land of the bow” (Säve-Söderbergh, 1987:14), this is also the name of the first Upper Egyptian nome (centred at Elephantine) (Hannig, 2006). More specifically, Lower Nubia was referred to as  (*w3w3t*) and Upper Nubia as  (*k3š*) (Emery, 1965:16; Hannig, 2006:1129, 1195). A number of other place names connected to Nubia exists whose proper locations have been discussed and are considered unclear. One of them is  (*i3m*), a term that has been suggested for sites both in the Middle Nile Valley *and* in the remote deserts fringing riverine Nubia (Zibelius, 1972:78–81; O'Connor, 1986; Clayton et al., 2008).

1.2. A brief Chronology of Nubia

The following synopsis is derived from information in Edwards (2004) unless otherwise stated. A chronological chart of the time periods mentioned in this text can be found in the appendix (table A5).

1.2.1. The Late Palaeolithic and Mesolithic Periods

Fluctuating climate has induced changes in the human habitation patterns inside Saharan Africa since the late Palaeolithic. During the last glacial maximum, which occurred approximately 20 000 years BP, the climate was relatively arid (Gasse, 2000:192) with lowering of sea level and a substantially reduced water flow in the Middle Nile. Several lithic industries have been defined for the late Palaeolithic in Lower Nubia at sites such as Wadi Kubbaniya (ca 20 000 BP) and the Qadan culture with associated cemeteries at Gebel Sahaba (ca 13 000–9 000 BCE). Comparable material from Upper Nubia is scarce and the Late Palaeolithic of the Middle Nile above the Second Cataract is thus unknown.

During the beginning of the Holocene epoch, the climate had changed and had become much wetter with a maximum of precipitation and higher flood levels around 7 000–6 000 BCE. It is from around this time the so-called Khartoum Mesolithic, a semi-permanent hunter-gatherer culture that used pottery, is identified in several places in both Upper and Lower Nubia, with an earliest appearance probably in the tenth millennium BP. These types of settlements are located close to the river and the people are believed to have lived primarily on fishing. Few have been found in other areas but that may be solely a reflection of archaeological activity that has focused on e.g. areas near the confluence of the White and the Blue Nile, which is conveniently located close to the Sudanese capital, rather than actual settlement patterns. Grindstones may indicate that at least some *wild* grains were processed in these settlements. In Lower Nubia, a later Mesolithic culture, the so-called Khartoum Variant has been found as small campsites with relatively little material associated with them and an apparent lack of fishing equipment. However, presence of Egyptian flint in these sites indicates substantial north-south contact along the river.

1.2.2. The Neolithic Period

The change from Mesolithic to Neolithic time period in this part of the world occurred about 5 000 BCE and is characterised by a shift towards food production in terms of livestock keeping. Pottery had, as seen above, already been used for millennia but domesticated cereals seem not to have been in use until quite late, at least in Upper Nubia. However, grain impressions have indicated use of wild plants already in the early Neolithic.

This change was correlated in time with the mid-Holocene climate change in which the area of the Middle Nile was moving towards drier conditions. This may have partly caused the focusing of the once dispersed Nile Valley populations into more favourable and relatively restricted areas. Populations became more dense, distinct and isolated and in this process different life styles developed. Communities resembling true farming developed in parallel with seasonal settlements and pastoral groups. The range and elaboration seen in the material culture is expanded and is primarily noted in burial contexts. Apart from pottery also bone, ivory, shells, polished stones and pigments were used for implements and personal adornment. The importance of livestock is evident in e.g. the presence of cattle skulls among grave goods. There is also plenty of rock art depicting

both wild and domestic animals from the Neolithic Period onwards[11]. However, meat from domesticated animals (cattle, sheep and goat) may not have been part of the staple-food in those early Neolithic communities (e.g. the Khartoum Neolithic in Upper Nubia) but may have been used only at special occasions marking status or ceremony. Instead, milk and blood would have been the primary products of those animals (Kendall, 2010:402). Indeed, assemblages of bones at find sites have shown that the domesticated animals only constituted a small part of the animal bone refuse, the rest belonged to wild game.

The late Nubian Neolithic (third and fourth millennium BCE) exhibits growth of hierarchies of power and status among the communities suggested by variability seen in burials, primarily in northern Upper Nubia and Lower Nubia. In Southern Nubia though, the traces of populations after the early Neolithic are scarce, perhaps due to de-population caused by climate change or because a shift in lifestyle into one that has left little of archaeological remains. In the Dongola reach, a pre-Kerma culture is appearing in the records in the fourth millennium BCE exhibiting elaborate burials and traces of proper, larger buildings perhaps used for livestock or as granaries. Further north is the well documented A-group[12] developing out of the Abkan culture, a group of various Mesolithic and Neolithic sites around the Second Cataract which in turn is believed to be a continuity of the earlier Qadan assemblage (Nordström, 1972a:12–13). A large bulk of data is available for the A-group culture in the area between the First and the Second Cataract as it was thoroughly examined in the 20th century (see below, section 1.3) and many sites belonging to this culture are described. However, estimates have given that this population was quite small, comprising a few thousand individuals. With time it has become considered less distinct than when originally identified and even though there are similarities with the contemporary Predynastic cultures in Egypt, evidence is increasingly pointing towards shared characteristics with areas further south, in Upper Nubia. The chronology of the A-group is firm due to the abundance of Egyptian material in A-group contexts which enables cross-cultural dating but also to several radiocarbon assays. Nordström effectively divided the A-group into three chronological phases (1972:28–32):

- Early A-group,
- Classic A-group
- Terminal A-group

The finds of the Early A-group are located around the area between the First Cataract with Kubbaniya as the northern end slightly north of modern day Aswan and the Dakka–Sayala region to the South, halfway up to the Second Cataract. Chronologically, the Early A-group corresponds to the Naqada Ic (Amratian) until Naqada IId (Gerzean) of Predynastic Egypt, roughly equivalent with 3800–3400 BCE. Few or no remains of the Early A-group exists south of Sayala. The Classical A-group extends further southwards up until the Batn el-Hagar reach and is contemporary with Naqada III, approximately 3600–3200 BCE. The terminal A-group is contemporary with the Proto-dynastic Period of Ancient Egypt with its latest remains dated to before the end of the first Egyptian Dynasty

[11] However, the earliest rock art in the Nile Valley was produced much earlier, cf. e.g. the Pleistocene rock art at Qurta, Upper Egypt (Huyge et al., 2011).
[12] The A-group was first introduced by George A. Reisner in his chronological scheme of Nubian cultures (1910).

and is found, primarily, in two regions: the Sayala–Gerf Hussein in the north and between Qustul and Gamai in the south.
The remains of the A-group show considerable wealth of the elite and the cemetery at Qustul has been compared to the late Predynastic royal cemetery U at Abydos (Edwards, 2004:72). Exotic goods testify long-distance trade. Egyptian vessels indicate import of food-products and wine which was probably traded for material from areas further south such as ivory, ostrich feathers and eventually gold. Thus the A-group people acted as intermediaries in the trade but there has also been found Nubian ware occurring in Naqadan tombs (Smith, 1991:108) indicating export of local goods. The close connections with Predynastic Egypt and the apparent north to south direction of the distribution expansion have suggested that the A-group may have had some shared origin with, and a significant impact on, the cultural and political development that can be observed in contemporary Egypt which eventually went through state-formation in the end of the time period in question. The so-called Qustul Incense Burner (DeVries, 1976), an object found at Qustul displaying iconographical motifs considered fundamental of Egyptian kingship (e.g. the white crown) has been one of the foci in this discussion (Williams, 1987). However, it is not clear if that object really was indigenous to the A-group context into which it was found or if it was simply an import from Egypt. The latter alternative is usually claimed as more likely (Bard, 2007:104).

After the decline of the terminal A-group there is a lack of remains of indigenous human presence in Lower Nubia. A B-group, contemporary with the Egyptian Old Kingdom was once suggested but has been dismissed as a variant of, and contemporary with, the Early A-group (Smith, 1966; Adams, 1977:132–135). Local environmental causes do not suffice as explanation for the seemingly sudden disappearance (Nordström, 1972a), rather, "...hostile Egyptian military activity during the late Predynastic Period..." (Edwards, 2004:73) is commonly referred to. There are, however sparse, evidences of Egyptian military victories over Nubians in the form of inscriptions indicating dominion of an Early Dynastic king over *the bowland (-ers)* (*t3 sty*). One of these is an ivory tablet dated to king Aha (First Dynasty) with a prisoner below a *sty*-sign () (Petrie, 1901:plate III:2). A second example is a fragmentary victory stela of king Khasekhem (Second Dynasty) where a foreigner with the *sty*-sign above its head is being subdued (Quibell & Green, 1902 plateLVIII). However, in those two instances it is uncertain if the term is used to refer to the first Upper Egyptian nome or to Lower Nubia in general (Säve-Söderbergh, 1941:7; Smith 1966:119). Another source relevant to the discussion is a rock art site at the second cataract[13] which depicts a *sty*–prisoner supposedly subdued by king Djer (First Dynasty) (Arkell, 1950:27–31) though there is doubt regarding the dating of that scene (Helck, 1970:83–85). Moreover, Edwards (2004:73) mentions a similar inscription possibly relating to king Scorpion ("Dynasty 0").

Smith (1991:108) argues that it was the increasing need of luxury goods of the newly emerged Egyptian state, such as gold among the rising powers of Egypt, that caused the Egyptians to secure access to those material and products and thereby made the Nubian intermission redundant. The downfall of the Nubian A-group may have not extinguished the population entirely though but may have changed the internal organisation and lifestyle in a way that it has escaped the archaeological record (Nordström, 1972a:32)[14].

[13] Gebel Sheikh Suleiman.
[14] See also the note on the possible continuity between A-group and the subsequent C-group in section 1.2.3.

1.2.3. The Bronze Age

The fertile Dongola reach saw the emergence of the materially rich and distinctive kingdom centred around what came to be an urban centre at Kerma (see the map in figure 1) in the second half of the third millennium BCE. This culture dominated a large part of the Middle Nile Valley with dispersed and dense settlements. It was characterised by large-scale buildings and rich burials and was thus initially considered influenced by the Egyptian culture, but it is now believed that the Kerma culture developed independently of Egypt to which it was a powerful rival during the following millennium. This is the first stage of the indigenous Nubian kingdoms that the Egyptians referred to as Kush (see section 1.1.3. above).

In parallel with the development of the Early Kerma culture (2500–2050 BCE) a people started to re-settle Lower Nubia, namely the C-group. The remains of this people share many characteristics with the Early Kerma and it is believed that they originated from a common source in the Dongola province and with time moved northward into the area that had been more or less void of human settlements after the disappearance of the A-group. In this view, there is no continuity between the A-group and the C-group people. This has recently been challenged by Gait (2011) who argues that the interpretation of the change in uses of different pottery types in A-group and C-group contexts may be explained by other factors than a discontinuity and thus questions the traditional chronology in which A-group and C-group is both temporally and culturally distinct.

In the early second millennium, Egyptian activity established a military frontier in the area of the Second Cataract and thereby effectively dividing Lower Nubia with its C-group people from the area in the South and the kingdom of Kerma which was by then in the Middle Kerma phase (2050–1750 BCE). The Egyptian king Senuseret III built a series of forts further upstream in the Batn el-Hagar reach and huge efforts were put on the administration of the goods and manpower necessary to constantly upkeep such activities. The Egyptian presence enabled both control over trade and access to Nubian quarries as well as providing a defence against any northward progress of the Kushites.

During the Egyptian Second Intermediate Period royal power weakened and thus also the Egyptian control over Nubia. This offered the opportunity for Kerma to confront Egypt's southern border and advance the Kushite control into Lower Nubia. This time period, the Classical Kerma phase (1750–1500 BCE), coincided with the wealth and power of the city of Kerma which grew in size and importance and exhibited monumental palatial and religious buildings as well as substantial fortifications. The elite cemetery exhibits considerable wealth and large-scale superstructures (tumuli). Cattle symbolism is evident in the tombs with large number of cattle skulls along with occasional animal and presumably human sacrifices.

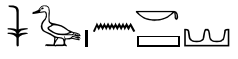
The C-group that which lived in parallel with the Egyptian occupation during the Middle Kingdom shows greater differentiation in burials and exhibits wealthy tombs with large superstructures and imported grave goods after the retreat of the Egyptian presence, thereby indicating indigenous power emergence.

From the eastern desert came people forming the Pan Grave culture, named after its distinctive burial type, and settled Lower Nubia and Upper Egypt with occasional presence far north close to the Egyptian delta. These are most likely the people that start to occur in Egyptian sources from the

beginning of the second millennium as the  (*mḏ3y*) and that were continuously employed in Egyptian police or military service up until the 17th Dynasty[15].

The Pangrave culture disappears from the records with the Egyptian entrance into the region and by the end of the 18th Dynasty the C-group seems to have shifted towards the Egyptian traditions to such a degree that it also can be considered as vanished. Egyptian material culture and burial traditions dominate in most of the cemeteries in Lower Egypt. This process, in which the indigenous culture seem to disappear due to adoption of the traditions of the Egyptian conquerors, is referred to as *Egyptianization* (Edwards, 2004:107).

With the rise of the Egyptian New Kingdom and the 18th Dynasty, Egyptian military activity was again strengthened in Lower Nubia. A southward expansion of control was opposed by the Kushite powers resulting in repeated conflict but the Egyptians succeed to progress successively their control into Upper Nubia. Kerma was finally reached and destroyed first by Tuthmosis I (around 1500 BCE). The same king advanced the Egyptian control as far as the Fourth Cataract and he and several of the subsequent New Kingdom kings left inscriptions at the site of Hagar el-Merwa, just below the Fifth Cataract. It was probably at this time that the formal introduction of the cult of the Egyptian national deity Amun began in Nubia and an ideology in which pharaonic legitimacy was tied to a Nubian origin was emphasised (Kendall, 2010:409). Religious building activity was upheld by the Tuthmoside kings and several of their successors throughout Nubia. Temples were built especially around the by then old Egyptian fortifications, close to the remains of the city of Kerma and at the ancient sacred site of Gebel Barkal, close to the Fourth Cataract.

The Egyptian Domination during the New Kingdom seems to have been strongest at Lower Nubia and Northern Upper Nubia[16]. The imperial government controlled the local administration through the office of the *Viceroy of Nubia*, titled as *the Kings' son of Kush*:  (*s3 nsw n k3š*) with two local governors, one for *Wawat* (in the North) and one for *Kush* (in the South). Nubians could serve in the Egyptian administration and children of the elite were raised at the Egyptian court thereby gradually adopting Egyptian traditions and material culture. The rulers in areas of the southern parts of Upper Nubia seem to have retained some degree of independence though, and repeated conflict with the colonial power is attested in Egyptian historical sources.

The later part of the New Kingdom, in particular in the Ramesside Period saw a decline in population density in Lower Nubia and the area seem to have been largely uninhabited again for some significant amount of time. It is believed that it was primarily due to increasing aridity which caused an environmental decline in the later part of the second millennium BCE while more beneficial conditions were upheld by regular precipitation in the more southerly parts of Nubia (Edwards, 2004)[17]. This process is contemporary with the weakening of royal power in Egypt and the lapse of Egyptian control over Nubia that had its onset after the reign of Ramses II. During the reign of

[15] The term "medjaj" came to be used for special police troops into the Ramesside Time Period but had by then probably lost its original connection to the people it once designated (Williams, 1999:585).
[16] Cf. Hein (1991) maps 3–8.
[17] However, ongoing excavations of The British Museum at Amara West near the Third Cataract show that significant Egyptian occupation was indeed present during the Ramesside Period. Cf. the reports at http://www.britishmuseum.org/research/research_projects/all_current_projects/sudan/amara_west_research_project.aspx.

Ramses XI (end of 20th Dynasty) the last viceroy of Nubia, Panehesy moved with a Nubian army north and waged a civil war in Egypt which he eventually lost, but the Egyptian rule could not re-establish authority in Nubia. It is likely that the local leaders that had once been subordinate to the Egyptian governors regained their independent rule.

1.2.4. The 25th Dynasty and the Napatan Period

The political situation in Nubia at the beginning of the first millenium BCE is very uncertain due to an almost complete lack of sources but *Egyptian* historical sources from the time period in question implies that one or several chiefdoms had again emerged in Nubia.

An elite cemetery at el-Kurru in the area of Napata (see the map in figure 1) reveals a series of rulers of the eighth century BCE with tomb constructions remarkably similar to Egyptian funerary traditions, e.g. pyramidal superstructures. These were the regents of a new Kushite kingdom that came to outgrow the size and importance of the previous Kerma kingdom. Lower Nubia as well as Egypt came under the control of those Napatan rulers that subsequently ruled from Memphis as the 25th Dynasty. The Nubian pharaohs assumed the Egyptian kingship on ideological grounds in which they considered Nubia and Egypt as parts of the same land belonging to the domain of Amun which had an important cult centre in Gebel Barkal as well as in Thebes in Upper Egypt[18]. Royal iconography was adopted from the Egyptian traditions and probably administrative strategies as well. Royal family members were given strategic offices such as *the God's Wife of Amun:*  (*ḥmt nṯr nt Ỉmn*) at Thebes. A sort of renaissance was initiated in which art and literature was archaised in a way to further strengthen the idea of the two countries' common mythological origin and a celebration of the final re-union of Egypt and Nubia. It is believed though that the almost complete Egyptianisation that the rulers adopted had limited impact on the majority of the population of their Nubian homeland. Cemeteries of the non-elite in Nubia show features of *both* Egyptian and native burial traditions. Recorded settlements are rare and thus the knowledge of the life of the people of Nubia at this time is very limited.

Even though the kings of the 25th Dynasty were active in foreign policy and international relations, they were not able to withstand the repeated Assyrian invasion attempts that eventually led to the expulsion of the Kushite kings from Egypt.

The Napatan kings continued to rule Upper Nubia during the following three centuries with a focus on the area of Napata with Gebel Barkal and the cemetery of Nuri as well as the city of Meroe, far upstream. The Egyptianised traditions were kept with regards to writing, art, architecture and burial customs. The scarcity of sources and in particular documented settlements from this time period makes it otherwise largely unknown.

1.2.5. The Meroitic Period

Immediately following the Napatan Period, the Meroitic Kingdom came to last about six centuries and was at least as large and powerful as its predecessor kingdoms of Nubia. It may be regarded as a state comparable with the ancient Egyptian kingdoms however created in fairly dissimilar natural environment and thereby unsurprisingly different in character.

[18] It is ironical that similar reasoning about the relationship between Egypt and Nubia that had once legitimized the New Kingdom occupation was later reused to claim the legitimacy of the 25th dynasty Nubian kings' supremacy (Kendall, 2010:409–411).

The temporal distinction between the Napatan Period and the era of the Meroitic Kingdom is set at the time when the location of royal burials shifted from cemeteries at the Napata region to Meroe, between the Fifth and the Sixth Cataracts, around 300 BCE. It is not clear as to why this shift occurred but there are differences between the cultures of the two time periods, apart from the location of royal burials that is, to make this distinction relevant.

Few historical sources about this time period are available except for some roughly contemporary accounts of classical authors. The writing system of the Meroitic language has only partially been deciphered which is why information from indigenous sources is limited. On the other hand, the Meroitic Kingdom has left numerous sites with archaeological remains that have provided extensive information from funerary, religious, palatial and irrigational constructions.

In contrast to the previous kingdoms of Kerma and Napata, which were limited to a certain length of the Middle Nile Valley, the Meroitic Kingdom stretched in more than two directions. Thus, important Meroitic settlements have been located at significant distances from the river, especially in the area of the so-called Island of Meroe, a semi-desert region bounded by the Nile, the Atbara and the Blue Nile rivers. Subsistence patterns varied from region to region depending on the different local ecological conditions. Areas distant from the Nile were supported by *hafirs*, large constructions that could store rain water to be distributed over a longer period of time.

As in the case of the culture of the Napatan Period, the Meroitic Kingdom was greatly influenced by the long tradition of characteristics with Egyptian origins. However, the Meroitic Kingdom departed some from the strict adherence to Egyptian traditions which is evident in the royal iconography and religion. Indeed, the abandonment of the royal cemeteries of Napata is explained by a Meroitic king that brutally demolished the power of the previously influential priesthood at Napata according to classical sources[19]. It is also evident that the culture within the Meroitic Period showed much more regional variability than the more uniform practices in the Napatan Period.

The Meroitic Period is contemporary with the Ptolemaic and Roman Periods in Egypt. The relationship of the early Meroitic Kingdom and the contemporary Ptolemies of Egypt was largely peaceful and focused on trade and common interests in the temples of Lower Nubia. Shortly after the Roman conquest of Egypt, the Meroites initiated a military confrontation but were rebuked by the Romans. A peace treaty was made which endured until the end of the Meroitic Period.

Settlements in Lower Nubia are evident from the Meroitic Period but it is believed that their populations were relatively small due to the limited agricultural potential of the region. The Meroitic presence may have been due rather to its importance as a channel for communication with the Egyptian Kingdom and other areas in the North. The small settlements have thus functioned as way-stations for facilitating and controlling trade and other types of contact such as religious connections with the temple of Philae and the important cult of Isis at the First Cataract. Sporadic Roman presence is also attested in the region and particularly substantial at the end of the first century CE when the relation with the Meroites was tense. The harsh environmental conditions, which may themselves have fluctuated with time, is likely to explain the lack of substantial and continuous habitation in the area.

[19] A section of the Library of History suggests a political event in which a king revolted against and killed the influential priesthood (presumably of Gebel Barkal) (Diodorus-Siculus, 1933).

1.2.6. The Transitional Period

The political and cultural seat of power at Meroe seemed to have declined in the beginning of the fourth century CE. Important buildings were abandoned or even destroyed, the royal cemetery went out of use and the city became depopulated. The time period that followed, the Transitional Period (350–550 CE) was characterised by the breakdown of central power in favour of regional states with local traditions. The Meroitic language fell out of use and came to be replaced by the Nubian language which appears for the first time in this era.

The cultural and political changes in the post-Meroitic Period have traditionally been ascribed the movement of populations, that is, invasions of people into the area previously controlled by the declining Meroitic empire. This is exemplified by Reisner's X-group which was originally attributed to the immigration of new people into Lower Nubia based on characteristics in grave types and anatomical assessments of human remains (Adams, 1977:390–393). Likewise, it is sometimes claimed that intervention of the Aksumite Kingdom and the invasion of so-called Noba tribes were involved in the fall of Meroe. Indeed, there are considerable cultural differences from what was typically Meroitic, e.g. the disappearance of the typical Meroitic wheel-made pottery[20] but there are also continuities evident such as the practice of metal-working. With time the opinion on the mechanisms behind the transition in question has changed: it seems that it may *not* have been due to one or a few sudden events but rather to a gradual process and that population movement is not necessary to explain the cultural changes. Thereby Edwards (2004:185) argues that the origin of the emerging cultures may be sought within the, as previously seen heterogeneous, Meroitic Kingdom itself.

Transitional elite cemeteries considered royal are found at several places in Nubia. In contrast to the Meroitic kings, those elites were not buried in Egyptian-styled pyramidal tombs but below tumuli as in practices of older Nubian traditions. One such cemetery is found at el-Hobagi in the region of the previous political centre Meroe. It has been suggested that those burials belonged to successors of the Meroitic kings but little evidence is actually pointing towards a continuity between the Meroitic Kingdom and the polity of unknown extent that would have been governed by the el-Hobagi rulers. The end of the Transitional Period saw the rise of the kingdom of Alodia in the southernmost part of Upper Nubia. A parallel site is Tanqasi in the southern part of the Dongola, a region where multiple archaeological sites indicate a substantial human population in the Transitional Period. This area finally emerged as the kingdom of Makuria.

While relatively little is known about this period in Upper Nubia, the human activities in the North are better known. Lower Nubia had already as a Meroitic province developed a distinct culture that continued into the post-Meroitic times and eventually formed the Nobadian kingdom. This is the equivalent with what is also-called the X-group (Reisner, 1910) or Ballana culture (Trigger, 1969). The proximity of Roman Egypt and a newly immigrated tribe from the eastern desert, the Blemmyes, which had settled in the very north of Lower Nubia, tinted the development of Nobadia through numerous conflicts. By this time Lower Nubia became settled much more extensively and dispersed then previously. There is an obvious lack of monumental architecture and the settlement pattern is indicating a relatively decentralised kingdom. Royal cemeteries have been found at the adjacent

[20] The change of pottery types has been regarded as diagnostic for differentiating Meroitic from Post-Meroitic contexts but this is not un-problematic as their uses have been shown to overlap in some instances (Edwards, 2004:189–190).

sites of Ballana and Qustul close to the modern Egypt–Sudan national border and a concentration of activity is also found around the Second Cataract in the very south of Lower Nubia with some settlements even in the Batn el-Hagar. Agricultural advancements such as the introduction of the water-wheel and new crops, probably in the fourth century CE, is a likely explanation for the exploitation of areas that were previously too meagre to uphold permanent settlements.

1.2.7. The Medieval Period

The transition into the Nubian Medieval Period is set at the time of the Christianisation which is known from historical accounts to have occurred in the middle of the sixth century following official missions. It is likely though that Christianity had started to penetrate Nubia already in the fifth century, at least in its northern areas, and that the conversion in reality was a gradual process. The most obvious changes from the post-Meroitic Period is the seeming absence of royal burials and the appearance of the diagnostic Christian pottery along with the construction of churches of which numerous examples have survived in the archaeological records.

A number of new political and religious centres appeared that seem to have replaced the Meroitic cities which were no longer in use. The landscape, especially in the North, was densely populated with settlements that have a substantial amount of brick architecture preserved into modern times. Areas in the South exhibit less preservation due to the erosive effects of rain but it is also believed that wood was substantially employed in building construction there which would contribute to the scarcity of architectural remains. Almost all of the historical sources available from this time period are from contemporary Arabic writers. Indigenous written sources exists as the Nubian language developed a writing system that filled the void left by the disappearance of the Meroitic language. However, these are few and have little use for reconstructing history. Little is known about the royal administration or kingship at this time and no royal successions are known since the significance of dedicated burials had diminished.

Conflicts with the Arab conquerors of Egypt are attested at several occasions but Nubia itself was never conquered, probably due to its low economical value in relation to the persistence of the Nubian rulers. Instead, peace treaties that regulated annual tributaries were established and the border at Aswan was respected.

By the early Medieval Period, Nubia had effectively been divided into the three separate kingdoms of Alodia in the South, Makuria in the middle and Nobadia in the North: Little is known about the Alodian Kingdom in Medieval times and thus have the northern areas traditionally received much more of the scholarly attention. However, historical sources emphasise that the more fertile region in the South had a more powerful leader than the polities in the North. Indeed, the capital of Alodia, Soba, has in repeated excavations revealed major complex monumental buildings such as churches and palaces. Makuria had its capital at Old Dongola, a settlement similar to Soba and it extended into several areas which the new irrigational techniques made it possible to uphold settlements in. Makuria was apparently superior to Nobadia in the North as the latter kingdom was incorporated into the former sometime in the early eighth century resulting in a Makurian-Nobadian union. It is also possible that, at times, Makuria and Alodia shared a common ruler.

The medieval Nobadia, which was centred around Faras, slightly north of the Second Cataract, thrived with an steady increase in population size and prosperity. This is explained by the more peaceful conditions that prevailed after the expulsion of the Blemmyes of the Transitional Period

and the prosperity gained by the re-introduction of long-distance trade between the bordering regions. The Nobadian area is much better known than the ones to the South and there is an obvious continuity in the settlement patterns and major centres from the early Medieval Period until modern times.

Christianity eventually lost its supremacy gradually in the 13th and 14th centuries and Islam was introduced successively through immigration. At the same time, the Nubian kingdoms shrank in size and power. These processes mark the end of Medieval Period in Nubia and are set at around 1500 CE.

1.2.8. The Islamic Period

The post-medieval period up until modern times is conventionally referred to the Islamic Period as a counterpart to Medieval Nubia that was dominated by Christianity. Little archaeological interest has been devoted to the Nubian regions of this time period. The northern parts came to be ruled under the Ottoman Egypt and the Kingdom of Sennar emerged in the area of the previous Alodian Kingdom.

1.3. The Exploration of Nubia

The first known scholarly account of ancient Nubia is the description of the fifth century BCE Greek historian Herodotus[21] who actually never journeyed south of the First Cataract but compiled information from other travellers (Herodotus, 1920, II:29). Other classical writers such as Strabo[22], Diodorus Siculus[23] and Pliny the Elder[24] also make commentaries on contemporary Nubia around the first century BCE and the first century CE. From the late antiquity have survived accounts of the Christianisation of Nubia by writers such as John of Ephesus[25] and John of Biclar (Grillmeier et al., 1996). Medieval Nubia is treated by several Arabic writers, most important among the surviving documents may be the works of Ibn Khuldun (Vantini, 1975:547–562) and Al Maqrizi (Burckhardt, 1819:493–521; Vantini, 1975:585–723).

Post-medieval travellers were few before the time of Muhammed Ali (early 19th century) as Egypt, which most often was the primary destination and starting point for Europan explorers heading towards Nubia, had been considered unavailable due to lack of adequate security. In the second half of the 18th century, James Bruce, a Scottish traveller journeyed through Nubia in order to trace the origin of the Blue Nile (Bruce, 1790). He passed an area outside of the town Shendi (in the northern part of the reach bearing its name), where he encountered remains of ancient monuments whereby he correctly recognised the site as belonging to the ancient city of Meroe[26]. In the wake of the Napoleonic expedition to Egypt (which never ventured south of the First Cataract) the increase of scientific interest in ancient Egypt and Nubia coincided with the improved conditions for travelling. The first scholar to extensively explore Nubia was Burckhardt who made two journeys up the Nile and through the Nubian desert in 1813 and 1814 (Morkot, 2000:8–9). His observations of many of the ancient monuments were published post-humously as *Travels in Nubia* (Burckhardt, 1819).

[21] Books II, III and VII (Herodotus, 1920).
[22] Book XVII (Strabo, 1877).
[23] Chapter I, section 33 (Diodorus Siculus, 1933) and chapter III, sections 2–8, 15–35 (Diodorus Siculus, 1935).
[24] Book VI, chapter 35 (Pliny the Elder, 1855).
[25] Book IV, chapter 53 (John of Ephesus, 1860).
[26] See volume V p. 453 (Bruce, 1790).

William Bankes was another early 19th century explorer who collected numerous plans and drawings of Nubian ruins[27]

By this time, Lower Nubia had become a regular extension to the classic itinerary of European travellers that reached up the Nile through Egypt. However, few travelled beyond the Second Cataract which acted as an efficient road block preventing easy access to Upper Nubia.

In 1828–1829, Jean Francois Champollion and Ippolito Rosellini led the first, large and systematic, expedition with the aim of recording monuments. Their work was published and it includes numerous drawings and plans of sites up until Semna, just south of the Second Cataract (Rosellini, 1832–1844). Substantial contribution was also made by George Hoskins (1835) who documented sites as far as Meroe and made, together with data from classical and biblical sources, grand conclusions on the historical importance of the ancient kingdoms of Nubia (Morkot, 2000:12–13). Another large survey of Nubian antiquities was the Royal Prussian expedition led by Karl-Richard Lepsius 1842–1844. The massive publication of that survey is comparable in scope to the work of the more or less contemporary work of Rosellini and Champollion, but included also Upper Nubia (Lepsius 1849–1859).

By the end of the 19th century, a national interest into ancient history and its monuments arouse in Egypt with extensive activities of the newly formed antiquities organisation founded by Auguste Mariette. This kind of attention was *not* mirrored in the archaeology of Sudan however. The British interests into Sudan were mainly political as the indigenous Mahdists rulers were revolting against the Turco-Egyptian government. British forces finally defeated the uprising and by 1899 the country came to nominally be under Egyptian rule but in reality controlled as a British colony as Anglo-Egyptian Sudan.

At the turn of the century, the by now controversial, Wallis Budge wrote *The Egyptian Sudan, its history and monuments* (1907) and *The Annals of the Nubian kings* (1912). A few scientific investigations on site were also conducted at this time. They were mainly aimed at inspecting and recording the preservational statuses of the ancient ruins (Morkot, 2000:23–24).

The first true archaeological expedition into Nubia was inaugurated by the decision to enlarge the Aswan Dam built 1898–1902[28]. In order to examine and document all Nubian sites that would become inundated by the rising water level, George A. Reisner and Cecil Firth successively led *The First Archaeological Survey* between the years 1907 and 1911 (Adams, 1977:71). The surveyed area stretched from the First Cataract until Wadi es Sebua, that is, the northern part of Egyptian Nubia (see the map in figure 3). The work produced large datasets and Reisner was able to construct the chronological scheme with, what was initially thought as temporary, letter designations for the cultures he discerned (A, B, C and X) (Morkot, 2000:24–25). The majority of the excavated sites were cemeteries and an emphasis was put on the earlier time periods. The expedition also focused primarily on the large number of objects that was retrieved, an attitute natural of the time when the importance of context was not as emphasised as it is today. Contrary to its shortcomings, the work of Reisner and Firth (Reisner, 1910; Firth, 1912; Firth, 1915; Firth, 1927) came to lay the foundation of Nubian studies (Morkot, 2000:26–27).

[27] Recently made available at http://archives.dorsetforyou.com/adlibwebapp/default.aspx.
[28] The water level would thereby be raised from 106 m.a.s.l. to 113 m.a.s.l. (Sampsell, 2003:47).

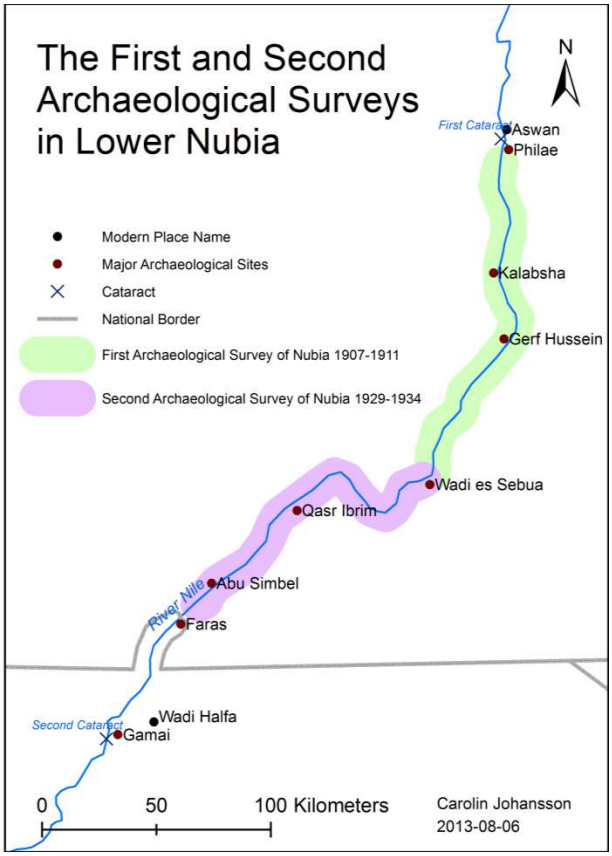


Figure 3. Map illustrating the extents of the First and Second Archaeological Surveys in Nubia.

Several other archaeological missions made substantial work in Nubia during the early 20th century. The Eckley B. Coxe Expedition from the University of Pennsylvania 1907–1910[29] and the Oxford Excavations led by Francis. Ll. Griffith 1910–1913[30] which worked in Lower Nubia, John Garstang at the Liverpool University 1910–1914[31] and the Wellcome Excavations in Upper Nubia 1910–1914 (Addison, 1949; Crawford & Addison, 1951), amongst others, complemented the work of Reisner and Firth with regards to archaeological site types and time periods (Adams, 1977:74–75).

In 1913, Reisner returned to Nubia and led the Harvard-Boston expedition's initial excavations at Kerma (Reisner, 1923a; Reisner, 1923b), investigations of forts around the Second Cataract (Reisner et al., 1960; Reisner et al., 1967) and examinations of royal cemeteries at Napata and Meroe (Dunham & Reisner, 1950–1963).

Another scheduled enlargement of the Aswan Dam[32] made neccesary a second Archaeological Survey covering the area between Wadi es Sebua and the national border between Egypt and Sudan (see the map in figure 3). In other words, all of Egyptian Nubia was to become inundated up to the new water level. Bryan Emery and Laurence Kirwan directed that expedition during the years 1929–1934 (Morkot, 2000:29–30). The results (Emery & Kirwan, 1935) reflected those of the survey of Reisner and Firth but added a significant highlight of Lower Nubia; the investigation of rich royal tombs of the X-group at Ballana and Qustul (Emery & Kirwan, 1938). In parallel with the Second Archaeological Survey of Nubia, an extensive inventory of churches and other Christian remains was performed by Monneret de Villard (1935).

Meanwhile, the Oxford University Excavations were resumed with work on pharaonic and Napatan temples at Kawa in the Dongola reach 1929–1936 (Kirwan, 1936) and X-group tombs at Firka at the Abri-Delgo reach 1934–1935 (Kirwan, 1939). Egypt Exploration Society worked on pharaonic remains in 1937 at Sesebi in the Abri-Delgo reach (Blackman, 1937) and in 1938–1939 and 1947–1950 at Firka (Fairman, 1939; Shinnie, 1951).

[29] Published as *Eckley B. Coxe Junior Expedition to Nubia 1–8* between 1909 and 1911 by University of Pennsylvania, University Museum.
[30] Published as *Oxford Excavations in Nubia* between 1921 and 1928 in *Annals of Archaeology and Anthropology (Liverpool)* volumes 8–9.
[31] Preliminary reports from the years 1910–1916 are found in *Annals of Archaeology and Anthropology (Liverpool)* volumes 3 –7.
[32] This time, the water level would be raised up to 121 m.a.s.l. (Sampsell, 2003:47).

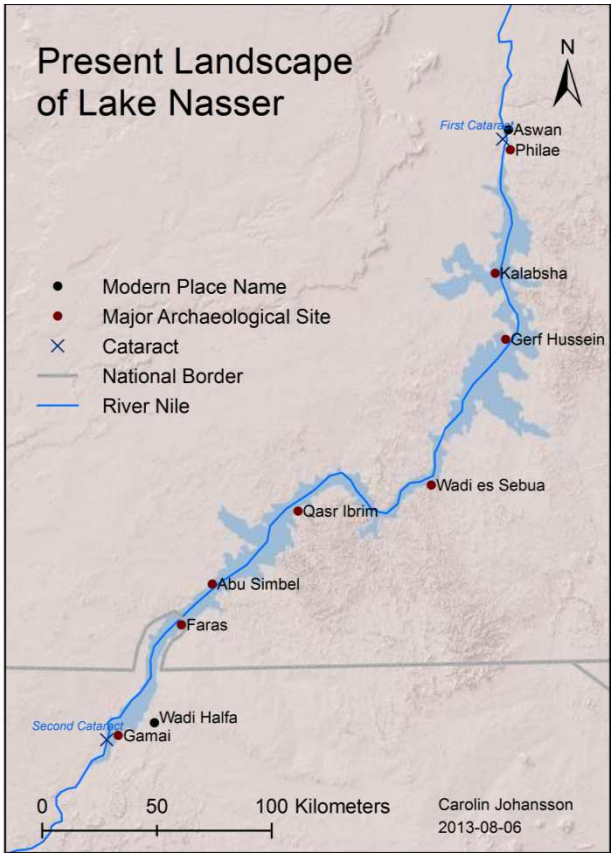


Figure 4. Map illustrating the present landscape of Lake Nasser. Major sites of importance are indicated. The approximate stretch of the old River Nile is superimposed for reference.

Foreign archaeological activity was absent during the years of the Second World War and immediately after (Adams, 1977:77). An expedition of the Khartoum University examined Neolithic remains around the Second Cataract at 1948 (Myers, 1948a) and 1957 (Myers, 1958). The Sudan Antiquities Service also started a series of excavations. It examined Mesolithic and Neolithic remains in the southern parts of Upper Nubia during the years 1944–1945 (Arkell, 1949a) and 1949 (Arkell, 1949b). Christian remains were investigated at the Upper Egyptian site of Soba 1950–1952 (Shinnie, 1955) and X-group tombs at Tanqasi at 1953 (Shinnie, 1954). The tomb of Djehuty-hotep in Lower Nubia was first documented by Hassan Thabit in 1955 (1957).

In 1953–1954, a French mission directed by Jean Vercoutter examined pharaonic remains in Lower Nubia (Vercoutter, 1955) and at Sai Island in 1954–1957 (Vercoutter, 1958). The fortress at Buhen was investigated by Emery for the Egypt Exploration Society at 1957–1965[33]. Further pharaonic monuments were the foci of The University of Pisa at Upper Nubian sites of Soleb 1957–1963[34] and Seddenga 1964[35]. The Upper Nubian area of Butana and the Meroitic city of Musawwarat were investigated by the Humboldt University at 1957–1958 (Hintze, 1959) and 1960–1970[36] respectively.

1.3.1. The High Dam and the International Nubian Campaign

In the years following the Second World War it became evident that the economical benefits of the Aswan Dam were not sufficient to uphold the accelerating population growth that Egypt was experiencing. A lot of water were yearly lost into the Mediterranean as the capacity of the dam was limited. It became obvious that the country could no longer maintain a decent standard of living based on agriculture solely. An industrialisation was deemed necessary which required that an indigenous source of energy had to be sought. The apparent solution to both those issues was the construction of a new, even larger, dam. The government chose to implement the decision of building the High Dam in order to avoid human suffering after a recommendation by an international committee in 1954 (Säve-Söderbergh, 1987:50–52).

[33] Published as a series of articles in *Kush* volumes 7–12 between the years 1959 and 1964, see also Emery et al. (1979).
[34] Published as a series of articles in *Kush* volumes 6, 7, 9, 10 and 12 between the years 1958 and 1964, and *Levante* volumes 5–9 between 1958–1962.
[35] Published as a series of articles in *Kush* volumes 13–15 between the years 1965 and 1968.
[36] Published as a series of articles in *Kush* volumes 10, 11 and 15 between the years 1962 and 1968.

The High Dam, or the Sudd el-Ali, planned to be built slightly upstream of the old Aswan dam[37], was to become an enormous construction, 3600 m in length, 980 m in breadth at the base and 40 m at its top and thus required immense quantities of building material and labourers. The water level upstream of the dam would be raised approximately 60 m up to the current maximum level of about 175–180 m.a.s.l. The potential benefits of the dam were essential: Its capacity would suffice to regulate the necessary water supply year-round in Egypt with margins to compensate potentially devastating inundation deviances (Säve-Söderbergh, 1987:53). The total cultivable area in Egypt was to be substantially enlarged. Harvest would no longer be restricted to one time per year and thus new crops could be introduced. Simultaneously, the dam would supply a large part of the country's energy need. Although the benefits were crucial, several serious disadvantages were realised already at an early stage: About 100 000 Nubian inhabitants were about to lose their homes as the area between the dam and the Second Cataract was to become inundated by the rise of the water thus transforming the Nile river and its inhabited shores into a 50 km long artificial lake, the Lake Nasser (see the map in figure 4). Submerged together with the modern villages would also be remains of ancient settlements, cemeteries and monuments that dotted the Nile Valley of Lower Nubia. Other side-effects of the dam have been noted along the way: Economical losses were caused by the need to increase the use of fertilisers in the absence of annual silt deposits that the inundation previously brought (Säve-Söderbergh, 1987:54–56). Also affecting the farming is the build up of salts in the soil. Ecological changes affected the fishing industry negatively in the North but increased substantially at the newly created reservoir area. The constantly filled irrigation canals have provided new habitats for the snail host of the parasite causing Schistosomiasis but these effects have been counter-acted by increased health and medical measures. There are also geological effects of the dam as the construction itself and the amount of water in the reservoir exerts seismic pressure on the basement rock causing an elevated risk of earthquakes and a change in ground-water levels (Gupta, 1992:173–188).

A relocation programme was set up in order to provide new settlements for the populations of Lower Nubia. New villages were erected in the area of Kom Ombo in Upper Egypt for the inhabitants of Egyptian Lower Nubia while the Sudanese populations in need of evacuation were offered new homes in Khasm el-Girba, far away in Upper Nubia. Much emphasis was put on documenting the local habits and traditions of the Nubian people as well as making efforts to preserve the social organisations while planning their new villages (Dafalla, 1975; Hinkel, 1978; Riad & Abdel-Rasoul, 2007). An official initial inventory of the endangered monuments was made and it was anticipated that only a few of those monuments could completely or partially be relocated in order to save them from destruction. An appeal for scientific and economic collaboration was sent to organisations world-wide. The result was limited as only a few archaeological excavations were launched in the end of the 1950's. Efforts were put mainly on documentation and epigraphy in order to provide records available for future studies at a time when the monuments were no longer accessible. However, in 1959, a few dedicated individuals managed to pursue the idea that the monuments indeed *could* be saved and that the limited resources of the Egyptian and Sudanese states necessitated assistance from the UNESCO. It was argued that the preservation of the cultural heritage of Nubia was not only a national concern but an interest of the whole humanity. A program was set up in which foreign missions were invited to contribute with archaeological excavation, documentation, mapping and technical aid in the relocation of certain monuments. Both countries

[37] See the explanatory sketch in Hinkel (1978:14).

offered any participating mission a 50% share of recovered objects. Egypt could also present attractive concessions in other parts of the country and considered to donate some of the rescued monuments to the countries that had made the most significant contributions. Sudan emphasised the yet mostly unknown archaeology of Lower Nubia which would offer participating organisations the chance to contribute with ground-breaking discoveries (Säve-Söderbergh, 1987:64–73).

The launching of the International Nubian Campaign was indeed urgent. The work on the dam was to begin in 1960 and within a few years the water was about to start rising. Important international culture personalities were chosen to compromise an honorary committee and intensive media campaigns were organised with the aim of spreading awareness of the Nubian cultural heritage and its immediate threat of destruction. Egypt sent two major exhibitions[38] on international tour in order to raise money for and promote the issue (Säve-Söderbergh, 1987:73–78). Despite its short notice and several delays the salvage campaign was a success. A large number of countries participated with finances, expert consulting, technology and extensive archaeological surveys in addition to the efforts of Egypt and Sudan[39]. Most of the major monuments along the Nile of Lower Nubia were rescued by dismantling followed by relocation and re-building (see figure 5), either to higher elevation at locations nearby, to the museum of Khartoum or the planned museum at Aswan or, in a few cases, donated as gifts to be set up in countries abroad (Säve-Söderbergh, 1987:137–144). Large areas of the landscape to be submerged were surveyed and excavated by archaeologist of numerous nationalities yielding great amount of data of which some was to become published in the following decades (Säve-Söderbergh, 1987:187–216)[40]. Most attention was directed to the spectacular move of the giant temples of Abu Simbel in the 1960's (Säve-Söderbergh, 1987:98–126) and the relocation of the temples on Philae in the 1970's[41] (Säve-Söderbergh, 1987:151–186). These technical endeavours with significant infrastructural challenges yielded much notice in themselves and credits to the participating nations. The great success aside, several monuments were not possible to save because of lack of time and resources or because of construction methods. Among those were the majority of Lower Nubia's mudbrick built fortresses as well were numerous churches. However, efforts were taken to thoroughly document those, frescoes were dismantled and architectural fragments were removed from monuments that could not be saved completely.

Figure 5. Photograph of the Graeco-Roman temple of Dakka. This is one of the relocated temples of Lower Nubia, re-erected at Wadi es-Sebua. Photography by the author.

[38] The *Five thousand years of Egyptian Art* and the first *Tutankhamon* exhibition.
[39] See a comprehensive list and map of participating missions in Adams (1977:83–87) or Säve-Söderbergh (1987:223–226) as well as Bardeschi (2002) for an updated bibliography.
[40] For a comprehensive list of publications up until the year 2000, see Bardeschi (2002).
[41] Philae was actually located downstream of the High Dam but because it was upstream of the old Aswan Dam it was already periodically inundated and the temples were in need of relocation in order to be preserved for the future. The Isis temple and other minor buildings were moved in pieces to be re-erected at the island of Agilkia at higher ground.

1.3.2. The Scandinavian Joint Expedition to Sudanese Nubia (SJE)

As the Scandinavian countries of Denmark, Norway, Sweden and Finland had a tradition of collaboration with regards to issues within UNESCO, it was natural for them to respond to the appeal for salvage archaeology with a united effort: The Scandinavian Joint Expedition to Sudanese Nubia (from here on abbreviated as SJE). In 1960 the four countries agreed to conduct an archaeological investigation in the Sudanese part of Nubia. As much work had already been done in Egyptian Nubia during the surveys related to the adaptations of the old dam while the Sudanese part was largely unknown, it was argued that this was the area that was most urgent to explore.

The Sudanese authorities offered a concession at the eastern bank of the Nile, from the border to Egypt until the Second Cataract, which the expedition accepted. The cooperation between the four countries had the benefits of bringing together expertise in different fields and the collective financial effort made it possible to work on a larger scale than if the countries had worked separately. It was decided to primarily dedicate the expedition to surveying the whole area rather than to focus on excavation of specific sites because that strategy was more fitting the expertise of the Scandinavian archaeologists *and* because an emphasis on scientific data rather than objects was an intentional policy of the funding authorities (Säve-Söderbergh, 1970:14–15).

The SJE spent the first field work season already in the winter of 1960–1961 and continued with three more seasons in the following years ending in 1964 (Säve-Söderbergh, 1970:15), just in time before the water levels started to rise in the second half of 1964 (Säve-Söderbergh, 1987:105).

1.3.2.1. The Concession Area of the SJE

The limits of the concession area were the national border between Egypt and Sudan in the area of Faras in the North, the eastern shore of the Nile (with arbitrary inclusions of islands) and the ravine Khor Abu Dom in the South, slightly upstream of the Second Cataract in the district of Gamai. As one of the largest, if not *the* largest concession area in the whole International Nubian Campaign, the total length was about 60 km. The eastern limit was more diffuse and in some cases seemingly arbitrary. In the northern district, it was restricted by the national border that enclose some part of the Nile Valley from the eastern desert, both to the North and the East (see the map in figure 6). In the southerly parts, the 180 m.a.s.l. contour was aimed at as an eastern boundary for the investigation as that was the level at which the waters of Lake Nasser was going to reach after the filling of the reservoir was completed (Hans-Åke Nordström, personal communication). The archaeological remains located in the higher desert were mostly Palaeolithic and Mesolithic. Those sites were by agreement ceded to the Combined Prehistoric Expedition to Egyptian and Sudanese Nubia (from here on abbreviated as CPE). Most of the larger islands of the Second Cataract were surveyed by the SJE, however the islands north of the cataract were not surveyed (Hans-Åke Nordström, personal communication)[42].

A few exclusions were made from the concession: The Middle Kingdom fortress of Serra and its immediate surroundings were awarded the Chicago Oriental Institute[43] (marked in green in the map in figure 6). The Spanish expedition led the investigations of two Christian sites on the islands of Abkanarti (Almagro et al., 1963; Presedo Velo, 1965) and Kasr Ico (Almagro et al., 1963; Presedo Velo, 1963). Moreover, the SJE was not allowed to excavate in inhabited areas, thus the region

[42] There is at least one obvious exception, namely the site 119 located on an island in the district of Sahaba.
[43] See Hughes (1963), Knudstad (1966) and Williams (1995).

covered by Halfa town and the many small villages was in general not available for examination. The desert plain around the air field in Wadi Halfa was also excluded. In addition to the East Bank concession, the tomb of Amenemhet at the West Bank in the Debeira district (site Q) was also excavated by the SJE. From the records it is also obvious that the survey sometimes exceeded its limits in the estern desert as some of the recorded sites are indeed beyond the boundary of the 180 m.a.s.l. contour and should thus still, theoretically, be accessible.

Basic physiography splits the concession area into two natural regions. The southern part is the area of the Second Cataract where the basement complex, comprised mostly of pre-cambrian granite and other igneous and metamorphic rocks characteristic of the Batn el-Hagar is exposed creating a rough and inhospitable topography (Heinzelin et al., 1963). This area is in the SJE concession divided into the districts of Gamai and Abka (see the map in figure 6). The Nile here is severely impeded by numerous boulders, islands and streams, it is not surprising that this was the grand final destination for most of the 19th century travellers visiting Nubia. Many left their name on the cliff of Abu Sir[44] located on the West Bank from which the Second Cataract was viewed:

> ***The Cataract – an immense multitude of black and shining islets, among which the river, divided into hundreds of separate channels, spreads far and wide for a distance, it is said, of more than sixteen miles, – foams at our feet. Foams, and frets, and falls; gushing smooth and strong where its course is free; murmuring hoarsely where it is interrupted; now hurrying; now loitering; here eddying in oily circles; there lying in still pools unbroken by a ripple; everywhere full of life, full of voices; everywhere shining to the sun. [...] To the east, still bounded by out-liers of the same disconnected chain [of mountains to the North], lies a rolling waste of dark and stony wilderness, trenched with innumerable valleys through which flow streams of sand.***
>
> ***(Edwards, 1888:302)***

The northern region constitutes the lion part of the concession with the districts (from south to north) Halfa Degheim, Wadi Halfa, Sahaba, Ashkeit, Debeira, Serra and Faras. It is dominated by the layers of Nubian Sandstone that is superimposed on the basement complex (Heinzelin et al., 1963:74). The Sandstone is exposed in the desert where erosion has created a platform landscape increasing in elevation with distance from the river. The floodplain though, is covered by several layers of sediment deposits each comprising a terrace partially overlying the previous one. The geological sequence has been established and the different units dated by Wendorf et al. (1965)[45]. The relatively smooth and uniform landscape is interrupted by numerous inselbergs[46] and the wadi formations directed towards the river. The landscape and archaeology of each district is described by Säve-Söderbergh (1970:19–24) and a detailed geological account is presented by Heinzelin (1968).

[44] See figures 13 and 14 in Keating (1962).
[45] See especially the explanatory figure 2 in Wendorf et al. (1965).
[46] An inselberg is an "isolated mountain or hill in a desert landscape created by progressive cliff retreat, so that the hill is surrounded by a pediment or an alluvial fan."(Marshak, 2005:G10).

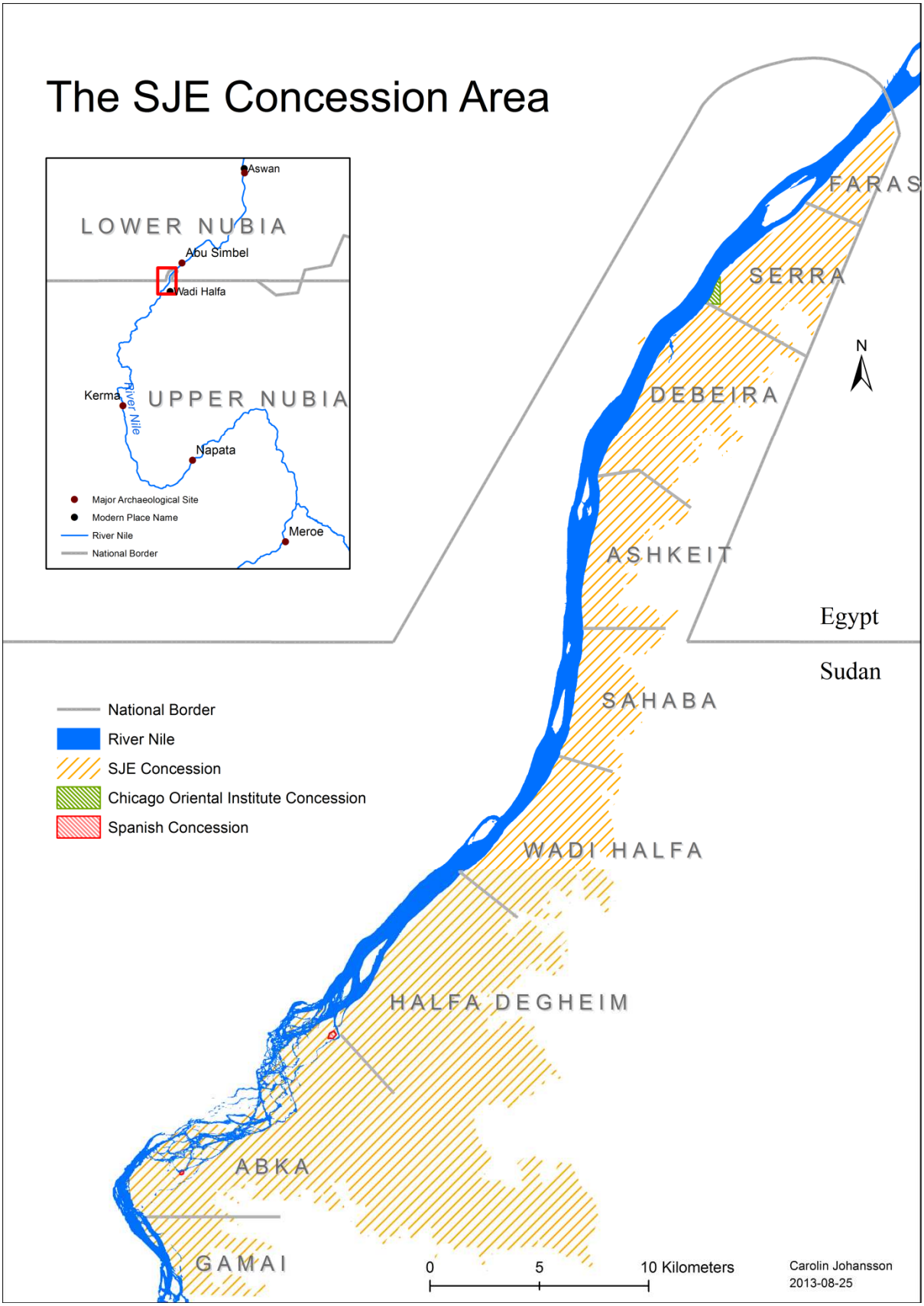


Figure 6. Map illustrating the concession area of the SJE. The orange-coloured, dashed representation symbolises the extent of the concession area, limited in the east by the 180 m.a.s.l. contour. Areas ceded to other expeditions are represented in green and red. The red square in the inset indicates the extent of the view relative to the geography of the whole of Nubia.

1.3.2.2. Previous Investigations in the SJE Concession Area

Previous to the SJE, very little archaeological work had been conducted in the concession area. The Eckley B. Coxe expedition (Mileham, 1910) and Monneret de Villard (1935) had briefly investigated the church remains. Vercoutter (1959) had examined two so-called gold-washing stations in the Faras district. Three New Kingdom tombs in the Debeira district had been previously described (Thabit, 1957; Nigm ed Din Mohammed, 1960). Oric Bates had examined several cemeteries in the Second Cataract area (Bates & Dunham, 1927). J. H. Dunbar surveyed Nubian rock-drawing sites (Dunbar, 1934; Dunbar, 1941) of which four were also included also in the SJE survey (Säve-Söderbergh, 1970:27). Oliver Myers led The Gordon Memorial College Expedition to Abka at several occasions where he examined rock-drawing sites. Before the launch of the SJE, his results had only been preliminary published (Myers, 1948b; Myers, 1950; Myers, 1958; Vaufrey, 1958; Myers, 1960; Palma di Cesnola, 1960). A large amount of Myers' material was instead incorporated into the publication of rock art sites of the SJE (Säve-Söderbergh, 1970:237). Given the large size of the concession area, the relatively short list of previous investigations above confirms that the object of investigation taken on by the SJE was largely unexplored ground.

1.3.2.3. The Method of the SJE Survey

It had initially been expected that the task of surveying the concession area could be performed with only brief investigations of the different localities. However, it turned out that most of what was found needed a complete investigation and it was acknowledged that information on whatever the expedition did *not* undertake would be lost forever (Säve-Söderbergh, 1970:14–15; Säve-Söderbergh, 1996:177). The SJE aimed at collecting as much data as possible without any preconceptions about scientific importance of different types of sites or time periods represented (Säve-Söderbergh, 1970:17; Säve-Söderbergh, 1996:177). Thus a total investigation of all the available parts of the concession area was deemed necessary. Aided by a topographical map series at 1:25 000 in scale (described in detail in section 3.1.1.) and a set of aerial photographs, the ground was surveyed mainly by walking across it. Trial excavations were made at suspicious spots with surface finds or as indicated by systematic iron rod probing (Säve-Söderbergh, 1970:17–18). As erosion had obliterated almost completely all but the subsurface remains of most of the sites, they were not readily discovered. This also meant that a substantial part of all investigated burials were found unplundered (Säve-Söderbergh, 1996:178). Each excavation team consisted of one archaeologist and a group of workers. Thereby the expedition could spread out geographically and work at several places at the same time, a strategy that turned out to be efficient as local knowledge accumulated (Säve-Söderbergh, 1970:17–18). The, slightly unorthodox, practice of employing workers locally instead of bringing specialised labourers[47] was carried through with great content. It turned out that the local workers were well suited, and indeed motivated for, the task of documenting their own cultural heritage[48] (Säve-Söderbergh, 1996:181). A single headquarter (located initially in Debeira[49] and in the last season in Wadi Halfa) was sufficient to coordinate the

[47] See the note on the rather prejudiced ideas about the suitability of workers with regards to their geographical origin in Säve-Söderbergh (1996:176).

[48] The Nubians are often described in very positive terms, emphasising their peacefulness, hospitability, honesty, pride and obvious tolerance (Dafalla, 1975; Hinkel, 1978). At the same time they were working with the foreign archaeologists they were in the middle of preparing a forced evacuation from their ancestral origin towards a largely unknown and distantly located future home.

[49] See figure 64 in Keating (1962).

whole expedition. The centralised strategy facilitated the communication within the expedition team and provided suitable storage for shared equipment (Säve-Söderbergh, 1970:17–18).

A wide range of site types was recognised and indexed. Most of the sites were excavated entirely, plans were drawn, rock art sites and objects were photographed and catalogued. The finds were divided in cooperation with the Sudanese authorities which chose to keep only those objects that were not already well represented in their own collections (Säve-Söderbergh, 1970:17–18). The Palaeolithic and Mesolithic sites were readily offered to the Combined Prehistoric Expedition that had better pre-requisites to investigate them (Wendorf, 1968; Marks, 1970). Two pottery kilns found in Debeira were ceded to the analysis of William Adams (1962).

1.3.2.4. General Results of the SJE

Initial reports of the SJE were published in Kush volumes 10, 11, 12 and 15 by Torgny Säve-Söderbergh (1962; 1963a; 1964; 1967–1968). A final publication was accomplished successively between 1970–1991 in a series of nine volumes as *The Scandinavian joint expedition to Sudanese Nubia publications* edited by the same author:

1. **The Rock Drawings**: including the results of the Gordon memorial college expedition to Abka (Hellström, 1970a; Hellström, 1970b)
2. **Preceramic Sites** (Marks, 1970)
3. **Neolithic and A-group Sites** (Nordström, 1972a; Nordström, 1972b)
4. **Middle Nubian Sites** (Säve-Söderbergh, 1989a; Säve-Söderbergh, 1989b)
5. **New Kingdom Pharaonic Sites** (Holthoer, 1977; Säve-Söderberg & Troy, 1991a; Säve-Söderbergh & Troy, 1991b)
6. **Late Nubian Cemeteries** (Säve-Söderbergh, 1981)
7. **Late Nubian Sites** (Gardberg, 1970)
8. **Late Nubian Textiles** (Bergman, 1975)
9. **Human Remains** (Vagn Nielsen, 1970)

This extensive collection of volumes includes a catalogue of the most important sites and objects together with descriptions and brief conclusions of analytical results. It all adds to about 2250 pages including 1230 plates. The total surveyed area, about 150 km^2 (Säve-Söderbergh, 1996:181), yielded more than 450 indexed archaeological sites ranging in age from the Palaeolithic to the Islamic Period. There was a wide variety of sites including settlements, churches, rock drawing sites and cemeteries. The most common site type was burial sites of which about 4200 tombs were excavated. Approximately 3000 complete New Kingdom vessels were unearthed (Holthoer, 1977:1) and even more textile fragments were conserved and published (Bergman, 1975). Anatomical examinations consisting of tens of thousands of measurements were made on human remains of about 1500 examined individuals (Vagn Nielsen, 1970:14). The concentration of rock art in the Second Cataract area was one of the highest in all of north-eastern Africa (Säve-Söderbergh, 1996:182). Almost 7000 incised or hammered figures in 294 rock drawing stations were recorded (Hellström, 1970a).

With regards to amount of data, the survey of the previously unknown and perhaps overlooked area of the SJE concession, was truly successful. Moreover, analyses and interpretation of that data contributed with valuable information on topics covering a range of time periods. Major emphasis has been put on the results from the Egyptian New Kingdom occupation of Nubia, described in

volume 5. The local administration of the Egyptian colony during the 18th Dynasty has become better understood after the SJE study of the tombs of the two brothers Djehuty-hotep and Amenemhet[50]. During the reigns of Hatshepsut and Tuthmosis III, the two brothers successively had the rank of princes[51] of  (*tḥ-ḫt*), an administrative region centred at modern Debeira (Säve-Söderbergh, 1991a). The tomb of Djehuty-hotep (site 36) had been excavated by Hassan Thabit (1957) previous to the SJE. That partially unplundered tomb contained texts that provided information on the identity and titles of Djehuty-hotep along with the names of his immediate family. Tomb paintings in a clear-cut Egyptian style were partly preserved[52] and possible to reconstruct (Säve-Söderbergh, 1960). The tomb of his brother, prince Amenemhet, was discovered by the SJE by chance as the expedition was asked to overtake the excavation of a tomb chamber located beneath an Islamic prayer place at the West Bank of the Debeira district (site Q). The inscriptions confirmed Amenemhet as the successor of his brother Djehuty-hotep and completed the genealogy of the family. Reconstructions based on architectural remains clearly pointed to a pyramid-shaped superstructure of the tomb comparable with examples from early New Kingdom Egypt (Säve-Söderbergh, 1963b). Despite their clearly egyptianised character displayed by their tombs, Säve-Söderbergh argues that these individuals were indeed Nubian in origin as opposed to immigrant Egyptians[53] (Säve-Söderbergh, 1963b:188; Säve-Söderbergh, 1991b). Another major find from the New Kingdom Period located at Fadrus in the Debeira district (site 185) was an immense cemetery, found largely undisturbed (Säve-Söderberg & Troy, 1991a:212–293). The SJE excavated approximately 700 tombs at Fadrus and found that it was also dominated by Egyptian-style burial customs. However, the absence of writing and essential objects such as ushebtis and scarabs, even in the richer tombs, resulted in the conclusion that its population was indeed also Egyptianised Nubians and not Egyptians (Säve-Söderberg & Troy, 1991a:9). The vast amount of data enabled a basic chronology of the cemetery by performing a correspondence analysis of 512 of the tomb units and 171 attributes (Sinclair & Troy, 1991:172–184; Troy, 1991:220–239). The same methodology had previously been applied on an inter-site level for Middle Nubian cemeteries. The results confirmed the cultural classifications of C-group, Pangrave and Transitional of those (Sinclair & Troy, 1989; Sinclair &Troy, 1991:166–169).

[50] These individuals were previously known by name from occasional contexts (Säve-Söderbergh, 1941:184).

[51] The slightly misleading translation of the title  (*wr*) into "prince" as used in the publications of the SJE, is adopted also in this text in the lack of a better alternative.

[52] See e.g. the banquet scene in figure 51 of Säve-Söderbergh & Troy (1991a:200).

[53] An illustrious example is that Djehuty-hotep is also occasionally referred to as Pa-itsy, a Nubian name , in texts in his tomb (Säve-Söderberg & Troy, 1991a:201).

2. Aim and Objectives

As seen above, the SJE collected and presented a vast amount of data of a large and largely continuous concession area of Lower Nubia. Moreover, the total investigation approach together with the expedition's thoroughness make it not far-fetched to argue that what was documented is a fair image of what was actually there to find. Säve-Söderbergh puts it this way in the introduction to the first volume of the SJE publication:

> ***When the Expedition finished its work in the concession area after four campaigns, we felt that it was no exaggeration to say that this part of Nubia was one of those which had been investigated in the greatest detail and that practically no site of any importance had been left entirely unexcavated. ..... (Säve-Söderbergh, 1970:14)***

Therefore, one might claim a certain amount of representativity among the recorded archaeological sites with regards to site type, time period and geography[54]. With these observations in mind it was deemed that the records of the SJE would be a suitable dataset to apply *Geographical Information System* (from here on abbreviated as GIS) technology onto.

A GIS is a system, in the contemporary sense of the word exclusively computerised, that is used for collecting, storing, visualising and analysing geographical data. The application of GIS technology in the field of archaeology is frequently valuable as a GIS has the ability to both illustrate *and* analyse spatial patterns of human activity in relation to the environment. The practical uses of GIS in archaeology are exemplified by thematic map making, landscape reconstruction and spatial analyses such as visibility, route tracking and predictive modelling. Although not a new phenomenon[55], GIS has become increasingly accessible to archaeologists through technical advances and is now routinely used as an archaeological tool (Conolly & Lake, 2006). Regarding the archaeology of Nubia, in which landscape-oriented perspectives have a strong tradition (Grzymski, 2004), modern GIS has seemingly been sparsely employed. To the knowledge of the author, no previous work had analysed the geographical aspects of the SJE data and concession area in a digital way and on a regional scale. This motivated the topographical reconstruction of the concession area and a compilation of site-specific data to be used together with it. The aim was that the digitally reconstructed archaeological landscape could act as a base on which archaeologically motivated and geographically related enquiries could be made on the SJE data on an inter-site level. The fact that the landscape to be reconstructed is today completely destroyed and totally inaccessible is another, largely unique, aspect of this particular area that increases the relevancy of this project.

[54] With the obvious reservation for potentially different preservation conditions and some exceptions that will be discussed below.

[55] Digital elevation model creation, site catchment analysis and intervisibility assessment were applied on the archaeology of the Island of Hvar in Croatia more than two decades ago (Gaffney & Stancic, 1991).

The objectives of this project can be summarised into two major components:

1. **Digitalisation and Classification**
    a. To reconstruct the landscape in the SJE concession area in terms of the topography of the habitable land in relation to the past stretch(es) of the Nile and the surrounding desert.
    b. To compile geographical and other relevant data of the archaeological sites indexed by the SJE into a database that can be used together with the reconstructed landscape of 1.a in a GIS for spatial enquiries on an inter-site level.
2. **Validity and Applicability**
    a. To assess the success of 1.a in terms of accuracy by comparison with data in other formats.
    b. To examine the usefulness of what will be achieved in objective 1 by performing a few archaeologically relevant geographical analyses on the SJE sites and to demonstrate the results.

3. Material and Methods

3.1. Analogue material

3.1.1. Topography

The geographical basis of the SJE documentation was the *Egypt New Series* map in the scale 1:25 000 (Säve-Söderbergh, 1970:17). It had been prepared by the Army Map Service (AM), Corps of Engineers, U.S. Army, Washington, D.C. for the Government of the Republic of Egypt and the Foreign Operations Administration of America. Compilation of aerial photography by stereo-photogrammetric methods was performed in 1953 and the map sheets used in this project were printed by the Sudan survey department in 1960. The map had not been field checked. The projected coordinate system used, the *Egypt Red Belt* is defined as in table 1 (Mugnier, 2008:1307).

Egypt Red Belt	
Projection	Gauss Transverse Mercator
Datum	Egypt Datum of 1907
Geographic Coordinate System	Egypt 1907
Central Meridian (λ_0)	31°E
Central Parallel (φ_0)	30°N
False Easting	615 000m
False Northing	810 000m/1 810 000m[56]
Scale Factor at Origin (m_o)	1.0

Table 1. Definition of the projected coordinate system Egypt Red Belt.

The following map sheets, preserved in the documentation archive of the SJE, cover the complete concession area of the SJE[57] and were the primary source of topographical information for the present study:

- SARA
- ARKIN
- DEBEIRA
- ANQASH
- WADI HALFA
- ABKA
- MURSHID

The maps 1–6 of SJE volume 1:2 (Hellström, 1970b), indicating features such as ground cover and district divisions, were used for guidance.

3.1.2. Site-specific Data

The final publication of the SJE was organised into themes based on chronology or find types (see section 1.3.2.4) and included data based on about two thirds of the indexed archaeological sites. For

[56] South of the false origin (located 810 km south of the origin), an additional 1 000 000m should be added to the northings.

[57] With the exception of the easternmost part of the plain near Wadi Halfa where no sites were recorded by the SJE even though the area is now inundated.

almost all of those sites, basic geographical data was accounted for in the form of coordinates that had been approximated from the Egypt New Series map and brief descriptions of the site and the surroundings. The sites that were *not* included in the publication were those of which information was considered too meagre or uncertain to be of significant relevancy[58]. Information on those sites was available in the expedition's original documentation (*Site List*).

The sites recorded by the SJE were given cardinal numbers (site number) in the order of their discovery date. Therefore, the site number has not necessarily any correlation to geography or to the content of the site. Some sites were divided into sub-sites by adding of an uppercase letter to the site number (e.g. 18A). Rock-drawing sites were divided into stations[59] of one or several drawings. These sub-sites were indicated by lowercase letters following the site number (e.g. 169a). Most of the sites were referred to as geographical points, that is, the coordinates given designated a location without extension. In some cases though, the size of the site was indicated by giving its extent in terms of a distance in one or two directions, thus describing a line or an area. It was not uncommon that several types of archaeological remains were found at the same site and that more than one time period or culture was represented, therefore are many of the published sites described in different SJE volumes.

3.2. Remote Sensing Data

Elevation data for the current landscape around Lake Nasser was retrieved by the Shuttle Radar Topography Mission (from here on abbreviated as SRTM) in the year 2000. Two entities with ID numbers SRTM3N22E031V1 and SRTM3N21E031V1 together contained an area surrounding the SJE concession. These were available in a resolution of three arc seconds[60] and in the WGS84 datum. The data was accessed through the U.S. Geological Survey[61] and licensed for unrestricted use.

3.3. Database Construction

A list of all the sites indexed by the SJE was constructed in the spreadsheet software Microsoft Excel 2007 (Microsoft, 2007a) by collecting information from the SJE volumes where basic geographical facts were listed. It was also noted in which contexts the sites were mentioned and a system was established in order to classify the sites with regards to their types. The list was completed by the expedition's original site list where information on unpublished sites were found. Discrepancies in the data between the sources (e.g. coordinate values) were solved by adopting the majority rule and/or by comparison with other known facts (e.g. closeness to another site or area description). The following attributes were sought for each of the sites:

3.3.1. Site Number

Site numbers were recorded as given by the SJE, each site number constitutes one entry (row) in the list. Some of the sub-site designations were kept as separate entries where sufficient information was available to keep such a distinction relevant[62]. The list is by default sorted by this attribute.

[58] In many cases undateable.
[59] Up to 26 per site.
[60] Approximately 90 m.
[61] http://earthexplorer.usgs.gov/.
[62] E.g. separate coordinates.

3.3.2. Geographical Coordinates

It was possible to find the approximated coordinates for 460 individual sites or sub-sites. These had originally been established by use of aerial photographs and the basemap and *not* by original measurements (Hans-Åke Nordström, personal communication). Some obvious errors in coordinates were encountered in which most could be spotted and corrected when the sites were plotted on a map in a GIS. For sites that were described as a line or a rectangle, a midpoint was calculated and used to express the location. Eastings were listed as X-values and northings as Y-values. An additional attribute was reserved for corrected Y-values in which the second false northing was subtracted (see table 1) as the GIS software used can't handle a coordinate system with ambiguous Y-values. Elevation values were available for a few of the sites and collected as Z-values (topographical level). These were in most cases also approximations made from studying the map and not original measurements (Hans-Åke Nordström, personal communication). An additional attribute was reserved for corrected Z-values in which a three meters error in the elevation values of the basemap noted by the SJE (Säve-Söderbergh, 1970:17) had been subtracted[63]. In cases an interval was given, the arithmetic mean was applied.

3.3.2.1. Note on the Coordinate Values

The number of significant digits used in the coordinates varies between the catalogues and may not reflect differences in accuracy. Moreover, it is important to note that midpoint coordinates calculated from a range have not been rounded off more than to the nearest integer and are indeed not more accurate than the original coordinates.

3.3.3. Description of Location

The district for each site was recorded as given in table 2 according to the SJE documentation or by comparison of the given coordinates with the maps 1–6 in SJE 1:2 (Hellström, 1970b) in cases where such information was lacking. In some instances, place names such as villages were given in the catalogues and these were recorded into the database as well into a separate field. Estimated distances to the Nile were also registered when available.

District
FARAS
SERRA
DEBEIRA
ASHKEIT
SAHABA
WADI HALFA
HALFA DEGHEIM
ABKA
GAMAI

Table 2. District divisions of the SJE concession.

3.3.4. Comments

Two fields in the site database were dedicated to various comments that were collected during the compilation of the list. One was reserved for notes deduced from the SJE publication and one for those of the original Site List. These fields were also used to store information on corrections or

[63] It was chosen to *not* correct for that deviance in the SJE publication (Säve-Söderbergh, 1970: 17). However, as the current project aims at compatibility with other data (SRTM), it was deemed appropriate to account for that in the present study.

other modifications made on the data through the course of the work. The notes were intended as a guide for the author when compiling data and comparing sites, the information was not classified and the information was not incorporated *per se* into the GIS-analyses.

3.3.5. Classification of Sites

The non-geographical characteristics of each site were categorised in order to facilitate queries onto the dataset. The divisions and terms largely coincide with those used by the SJE. Attributes that were considered uncertain were recorded with a question mark appended. Fields that were not applicable or those with unknown values were left blank.

Each site (entry) was given up to three site type designations (numbered 1–3) as it sometimes occurred that a single site number represented more than one type of archaeological remains. Each type may, in turn, be specified by a (one) subtype depending on the type of site. The classification of site type followed the scheme in table 3. Type and subtype designations were chosen from the vocabulary used in SJE publication.

Type	Subtype
BURIAL PLACE	CEMETERY[64]
	ISOLATED GRAVES[65]
	SINGLE TOMB
CHURCH	
FORTIFICATION	
HABITATION SITE	
OTHER	ENCLOSURE
	LOOSE FIND
	MUDBRICK CONSTRUCTION
	SAMPLE LOCALITY
	WASHING BASIN
ROCK DRAWING	

Table 3. Classification scheme for types and subtypes of the indexed sites.

Up to three time periods could be related to each type (see table 4, with attached subtype). Each time period was, in turn, given a possible specification in terms of one or several *cultural affiliation(s)*. In cases where the type was categorised as a BURIAL PLACE, it was possible to define the size of the cemetery in a separate field dependent on the time period. The size was given as the largest certain number of tombs or graves in a cemetery. This number equals the value given for the term "unit" that is frequently encountered in the catalogues, except in cases where it is obvious that the number of units exceeds the number of tombs or graves[66]. The number is likely to always be a lower estimate of the real size of a cemetery because not all tombs of a given site may have been excavated or recorded.

[64] SJE defines a cemetery as >15 graves.
[65] "Isolated graves" here means a group of funerary structures that are more than one but less than 15 in number.
[66] For example when superstructures and shafts are given separate unit numbers.

Time Period	Cultural Affiliation
PRECERAMIC	NUBIAN EARLY STONE AGE NUBIAN MIDDLE STONE AGE NUBIAN UPPER STONE AGE NUBIAN FINAL STONE AGE
EARLY NUBIAN	NEOLITHIC[67] A-GROUP
MIDDLE NUBIAN	C-GROUP PANGRAVE KERMA TRANSITIONAL[68] NEW KINGDOM PHARAONIC
LATE NUBIAN	MEROITIC X-GROUP CHRISTIAN MOSLEM

Table 4. Classification scheme for time periods and cultural affiliations of the indexed sites.

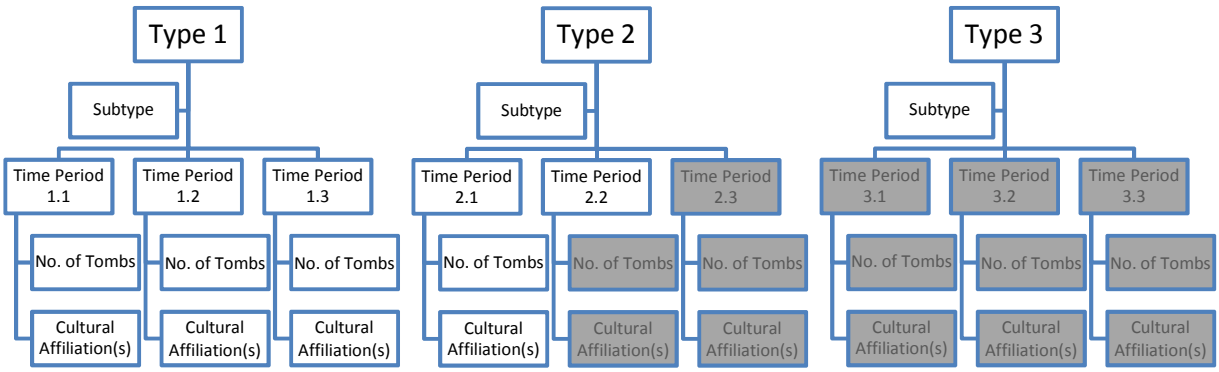


Table 5. Schematic representation of the organisation of the classification system used in the site database. Shaded fields are redundant.

3.4. GIS software

Digitalisation and geographical analyses were all performed in the ArcGIS ® Desktop 10.0 software (Esri, 2010) under a temporary student license.

3.5. Datum and Projection

All maps and analyses produced in this project were for simplicity performed in the Old Egypt Datum of 1907 and the Egypt Red Belt Grid (see definition in table 1) as predefined in ArcGIS with a single

[67] Collective term for ceramic assemblages of the Post-Shamarkian, Khartoum Variant and the Abkan groups.
[68] Culture contemporary with the 18th dynasty but with a local origin and conservative burial customs and limited Egyptianised traits. It may be related to a late stage of the C-group or Pangrave culture (Säve-Söderbergh, 1981:23). The transitional culture is not to be confused with the transitional *time period*.

false origin (810 km). Transformations of data in WGS84 format were executed by a geocentric translation with the following parameters: -dx=130, dy=110 and dz=-13.

3.6. Digitalisation of Topography

The Egypt New Series map, as described above, was the base from which topographical information was drawn in order to digitally recreate the landscape of the concession area. The seven map sheets described in section 3.1.1. were scanned into high resolution TIFF-files and imported into the GIS software. They were georeferenced and rectified using the coordinate grid given on the maps and by adopting the predefined projected coordinate system Egypt Red Belt with a false northing of 810 km. The process was aided by a detailed map of the Abka–Gamai districts provided as a map through-out in SJE 1:2 (Hellström, 1970b). The following features of the maps were digitalised into vector formats:

3.6.1. The River Nile

All water-surfaces were digitalised as polygons with gaps for islands. The shorelines[69] of the Nile from north of Faras to south of the Second Cataract (Gamai) were approximated with the isolines of 120 m.a.s.l. and 130 m.a.s.l. (uncorrected values), the theoretical fall of 10 m occurs in the middle of the cataract. Thus, two polygons represent the Nile, one southern part and one northern part. The area of the Nile at the region in question was about 51 km^2 and other water-filled surfaces such as depressions, particularly common in the Second Cataract area, adds up to 80, totalling 0.23 km^2.

3.6.2. Elevation Contours

The elevation contours representing topographical heights from 120 m.a.s.l. to 220 m.a.s.l. interspersed with 5 m or 10 m intervals were digitalised as polylines[70]. All of the isolines drawn on the original map were digitalised with some exceptions in areas where there is a significant overlap with the current shoreline (about 180 m.a.s.l.) or in areas with a complicated topography (and thus time-consuming to digitalise) *and* where no archaeological sites (recognised by the SJE) were located (mainly east of the Second Cataract). Local maxima (that is, hills) within the concession area were in general completely represented even in cases where they exceed the current water level (and may thus today form islands). One map sheet that was not available at the archive and thus not included in this project causes an awkward blank area between the Wadi Halfa and Abka map sheets. However, no archaeological sites were recognised in that region. In addition, there were no map sheets available to cover the vast plain of Wadi Halfa up until the modern shoreline but there are no indications of detected archaeological sites there either, so the loss was considered to be of less significance.

3.6.3. Lines of steepest Descent

A number of branched lines in the map were intersecting the elevation contours at right angles. These were interpreted as to represent the lines of steepest descent, that is, the floors of the desert wadis. Lines included in the concession area and connecting branches in the upper desert were digitalised in the direction from higher to lower elevations as independent segments of polylines.

[69] As this project primarily concerns the area east of the Nile, some simplifications of the western edge of the Nile were made.
[70] Continuous or built up by snapped segments.

3.6.4. Spot Elevations

The original map shows a number of spots with a given elevation value. These were mostly found on hilltops but also evenly spread on plains. All spots that were possible to identify in the SJE concession area and the adjacent desert were digitalised. In addition, a number of spot elevations on the West Bank were included in order to make an approximation of the landscape opposite the SJE concession area. A total of 1125 spots were digitalised and given the value indicated on the map. Only three of those spots were marked "checked".

3.7. Analyses

A number of analyses were performed in order to fulfil the objectives (section 2). These are accounted for below. The results of these are reported in section 4 (Results).

3.7.1. Digital Elevation Model Construction

A reconstruction of the topography in the concession area was made through the creation of a digital elevation model (from here on abbreviated as DEM). This was intended to act as an approximation for the landscapes contemporary with the archaeological sites of the SJE. In order to expand the coverage of the DEM, SRTM (described in section 3.2) elevation data acquired in the year 2000 describing the topography of the deserts surrounding the inundated area was included.

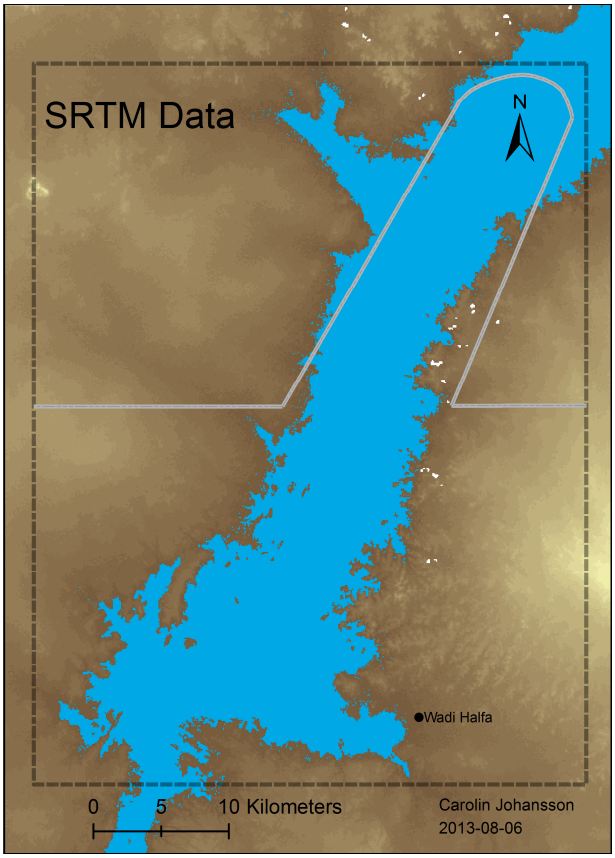


Figure 7. Map illustrating SRTM data for the current landscape of Sudanese Lake Nasser. Elevations below 180 m.a.s.l. have been visualised in blue in order to represent the extent of the lake. Elevation values on land are symbolised from dark to light colour with increasing elevation.

3.7.1.1. SRTM data processing

The two raster datasets representing the entities described in section 3.2. were merged and cropped in order to constitute a rectangular area defined by the extent of the SJE concession (see figure 7). Further, the area with elevation values less than 180 m.a.s.l. (blue in figure 7) was set to "NoData" thus creating a gap where the current lake is. From the resulting data, automated elevation contours were created with 10 m interval with a base contour at 180 m.a.s.l.

3.7.1.2. Interpolation

A DEM was constructed by the Spatial Analyst tool *Topo to Raster* with the indata and settings as in table 6 and 7 respectively.

Digitalised Features	Section Reference	Type
Nile shorelines = boundaries of all water surfaces	3.6.1.	Contour
Manually digitalised contours of SJE concession area*	3.6.2.	Contour
Lines of steepest descent	3.6.3.	Stream
Spot elevations for the East Bank and West Bank	3.6.4.	Pointelevation
Elevation contours of the current Landscape *	3.7.1.1.	Contour

Table 6. Interpolation indata for the DEM construction. *The algorithm was run on corrected values, that is three meters below those given by the basemap.

Setting	Value
Resolution	5m
Smallest Z value to be used in interpolation	117m
Primary type of input data	Contour
Maximum number of iterations	40
Discretisation error factor	0.9
Output extent	As in figure 7*

Table 7. Interpolation settings for the DEM construction. All other values were default.*Top: -50831,053000 m, Left: 625749,494962 m, Right: 666535,936468 m, Bottom: -104313,054458 m.

3.7.2. Validation of model

The reconstructed landscape in the form of the DEM can obviously never be validated by ground-check. However, as an assessment of how faithfully the reconstruction mimics the shape of the area as it was before the inundation is desirable, a few comparisons with other data were made.

3.7.2.1. Remote Sensing Data

Satellite imagery was used to compare the correspondence of the digitalised features and the resulting DEM in the region where the manually digitalised area overlaps the modern landscape above the level of the lake. The digitalised elevation contours and an artificial contour representing 179 m.a.s.l.[71], were mapped onto the satellite imagery in order to compare how the contour pattern and predicted shoreline match with the current shore.

The elevation-appended SRTM data was further compared to a DEM constructed with the settings as in table 7 but based only on the manually digitalised elevation features and restricted to the area which were covered by those. The two raster datasets were then visualised with identical symbologies and all cells of the manually constructed DEM with values less than 180 m.a.s.l. were set blue for reference. A quantitative assessment of the differences in elevation values (errors) was made by subtracting the raster values of the manually constructed DEM from the SRTM data in overlapping areas. Special emphasis was put on analysing the error distribution in the area covered by the elevation contours as higher accuracy of the interpolation is expected there than in areas only covered by spot elevations. Moreover, spot elevations were (as mentioned elsewhere) not randomly located but rather often used to indicate the elevation of hilltops.

[71] Which is the water level of Lake Nasser set in the SRTM data.

3.7.2.2. Photography

The SJE publication contains a number of photographs that illustrate the landscape in several areas now submerged. Relevant photographs were selected and used for comparison with the topography given by the DEM:

Landscape Photographs

- Plate 72.1 SJE 7 (Gardberg, 1970): Southward view from site 51 (Gebel Sahaba).
- Plate 73.2 SJE 7 (Gardberg, 1970): Gebel Sahaba viewed from the South.

Aerial Photographs

- Plate 138.2 SJE 1:2 (Hellström, 1970b): Aerial view of the surroundings of Bintibirra, district of Ashkeit.
- Plate 3.2 SJE 2 (Marks, 1970): Aerial view of the inselberg area 3 km south-east of Gebel Sahaba.
- Plate 4.2. SJE 2 (Marks, 1970): Aerial view of the Second Cataract area.

Drawings

- Plate 216 SJE 5:3 (Säve-Söderbergh & Troy, 1991b) Gebel Sahaba profile.

The motifs in these illustrations were located and corresponding images of the DEM were made in ArcMap (2D) or ArcScene (3D). In order to imitate the lighting and shadowing pattern in selected photographs, the spatial analyst tool *Hillshade* was applied. Judging from the direction and length of shadows in those photographs, the time of day at which the photograph was taken (unknown) was approximated. Altitude and azimuth angles were then calculated by an online service (http://aa.usno.navy.mil/data/docs/AltAz.php). The date of photography (unknown) was set to Jan 1st 1963. Profile graphs of the surface was made through the 3D Analyst tool *Interpolate Line* and *Profile Graph*.

3.7.2.3. Estimated Elevation Values

For 185 of the sites, an estimated elevation value had been recorded. These were estimates that had been established by use of the aerial photographs and the corresponding basemap sheets in conjunction with the determination of geographical x- and y-coordinates. A comparison of these z-coordinates with the elevation values of the DEM at the corresponding sites was made through subtracting the latter from the former.

3.7.3. General Site Distribution Analyses

After a simple plot of the SJE sites and a density distribution visualisation by the Spatial Analyst tool *Kernel Density* with 100 m cell size and 1 km search radius, two areas (Halfa Degheim and Debeira) were further examined by creating profile graphs, as described above, through the Nile valley.

Two alternative stretches of the Nile were suggested based on the distribution of Middle Nubian SJE sites in the Debeira region.

3.7.4. Temporal Distribution Analyses

Thematic maps were produced illustrating the distribution of classified sites with regards to their time period designation.

3.7.5. Type Distribution Analyses

Thematic maps were produced illustrating the distribution of classified sites with regards to their type designation.

3.7.5.1. Case Study: Spatial Autocorrelation in Habitation Sites and Burial Places

It was attempted to show differences in the distribution patterns of habitation sites versus burial places. All such sites classified into a time period were included except for those designated as Preceramic. A thematic map was complemented by a calculation of Moran's clustering index with 66 habitation sites and 168 burial sites distributed over the whole of the concession area. Euclidean distances were computed within a 10 km search radius using row standardisation in order to detect correlation between site type and distribution pattern.

3.7.6. Seasonal Habitation Patterns in the A- and C-group Sites

A seasonal habitation pattern in which a population lived in the Nile Valley during winter times and receded back to the desert during the months of inundation is attested for e.g. the Palaeolithic Kubbaniyans (Brewer, 2005:53–54). The climate shift during Predynastic times which caused a movement of human populations from desert areas towards permanent settlements along the river in Upper Egypt, eventually giving rise to state formation, was less effective in Nubia in that sense as the area still periodically received rain. Together with the lesser agriculture-potential of the Nubian Nile Valley compared to Egypt, it is likely that these circumstances kept Nubian populations mobile and that the incentive of permanent settling was absent (Kendall, 2010:404). This scenario has been suggested for the A-group that, according to Gatto (2001–2002), was not limited to the riverine areas of Nubia but inhabited to some extent the deserts as well.

An analysis of the A-group settlements that were recorded by the SJE (n=17) was performed by examining their distribution relative the river in terms of Euclidean distances to the river as well as their elevation relative the contemporary water level of the Nile. Ground distances were computed using the modern river stretch and the two reconstructions in figures 37c and 37d. Elevations were calculated based on the water-levels indicated in figure 5 in Heinzelin (1968:49) and gradient adjusted by the subtraction of 10 m from the elevation value for sites located in the upper half of the Second Cataract. The habitation sites of the C-group (n=13) were analysed in the corresponding way.

3.7.7. Spatial Correlation between C-group and New Kingdom Pharaonic Burial Places.

Vagn Nielsen remarks in SJE 9 that:

> ***Pharaonic tombs as a rule occur on separate cemeteries and are not mixed with burials of other cultural groups but there seems to be a tendency that Pharaonic New Kingdom cemeteries and C-group cemeteries occur in the vicinity of one another. (Vagn Nielsen, 1970:122)***

This claim was examined by compiling the co-occurrence of burial sites (identical sites) within the Middle Nubian burial sites that had been classified into one or several cultural affiliation(s). Further, the proximity of New Kingdom Pharaonic cemeteries and C-group cemeteries was examined by calculating the Euclidean distances between sites within and between those groups where the group containing *all* burial sites classified as Middle Nubian acted as reference. Zero distances (identical

sites) were disregarded in that calculation. The search radii were set to infinite as well as discrete values starting at 200 m.

3.7.8. Intervisibility of the Tombs of the two Brothers

The tombs of the two brothers Amenemhet and Djehuty-hotep are two of the most prominent remains of the New Kingdom administrative unit of Teh-Khet as recorded by the SJE (see section 1.3.2.4.). It is believed that the tomb of Djehuty-hotep (site number 369) was the first of the two to be constructed and was cut into a small hill on the East Bank of the Nile with a wide view of the whole area of Debeira. Several other rock-cut tombs indicating wealth but completely plundered had been built close-by on the lower part of the hill facing the river (Säve-Söderbergh, 1963b:162). To the South was a wadi and to the North was a mountain rising with a low inclination. Thereby, it is argued, was that position the only suitable location in the area to construct such a tomb. The tomb of the successor, Amenemhet, (site number Q) was constructed, also on a small hill, on the West Bank of the Nile and it is argued that the orientation of it was directed towards the tomb of the brother and not the other way around (Säve-Söderbergh, 1963b:172). Moreover, it was noted that it would have been possible to observe the tomb of Djehuty-hotep from the tomb of Amenemhet across the Nile (Säve-Söderbergh, 1963b:162). Indeed, the chapel wall of the tomb of site number Q, in which four life size statues of what is presumed to be Amenemhet and family members were hewn, was oriented perpendicular to an axis that pointed towards the site of the tomb of Djehuty-hotep with a 2° deviance as if the statues were looking directly at it (Säve-Söderbergh, 1963b:162; Säve-Söderbergh, 1991b:183).

Using the data of the present study, it was attempted to examine and reconstruct the view of the East Bank tomb of Djehuty-hotep from the West Bank tomb of his brother and successor Amenemhet as in the descriptions recounted for above. Since nothing remained of the superstructure of the tomb of Djehuty-hotep at the time of examination (Thabit, 1957) it cannot be known for certain what the tomb may have looked like from a distance. For simplicity it is here assumed that the tomb had a similar appearance as the tomb of Amenemhet, which was crowned by a steep sided pyramid surrounded by an outer wall, based on the layout of the preserved foundation (Säve-Söderbergh, 1963b:164; Säve-Söderbergh, 1991b:185). This suggestion relies on comparisons with contemporary tombs at Aniba, the head seat of the Egyptian administration in Lower Nubia, and with tombs at Deir el-Medina in Western Thebes in Egypt.

A 3D model used to represent a pyramidal superstructure of both tombs was made based on the plan drawing of figure 45a in SJE 5:2 (Säve-Söderbergh, 1991b:186) and the reconstruction suggested as alternative A in figure 45b of the same source (Säve-Söderbergh, 1991b:187). The modelled monument was then added to the landscape reconstruction and lines of sight were measured given observer offset distances as 2 m and target offset distances as 8 m. The latter figure represents the upper part of the pyramid whose top stands about 10 m above the ground. Visualisations were performed given a stretch of the River Nile as in reconstruction 1 of figure 37c in the results section.

3.7.9. Presentation

All maps were produced in ArcMap (Esri, 2010) and 3D visualisations of the reconstructed landscape were made by ArcScene (Esri, 2010). The basemap applied in the map of figure 4 is a World Shaded Relief based on data fraom GTOPO30, SRTM, and National Elevation Data (NED) data from the USGS

and was acquired through Esri at http://goto.arcgisonline.com/maps/World_Shaded_Relief. The satellite imageries used as basemaps in several maps of this document were acquired as Esri World Imagery at http://goto.arcgisonline.com/maps/World_Imagery: The imagery used in the inset of figure 13 was based on the DigitalGlobe of date 2011-01-21, the imagery used in the inset in figure 14 was based on DigitalGlobe of date 2012-03-13. Imagery in the map of figure 16a was based on the DigitalGlobe of date 2011-01-21 and 16b on the DigitalGlobe of date 2012-03-13.

The 3D model of the pyramid used to represent the tombs of the two brothers was made in Google SketchUp 8.0.11752 (Google, 2010).

The Venn diagram on Middle Nubian burial sites was constructed by VENNY (Oliveros, 2007) available as an online tool at *http://bioinfogp.cnb.csic.es/tools/venny/index.html*.

No information on individual creators (photographs) is available for the illustrations included in the SJE publication, therefore it has been impossible to seek individual permissions to reprint them. Moreover, no person or institution responsible to grant such permissions has been in office since 1998. However, the last person to hold that responsibility, Hans-Åke Nordström, has recommended to make use of photographs into this report together with thorough source references. It was chosen to apply that recommendation for the illustrations used in the analyses described above.

This report was written in Microsoft Word 2007 (Microsoft, 2007b). Hieroglyphs were written in the JSesh hieroglyphic editor 6.3.2. (Rosmorduc, 2013).

4. Results

The results of the work described in section 3 (Material and Methods) are presented below.

4.1. General Results

4.1.1. Database

The final database consisted of a matrix of 481 entries and 44 columns. A simplified version of this list is available as table A1 in the appendix.

The sites were distributed with regards to site type and time periods represented as in the following table and figures.

Attribute	Proportion of classifiable Sites (n=480)
Location (district)	97.5 %
First site type (T1)	80,8 %
Second (and first) site type (T2)	4.4 %
Third (and first and second) site type (T3)	0.2 %

Table 8. Proportion of classifiable sites with regards to the main attributes.

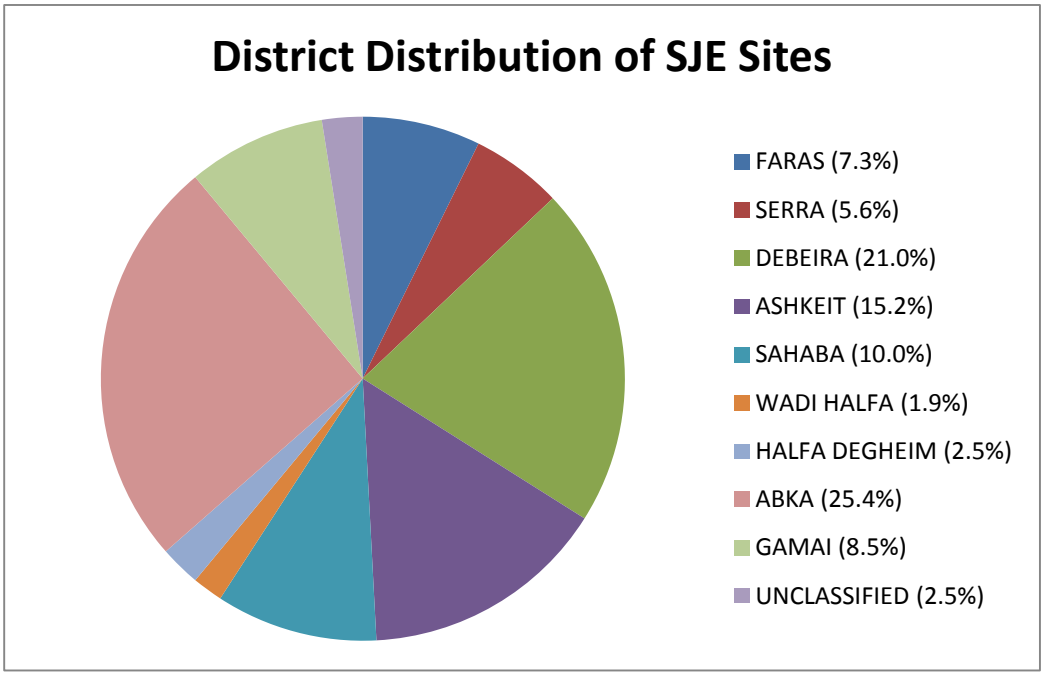


Figure 8. Pie chart illustrating the distribution of districts. n=480.

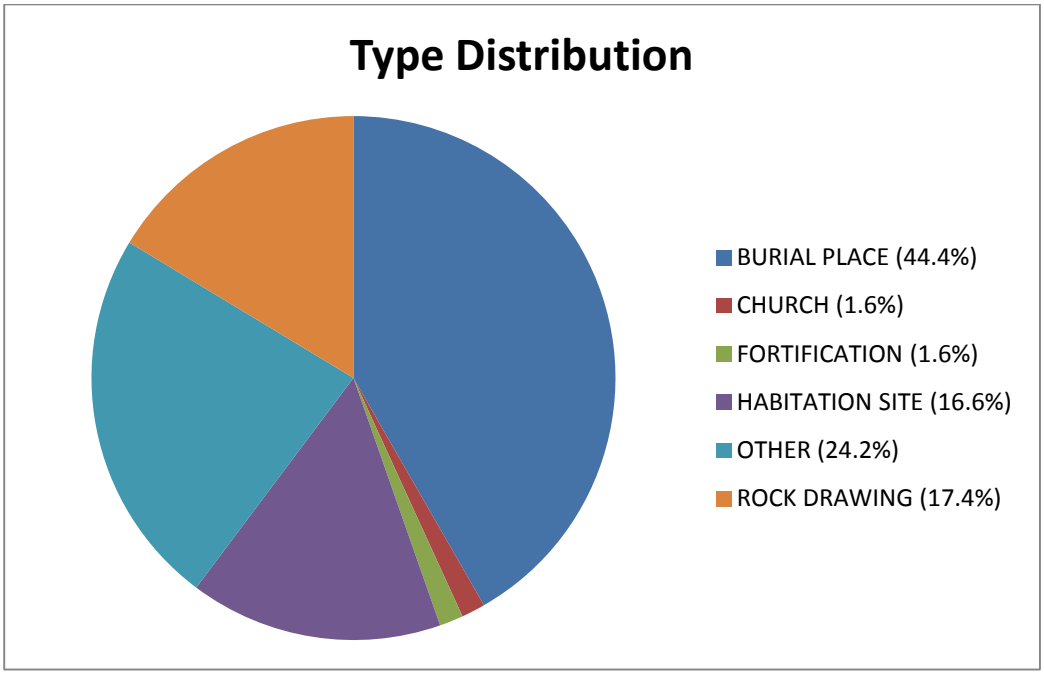


Figure 9. Pie chart illustrating the distribution of site types. n=407. Note that the number within parenthesis refers to total representation in sites, not exclusive representation. Uncertain classifications have been excluded. 95 sites were unclassifiable with certainty.

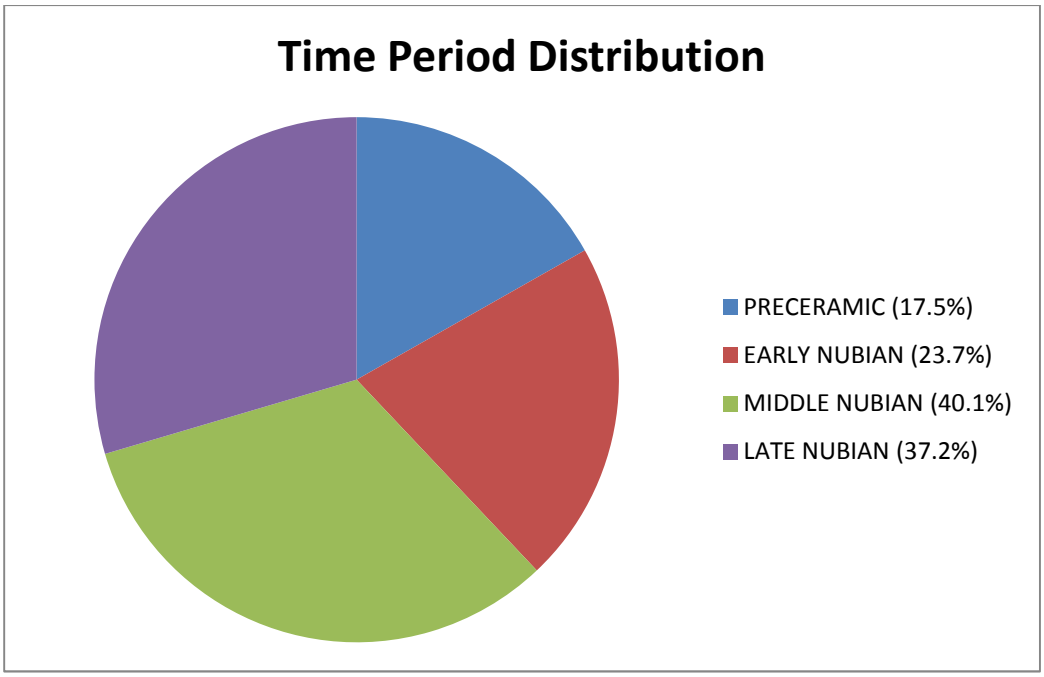


Figure 10. Pie chart illustrating the distribution of time periods. n=325. Note that the number within parenthesis refers to total representation in sites, not exclusive representation. Uncertain classifications have been excluded. 206 sites were completely unclassifiable with certainty.

4.1.2. Digitalisation

Feature	Number of Objects	Length (km)	Number of Vertices
Elevation Points	1327	–	1327
Elevation Contours	3220	3443	176 960
Nile Shores	78	412	22 111
Wadi Floors	791	732	13 837
Total:	**5416**	**4587**	**214 235**

Table 9. Scope of the map digitalisation process.

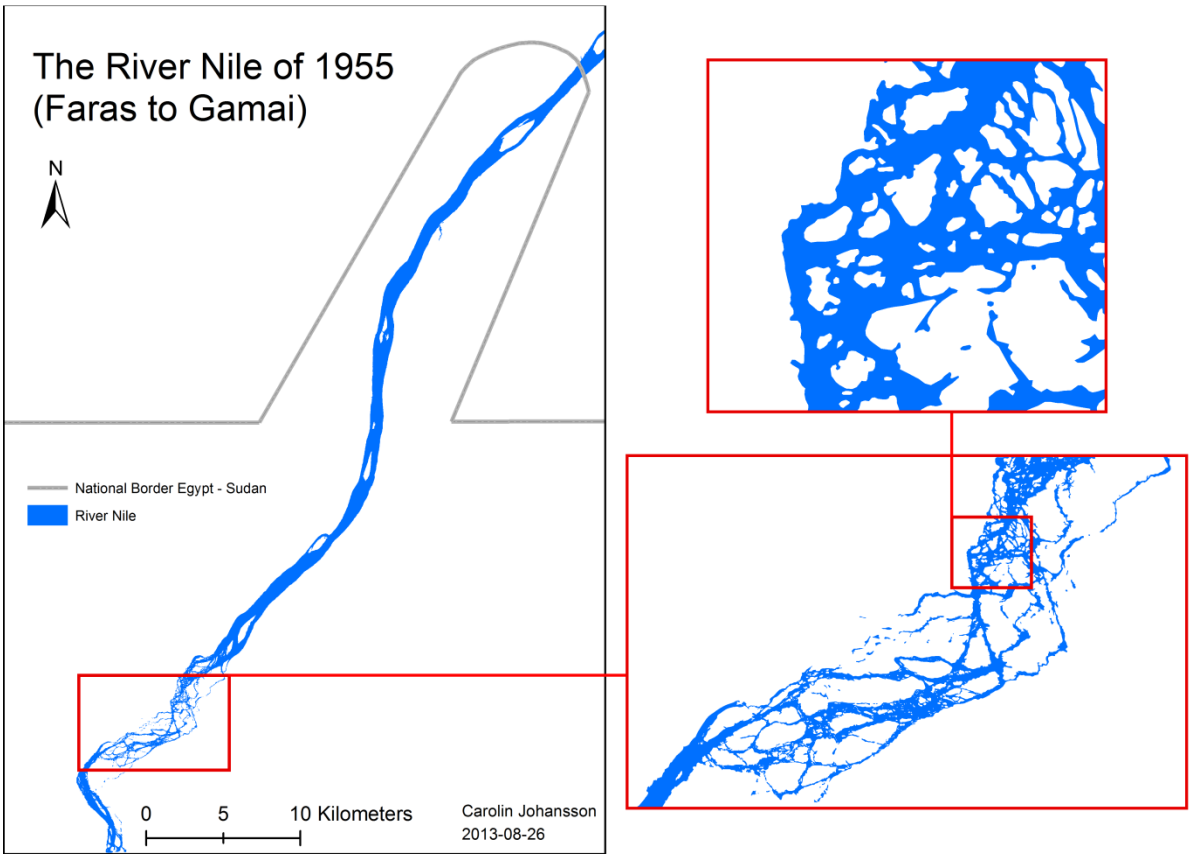


Figure 11. Map illustrating the digitalised River Nile along the SJE concession area as it was in 1955.

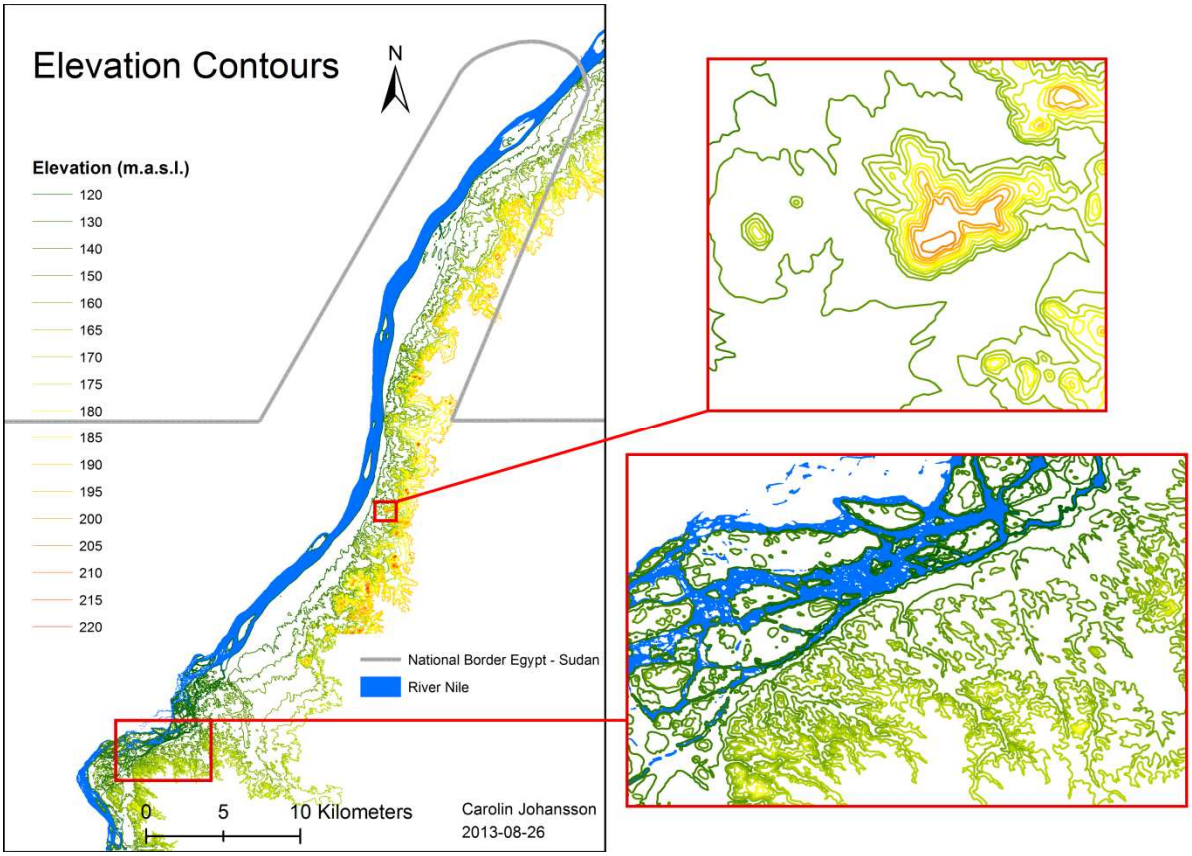


Figure 12. Map illustrating the digitalised elevation contours of the SJE concession area. These are reflecting the topography with intervals of five or ten meters. Numbers refer to uncorrected values (see the note in 3.3.2.).

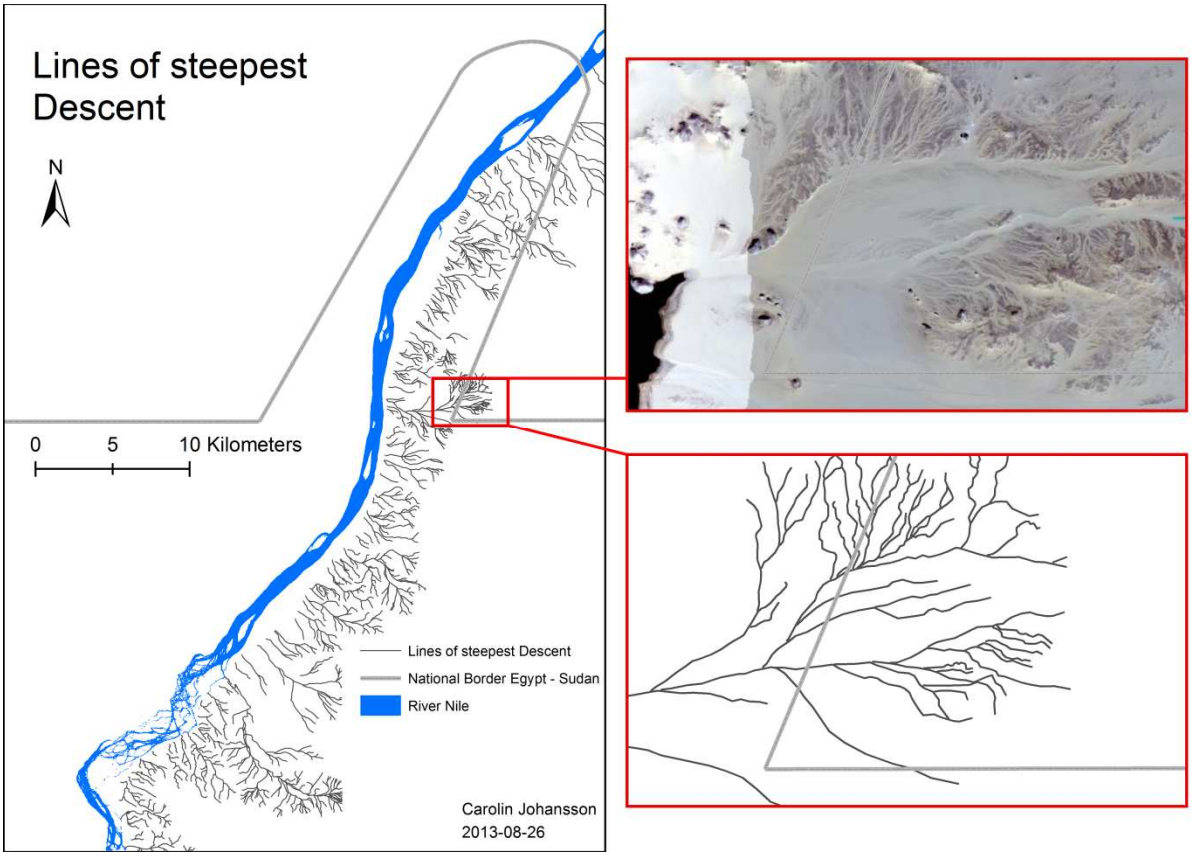


Figure 13. Map illustrating the digitalised lines of steepest descent of the SJE concession area. These are reflecting the topography in terms of wadi drainage system. The two insets detail an area currently above the water level. The content in upper box is based on a satellite imagery. The lower box presents the vectorised lines given by the basemap for the very same area.

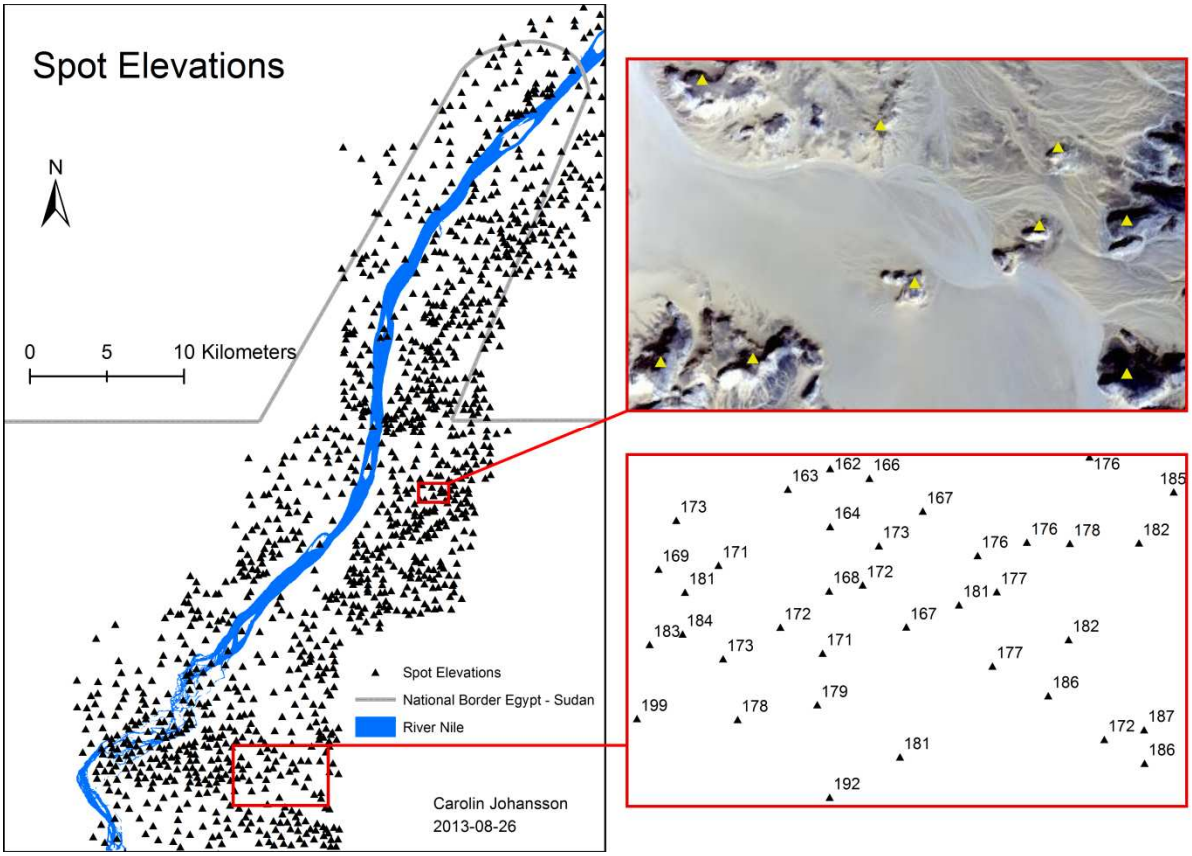


Figure 14. Map illustrating the digitalised spot elevations of the East and West Banks. The upper inset is based on a satellite imagery and illustrates the tendency for the spot elevations (marked in yellow for increased visibility) to be located on hilltops. It also reflects the concordance between the digitalised basemap of the present study and the imagery of the current landscape (established in WGS84). The lower inset details a part of the plain east of the Second Cataract where spot elevations have been labelled with uncorrected values (see the note in 3.3.2.).

4.2. Digital Elevation Model

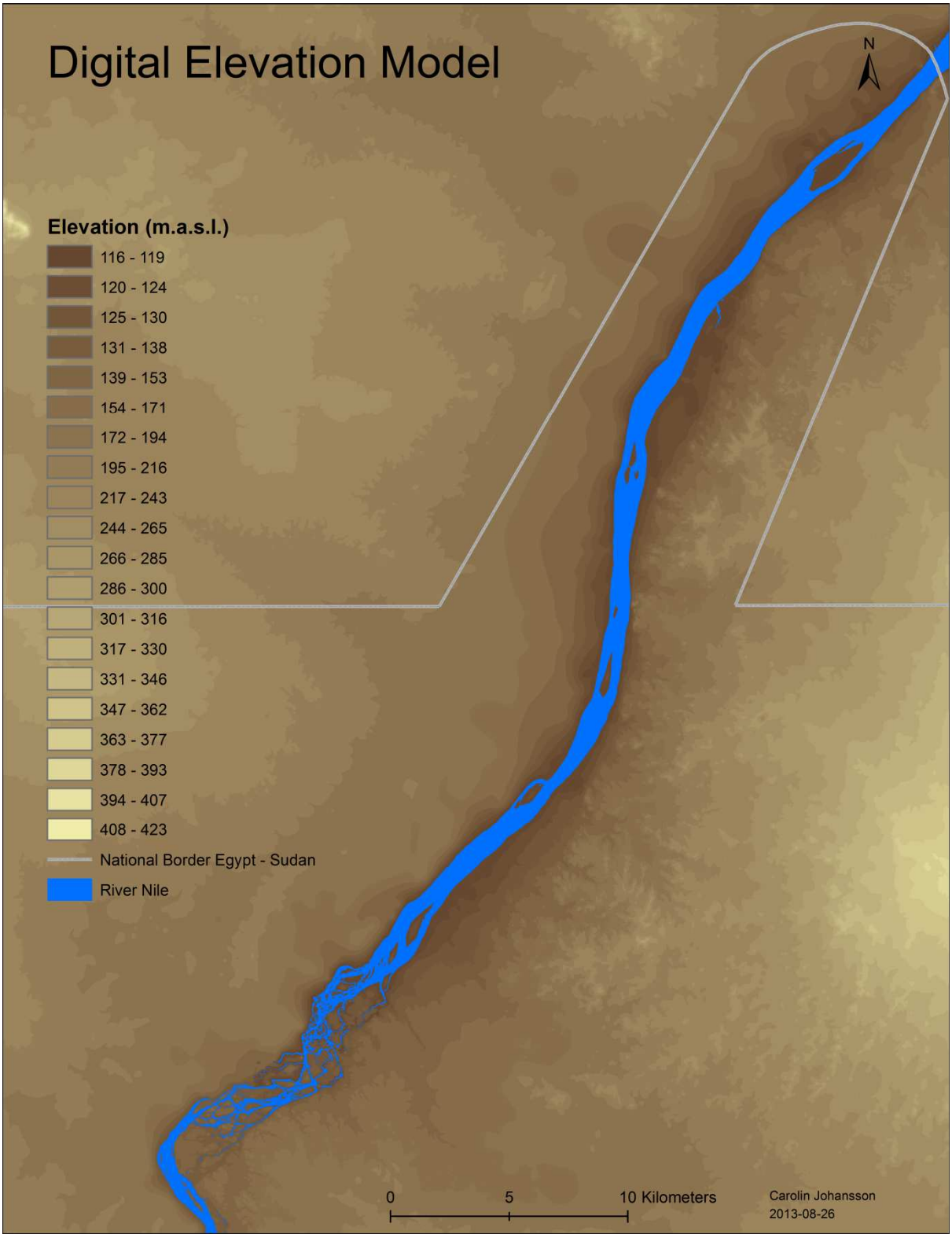


Figure 15. Map illustrating the digital elevation model. This DEM covers the SJE concession area and surrounding deserts. The extent of the Nile is superimposed for reference. Note the obvious simplification of the topography of the West Bank compared to the East Bank.

4.3. Validation of model

The rectified original map and thus the digitalised contour lines in the areas that have not been submerged correspond reasonably well with the topography that is given by satellite imagery of the current landscape. The comparisons are visualised in the figures below.

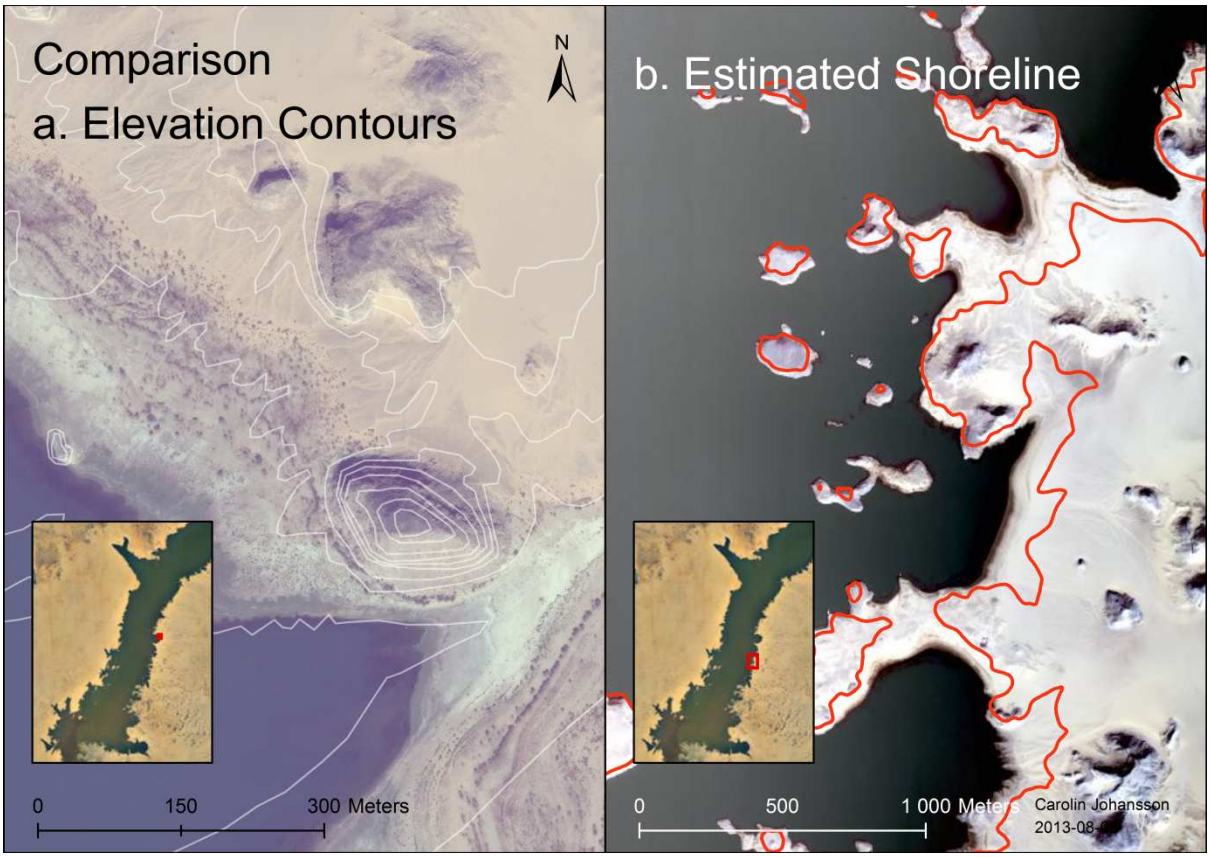


Figure 16(a–b). Map illustrating a comparison of digitalised features and satellite imageries of the current landscape in an overlapping area. Elevation contours, all visualised in white here, reflect the topography of the underlying satellite imagery in 16a. The image to the right, 16b, describes, in a smaller scale, a contour of 179 m.a.s.l. in relation to the modern topography. Note that the exact water level of the lake at the time the data for the imagery was collected is not known. The insets indicate the extent and locations of the details.

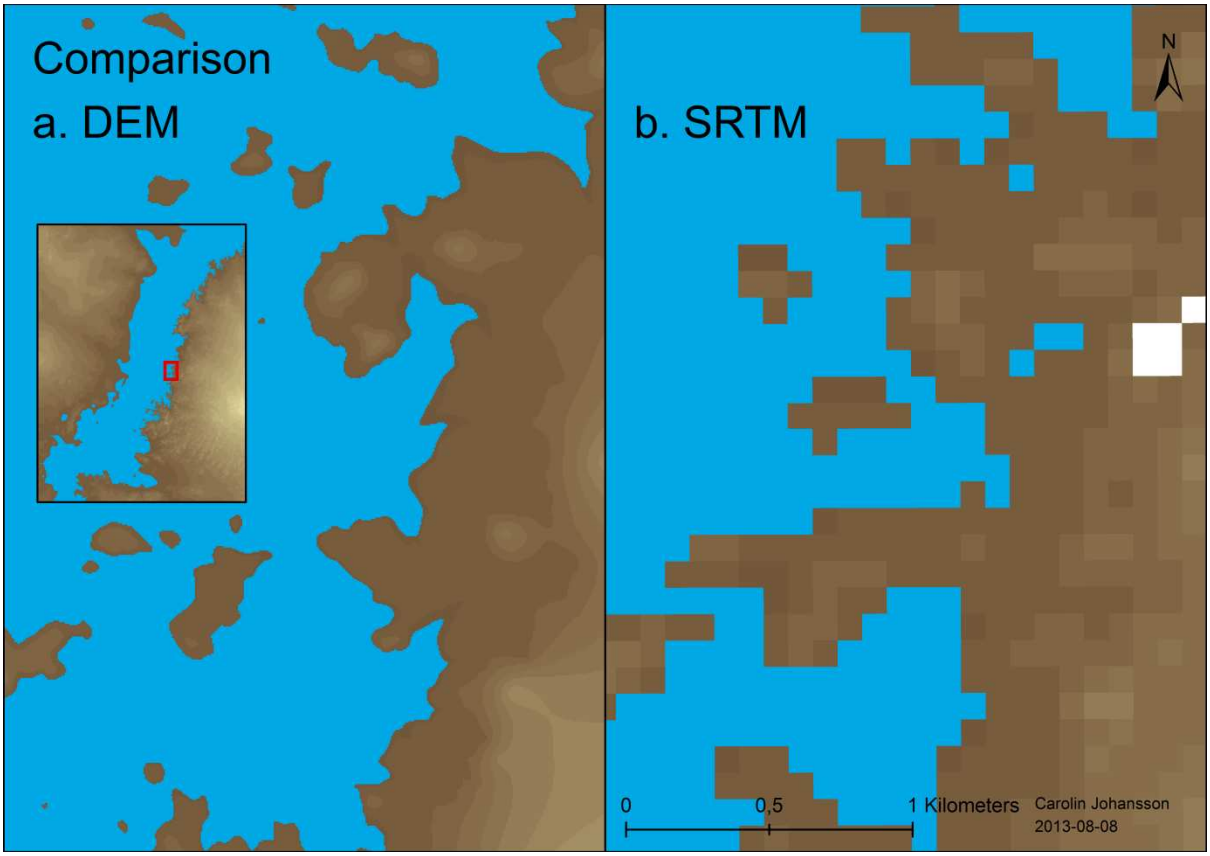


Figure 17(a–b). Maps illustrating a comparison between the DEM and SRTM data in an overlapping area. The topography and resolution of the DEM constructed from digitalised features of the basemap are reflected in 17a. and the corresponding area described by the SRTM data in 17b. The two datasets were symbolised in the same way. The inset shows the location of the detail.

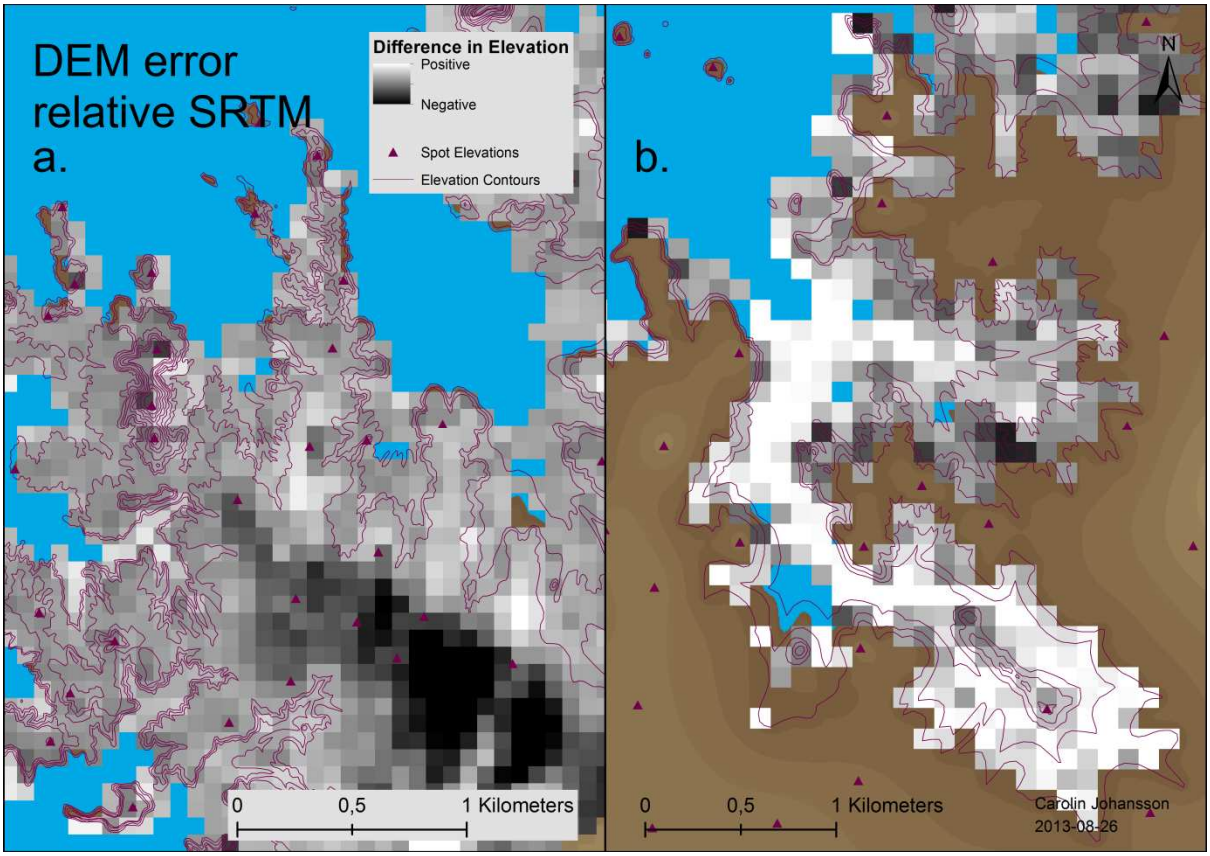


Figure 18(a–b). Maps illustrating the difference in elevation values between the SRTM data and the DEM. Figure 18a illustrates the tendency of overestimation (dark) compared to the modern landscape in areas where the interpolation is based solely on spot elevations. Figure 18b illustrates the differences only in the region that is covered by elevation contours in which a majority of the cells is underestimated (light grey or white). That underestimation of the DEM is particularly prominent in bays and wadis as exemplified in 18b. Only elevation contours and spot elevations with a corrected value of 177 m.a.s.l. or more have been rendered in this figure.

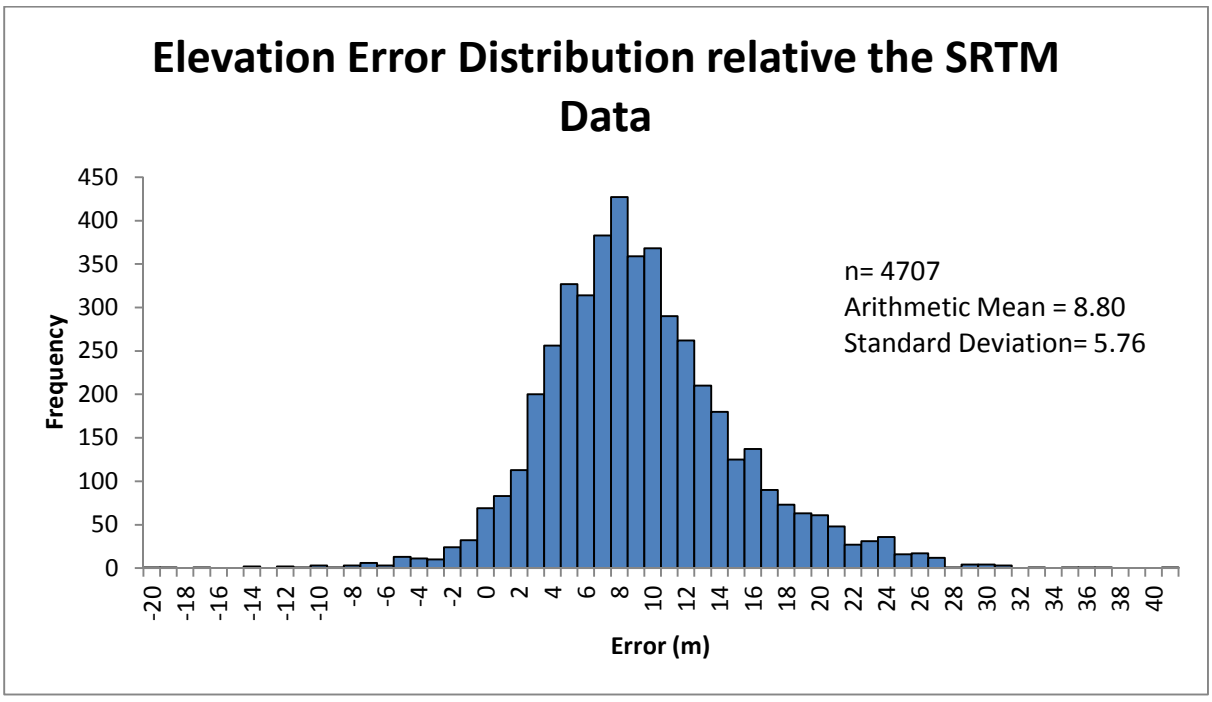


Figure 19. Diagram illustrating the frequency distribution of elevation errors. These are the differences between the SRTM data describing the current landscape and the elevation values of the manually constructed DEM. This distribution

refers only to the area covered by the digitalised elevation contours *and* SRTM values above 179 m.a.s.l. (as visualised in figure 18b). n refers to the numbers of cells in that overlapping area.

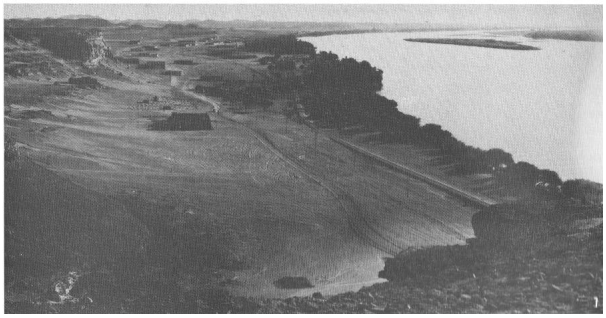


Figure 20. Plate 72.1 SJE 7: Photograph taken from the top of Gebel Sahaba looking south. A cliff of the mountain is visible in the foreground. Note the steep hill in the upper left corner.

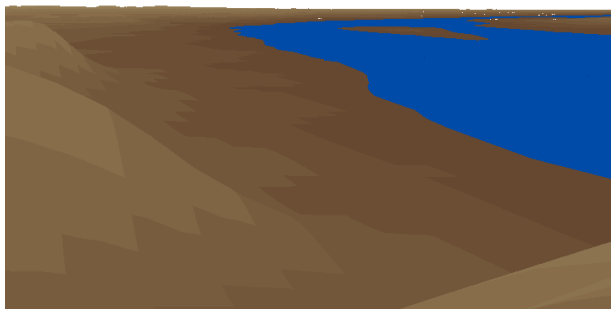


Figure 21. 3D model of the same area as in figure 20.

Figure 22. Plate 72.1. SJE 7: Photograph of Gebel Sahaba viewed from the South.

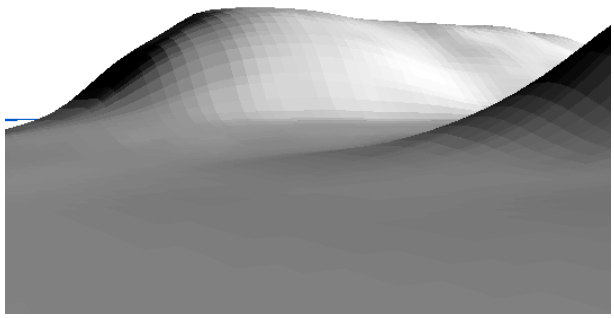


Figure 23. 3D model of the same area as in figure 22. Time of day was set to 08.00.

Figure 24. Plate 4 SJE 2: Aerial photograph of the Second Cataract.

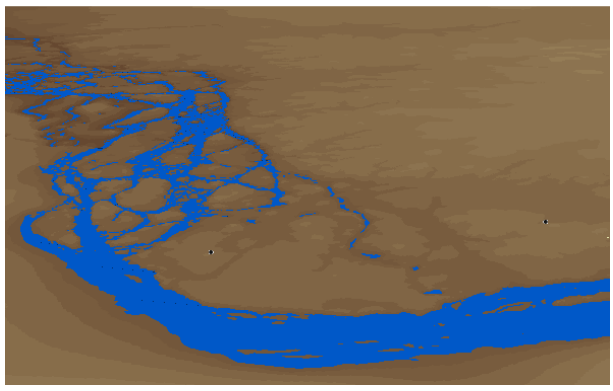


Figure 25. 3D model of the same area as in figure 23.

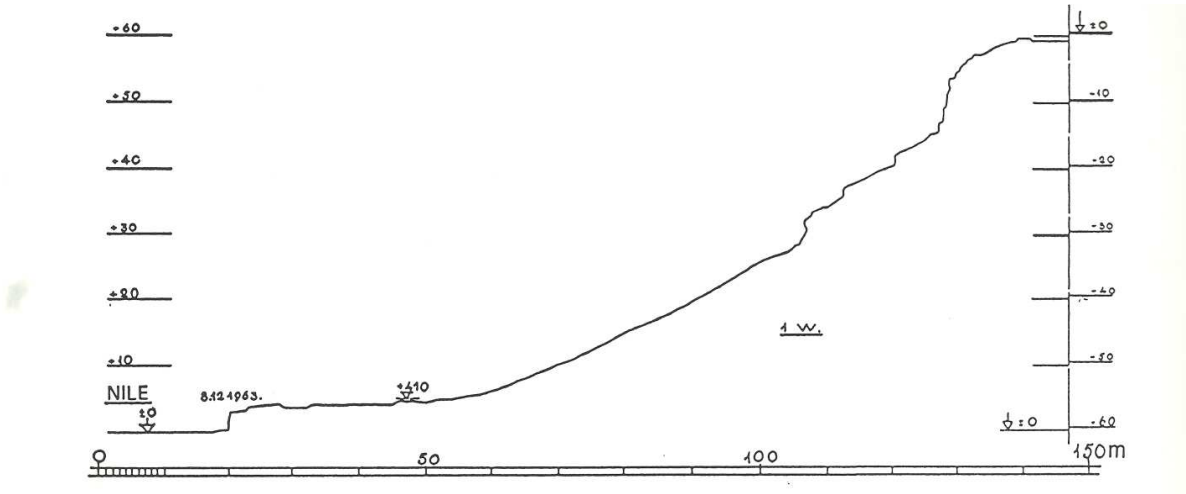


Figure 26. Plate 216 SJE 5:3: Manually drawn profile of the western slope of Gebel Sahaba. Cf. figures 22 and 23.

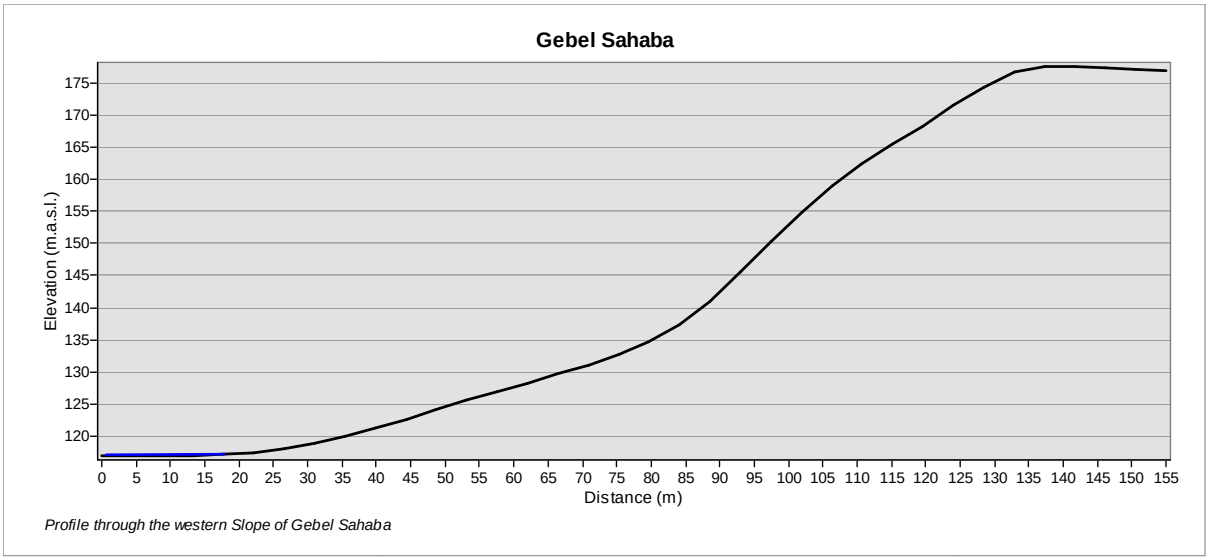


Figure 27. Digitally generated profile of the western slope of Gebel Sahaba. It is drawn in the direction from west to east. A blue line has been added to represent the level of the Nile. Cf. the drawing in figure 25, see also figures 22 and 23.

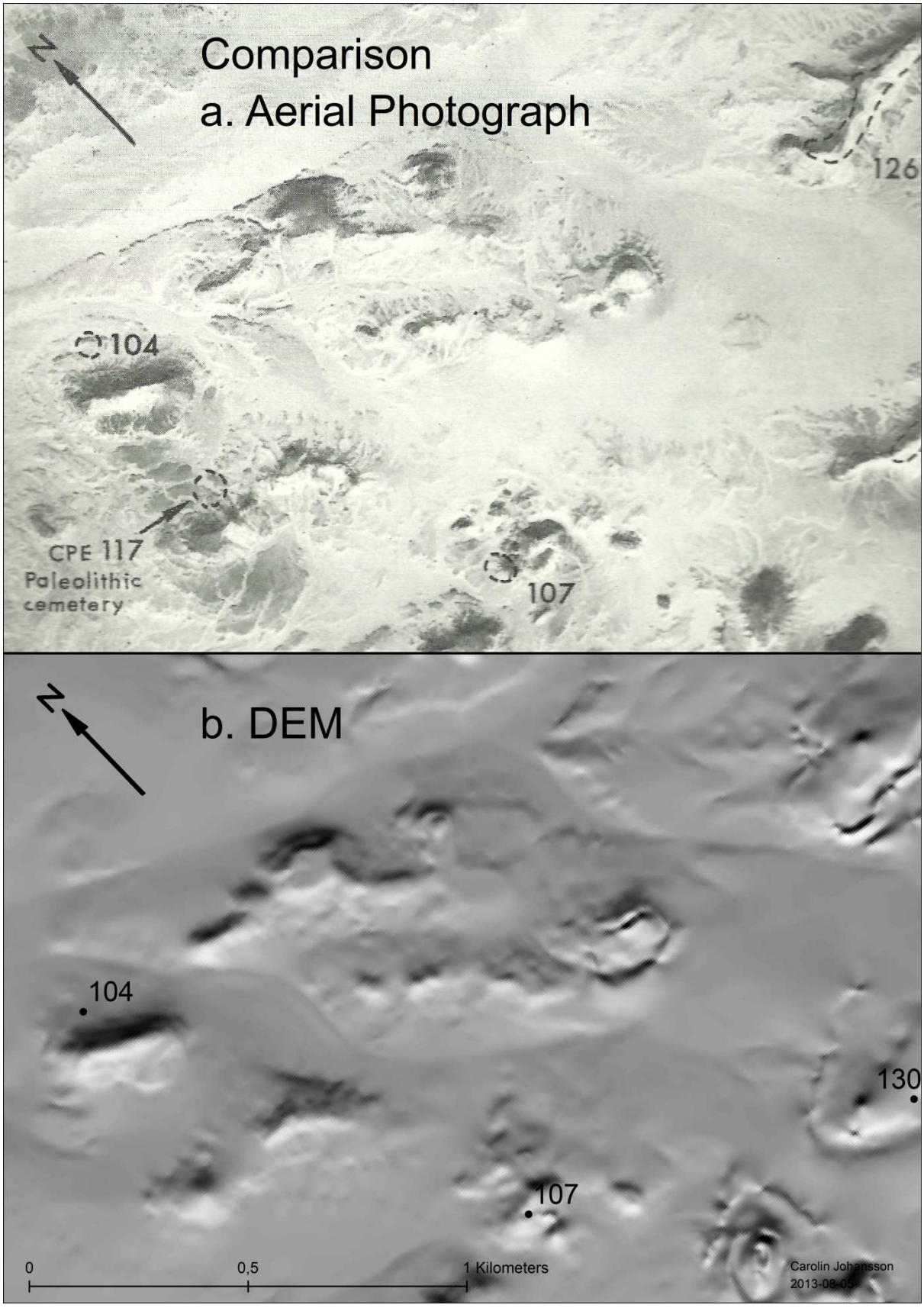


Figure 28(a–b). Plate 3.2 SJE 2: Aerial Photograph (28a) and a map illustrating the corresponding area of the DEM (28b). Shading has been applied as if the photograph was taken at 12.00.

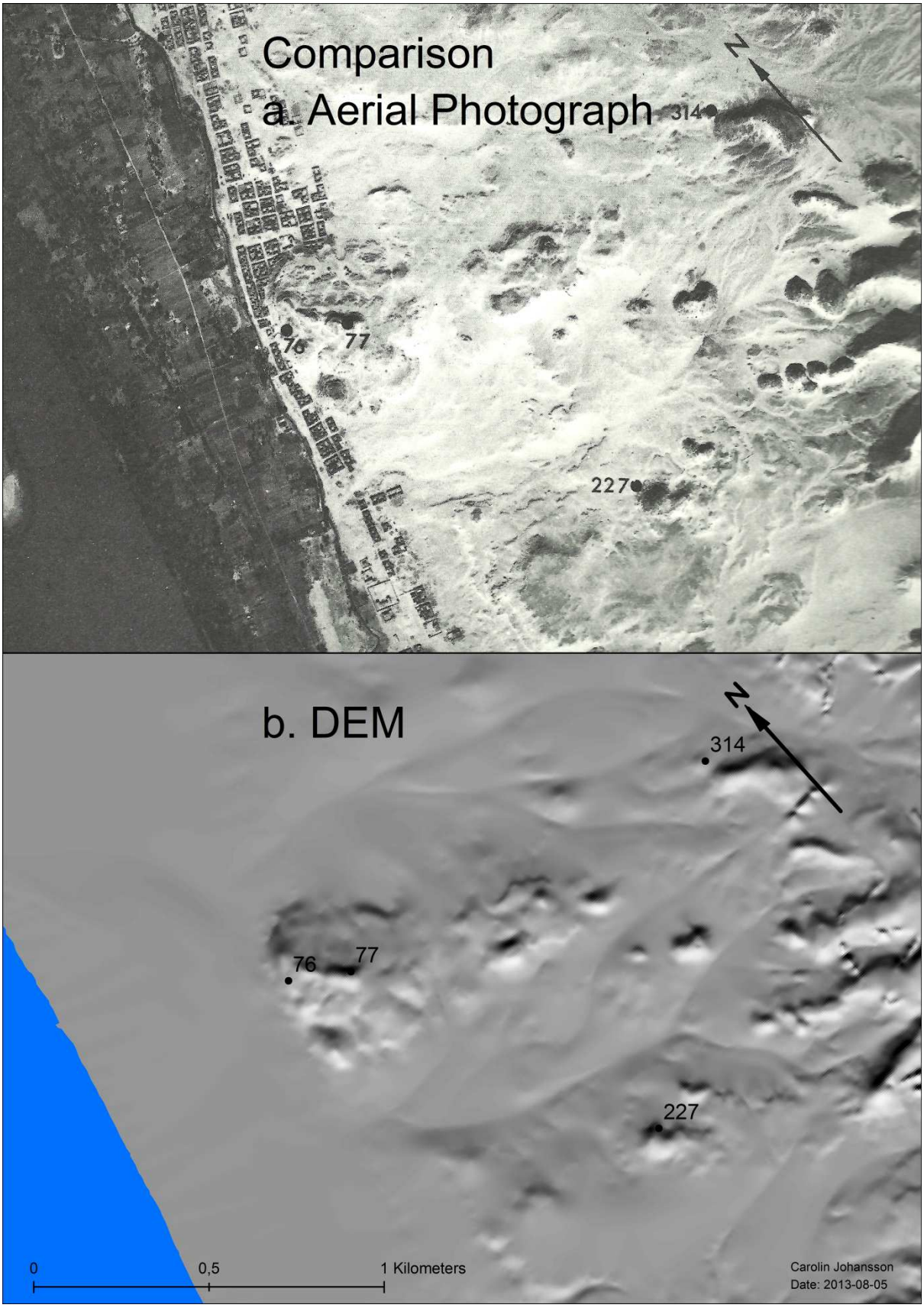


Figure 29(a–b). Plate 138.2 SJE 2: Aerial Photograph (29a) and a map illustrating the corresponding area of the DEM (29b). Shading has been applied as if the photograph was taken at 12.00.

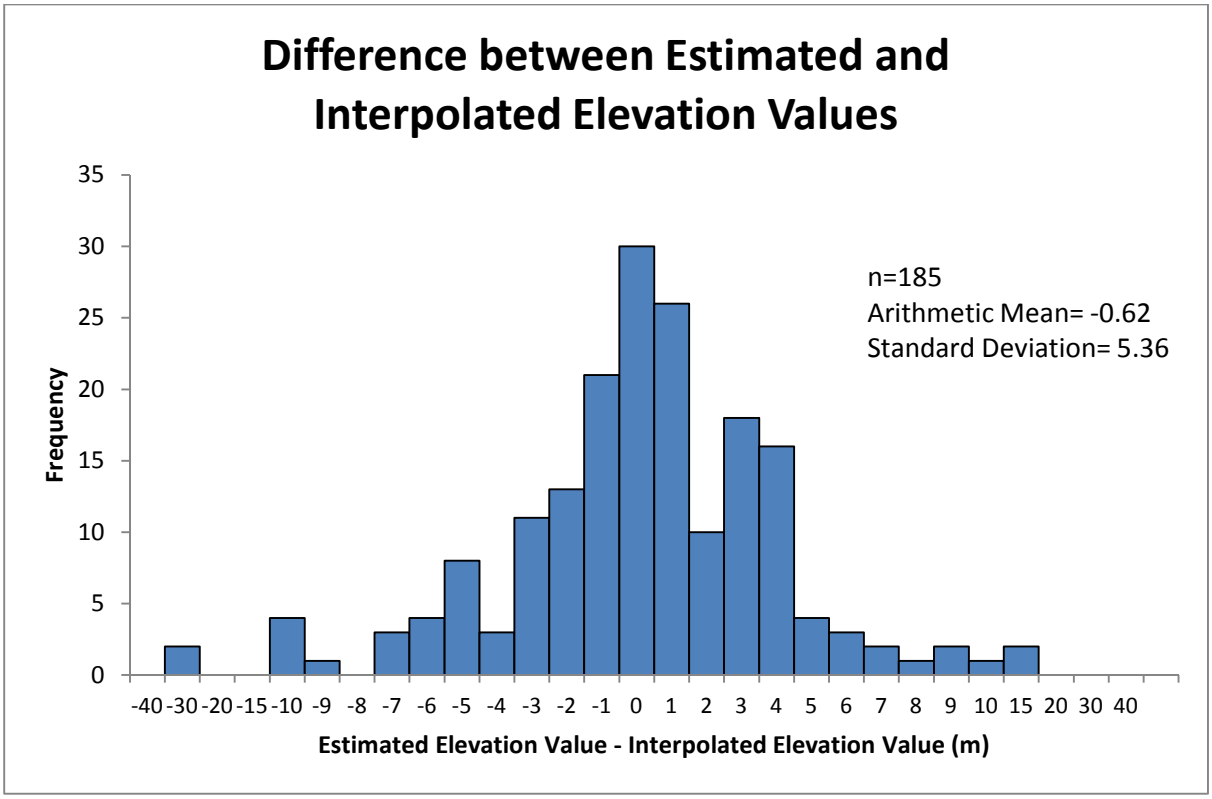


Figure 30. Diagram illustrating the frequency distribution of elevation differences. The differences refer to those between elevation values appended in the SJE and corresponding DEM values. n equals number of sites included.

Outliers in the diagram in figure 30 were examined in order to detect possible errors. In only two sites, number 68 and 364 it was found that the coordinate values were obviously wrong as the area description appended in the site information were not in concordance with the given location. If those two sites were excluded from the distribution in figure 29, the average error decreased to 0.34+/-4.49 m.

4.4. General Site Distribution and Reconstructions of ancient River Stretch

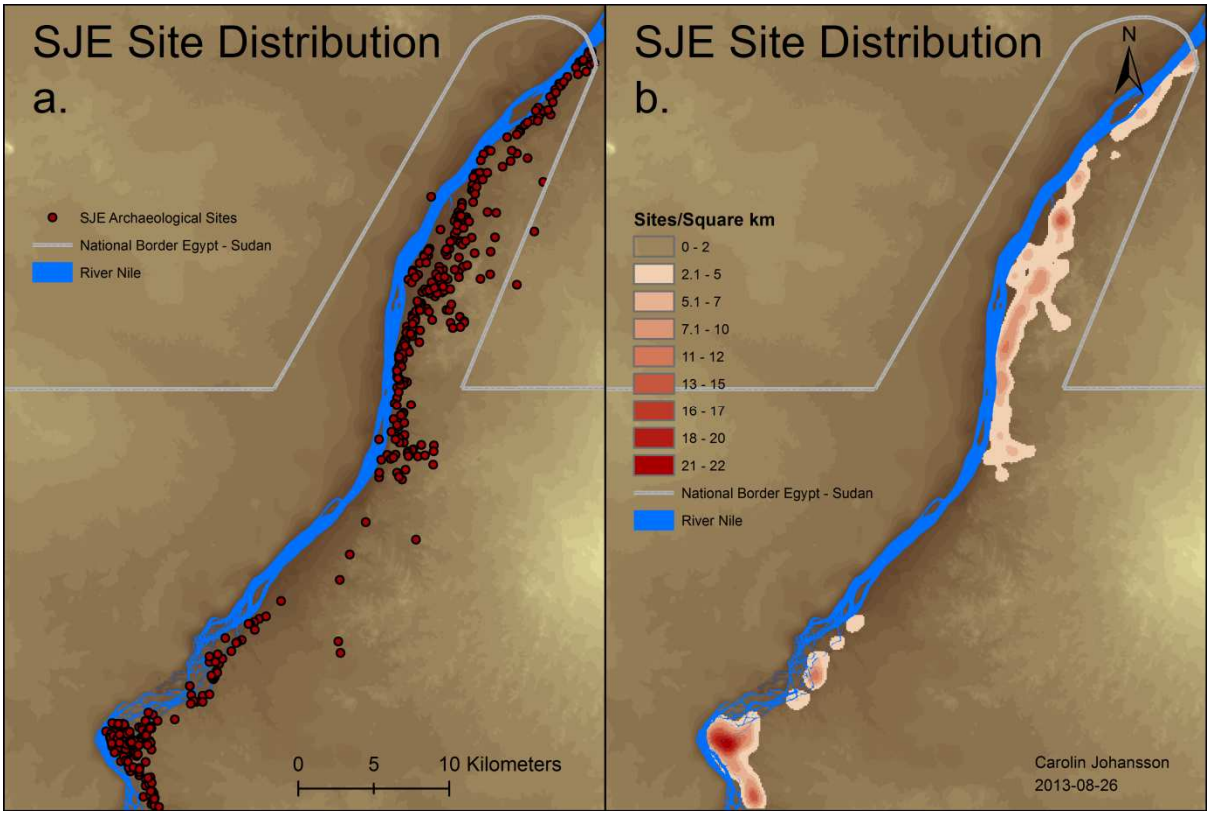


Figure 31(a–b). Maps illustrating the distribution of SJE sites. 31a displays the sites plotted over the concession area, 31b shows the corresponding kernel density map.

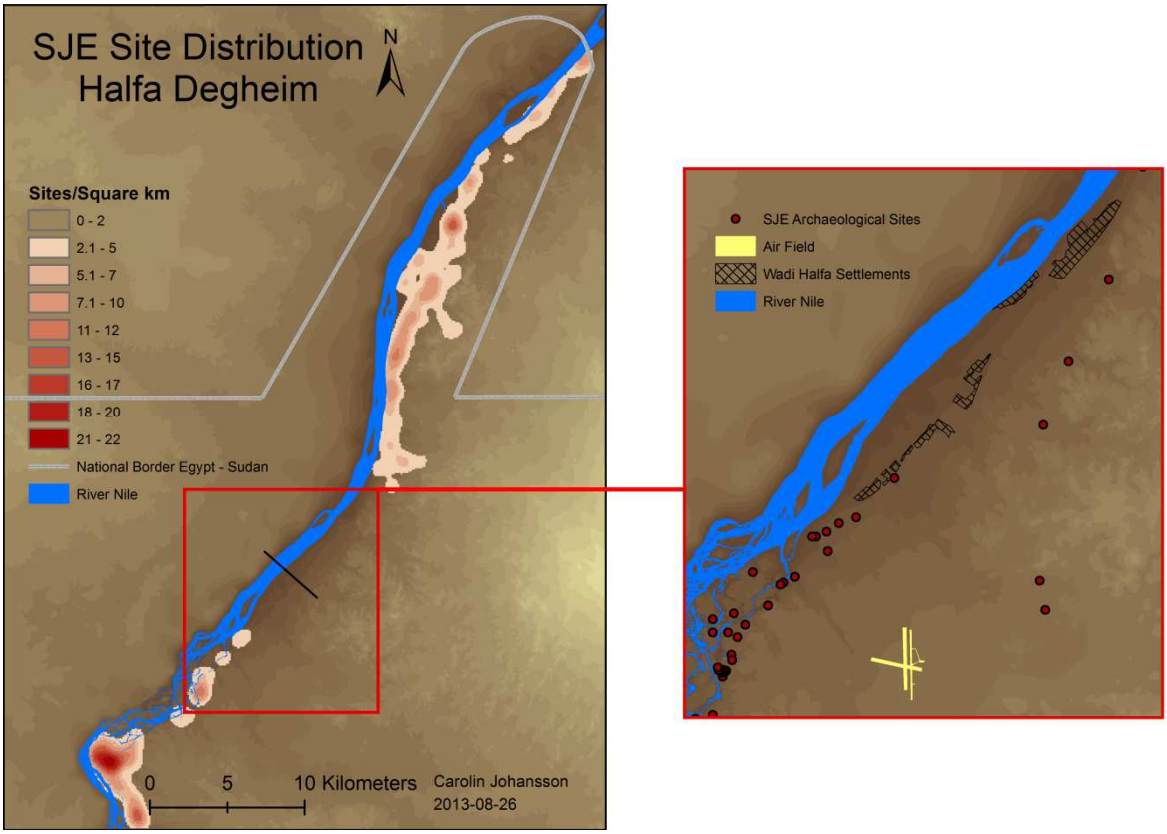


Figure 32. Map illustrating the site distribution in the Halfa Degheim district. The main map shows the extent of the detail to the right. The black line crossing the Nile Valley at a right angle represents the distance plotted in the profile graph below (figure 33).

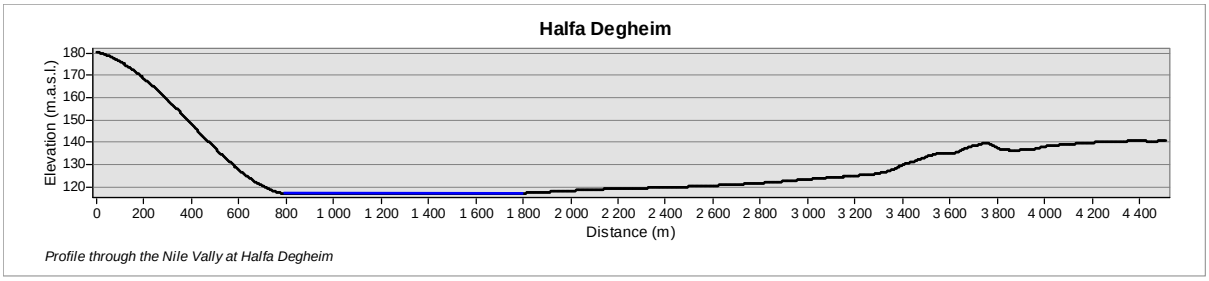


Figure 33. Digitally generated profile in the Halfa Degheim district drawn in direction from west to east. A blue line has been added to represent the level of the Nile. The axes are not to scale.

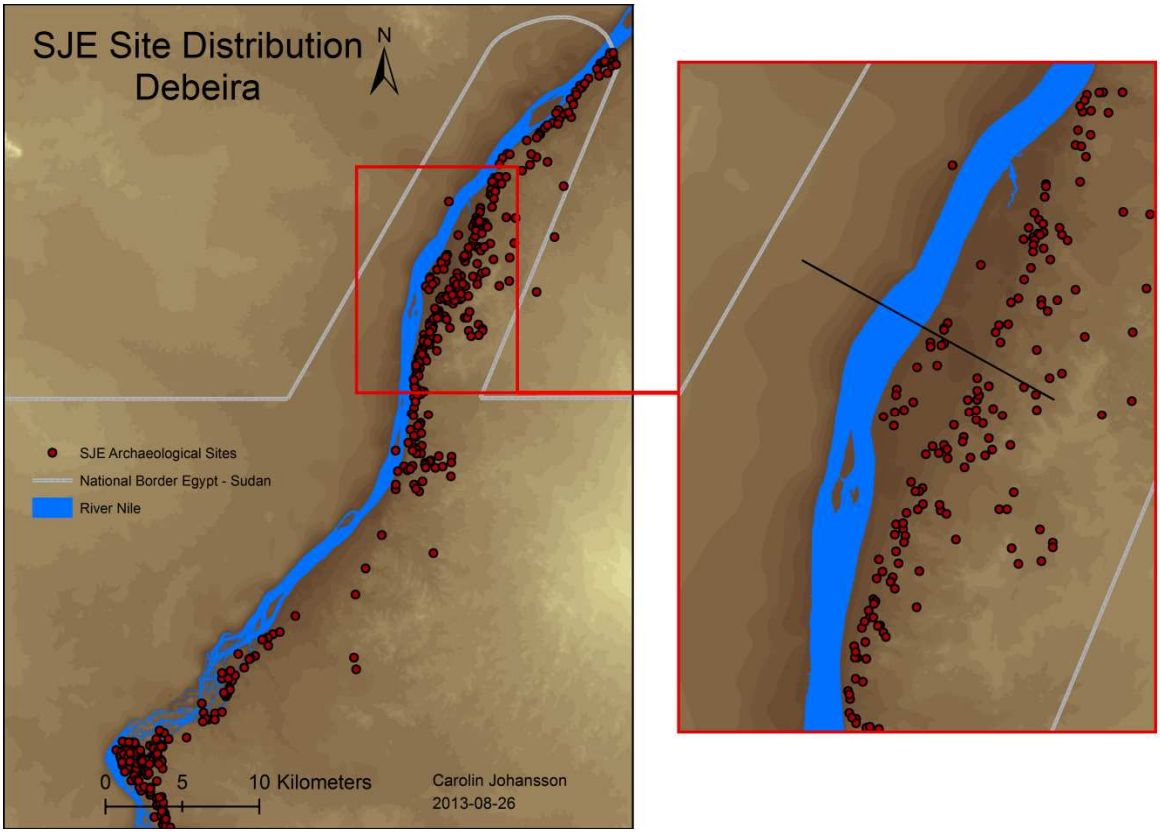


Figure 34. Map illustrating the site distribution in the Debeira district. The main map shows the extent of the detail to the right. The black line crossing the Nile Valley at a right angle represents the distance plotted in the profile graph below (figure 35).

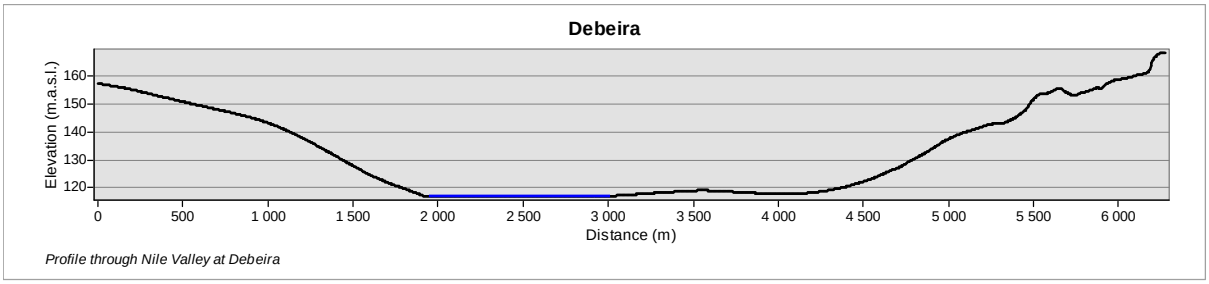


Figure 35. Digitally generated profile in the Debeira district. It is drawn in direction from west to east. A blue line has been added to represent the level of the Nile. The axes are not to scale.

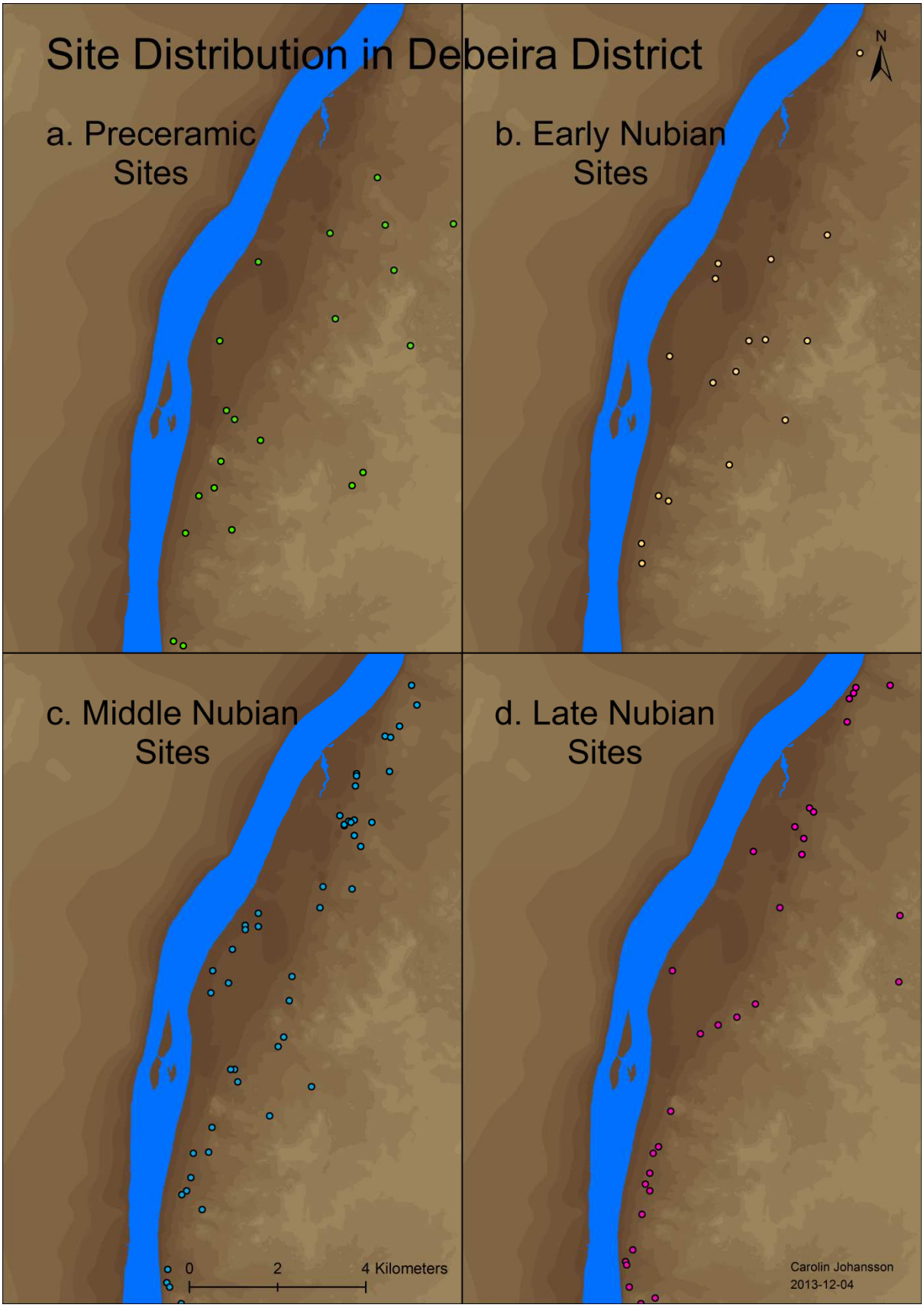


Figure 36(a–d). Map illustrating the site distribution in the Debeira district with regards to time period. Note that no preceramic sites were identified in the plain immediately east of the river's current stretch (36a).

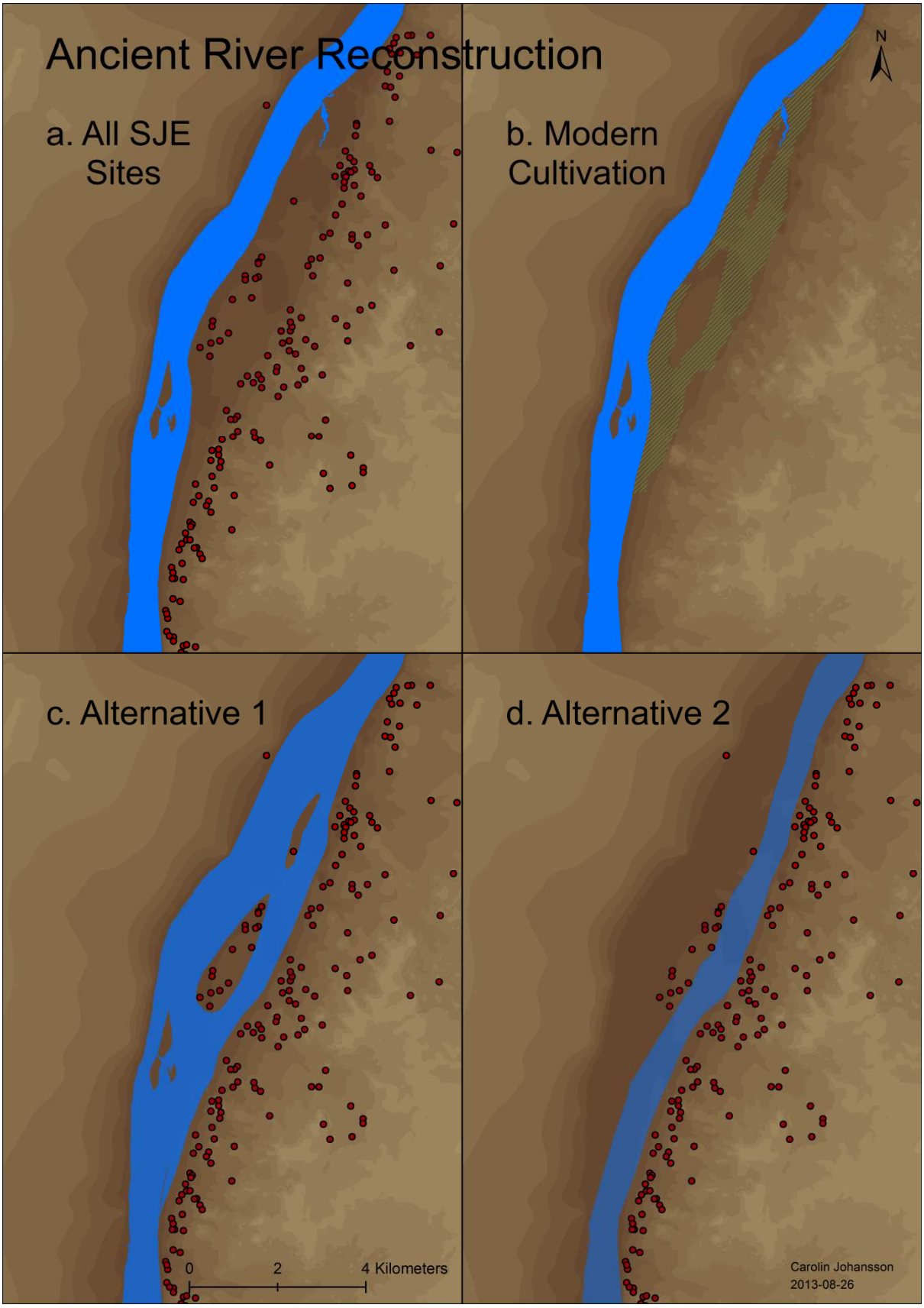


Figure 37(a–d). Map illustrating the alternative river stretches in the Debeira district. 37a describes the stretch of the Nile immediately before the inundation of Lake Nasser with the location of all indexed SJE sites. 37b includes a green shade representing the area covered by fields of cultivation before 1961 as indicated on map 2 SJE 1:2 (Hellström, 1970b). 37c shows a reconstruction of the Nile restricted by the site distribution resulting in an island encompassing Komangana and

Fadrus. 37d suggests another scenario in which the Nile has an easterly flow leaving the sites situated on an island in c. on the West Bank of the Nile (cf. the map on plate 61 SJE 5:3 (Säve-Söderbergh & Troy, 1991b)).

4.5. Temporal Distribution Patterns

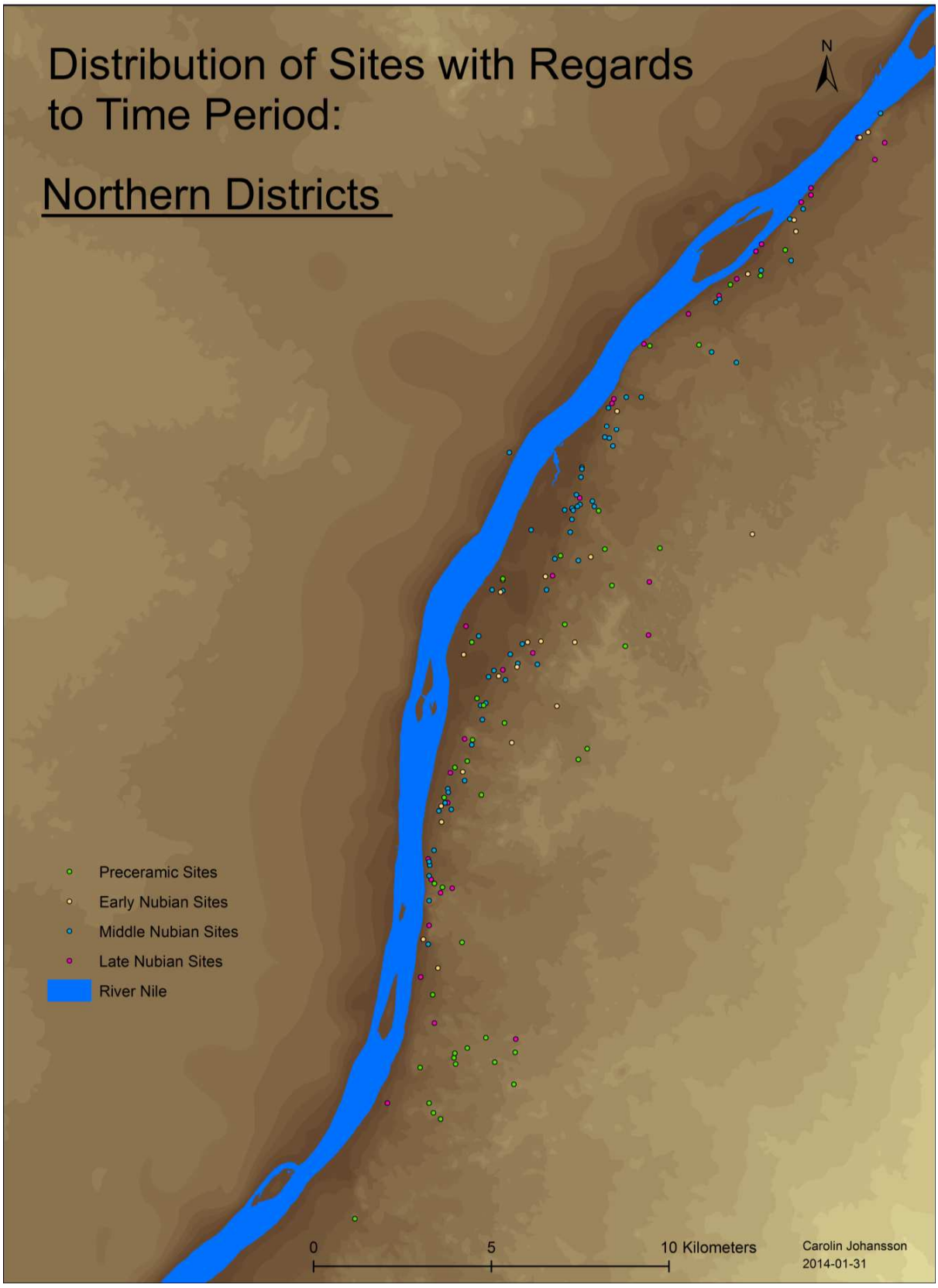


Figure 38. Map illustrating the distribution of sites with regards to time period in the northern districts of the concession area. The legend on the left side of the map indicates the order into which the different classes of sites have been drawn.

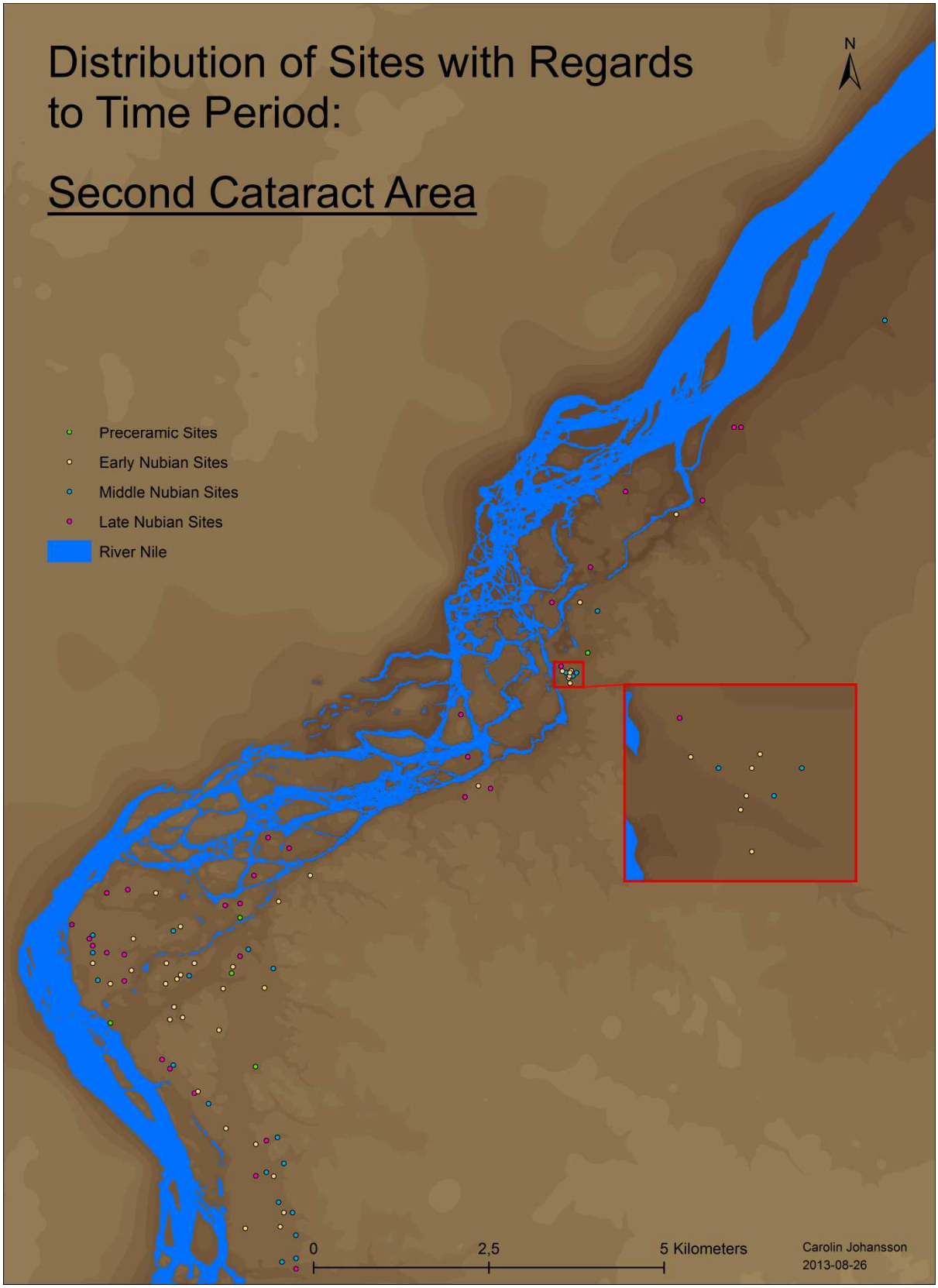


Figure 39. Map illustrating the distribution of sites with regards to time period in the area around the Second Cataract. The legend on the left side of the map indicates the order into which the different classes of sites have been drawn. The inset details the crowded area of Farki.

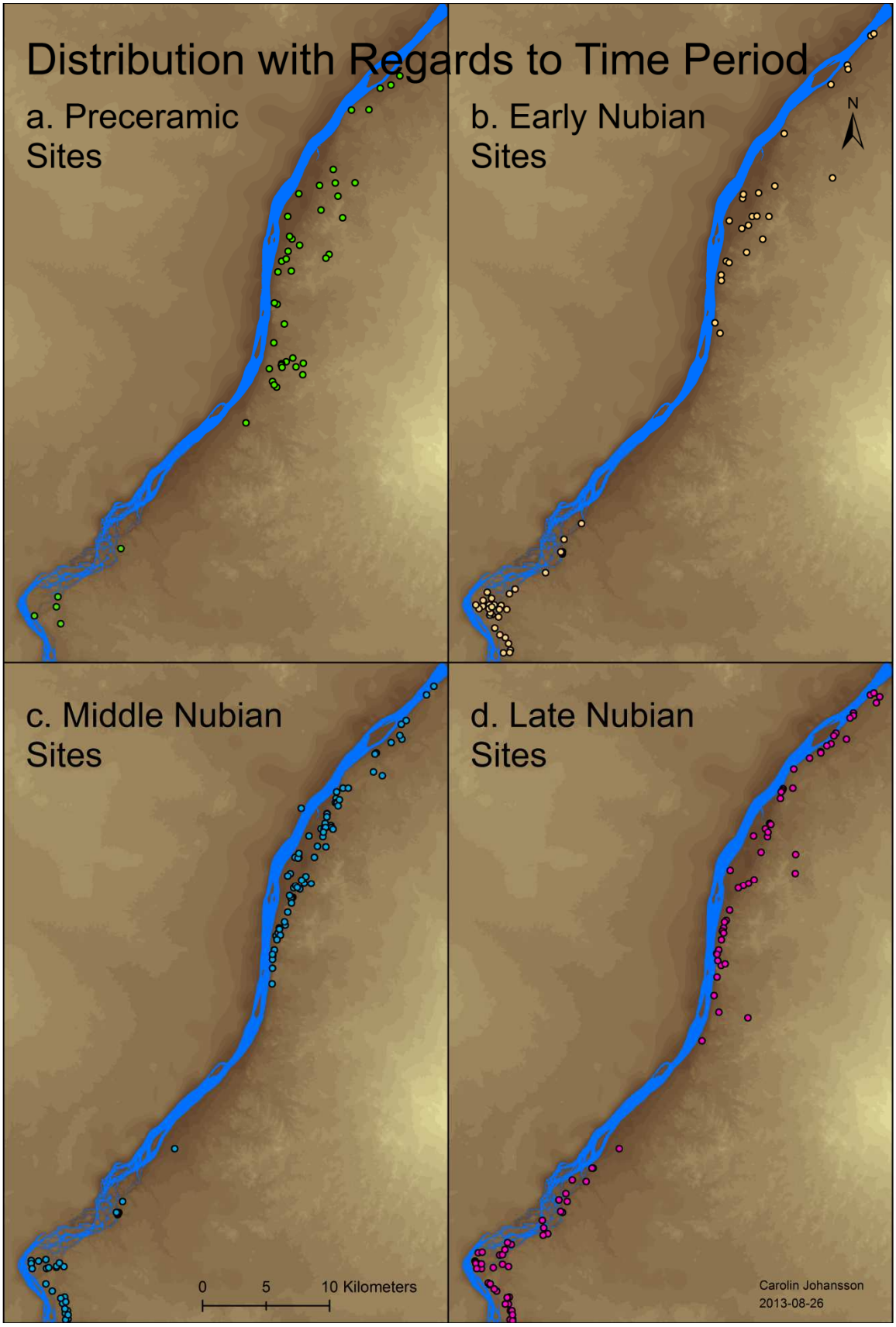


Figure 40(a–d). Map illustrating the distribution of Preceramic, Early Nubian, Middle Nubian and Late Nubian sites. Equivalent to maps in figures 38 and 39.

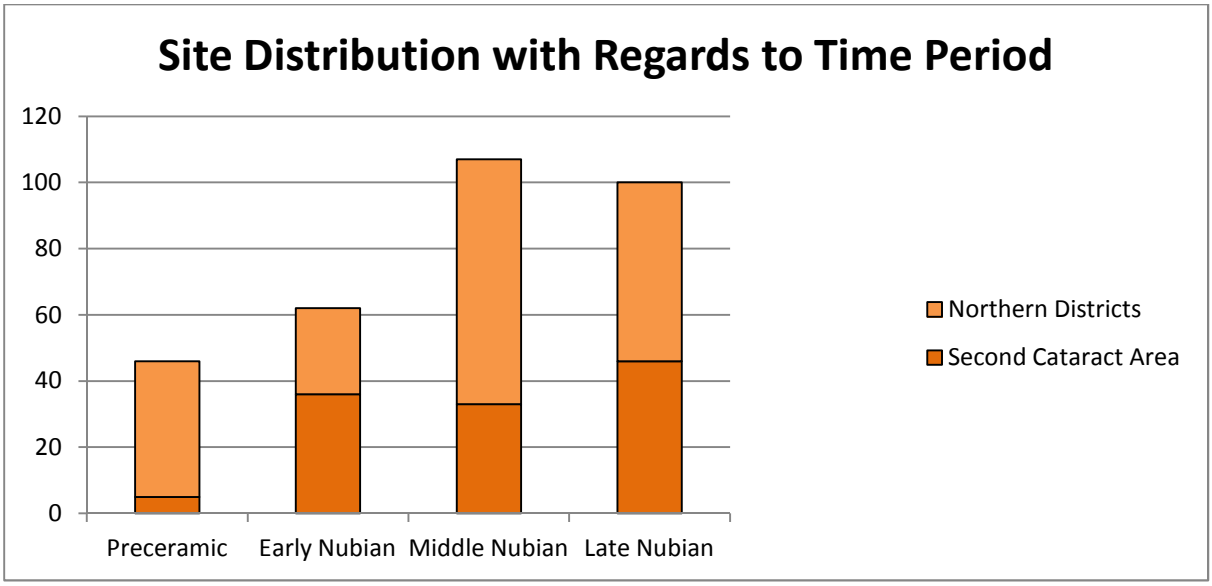


Figure 41. Diagram illustrating the distribution of sites with regards to time period and location. The geography refers to that presented by maps in figures 38 and 39.

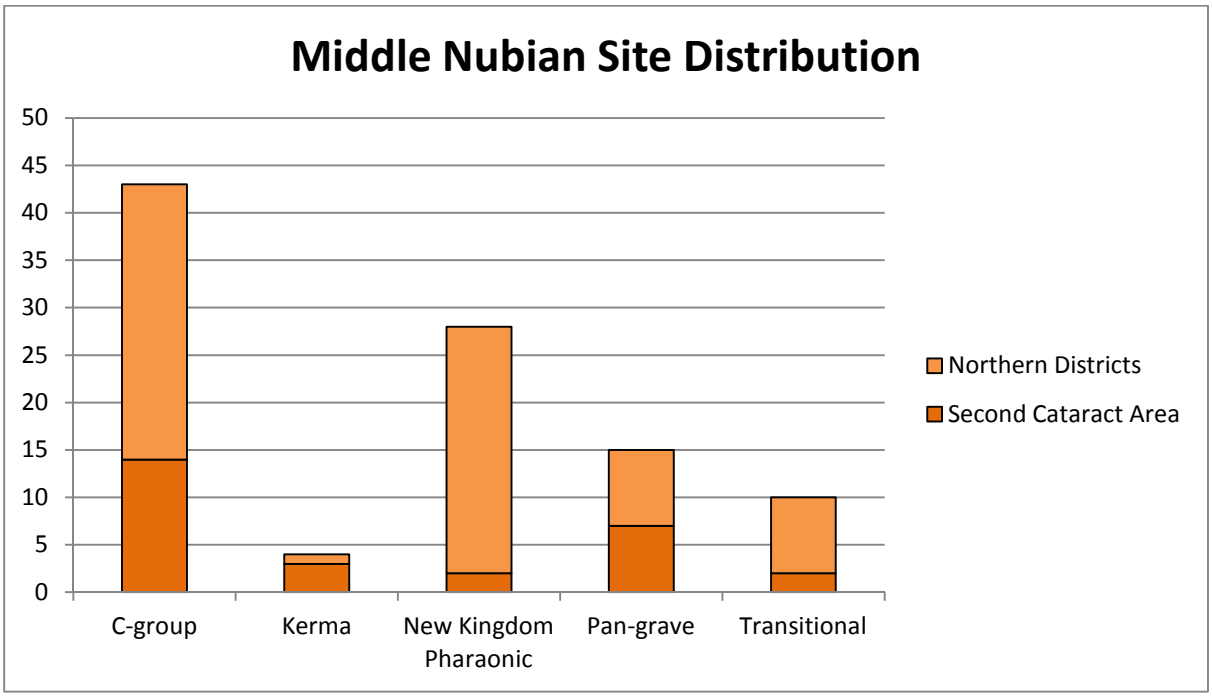


Figure 42. Diagram illustrating the distribution of sites with regards to cultural affiliation within the Middle Nubian time period and location. The geography refers to that presented by maps in figures 38 and 39.

4.6. Type-specific Distribution Patters

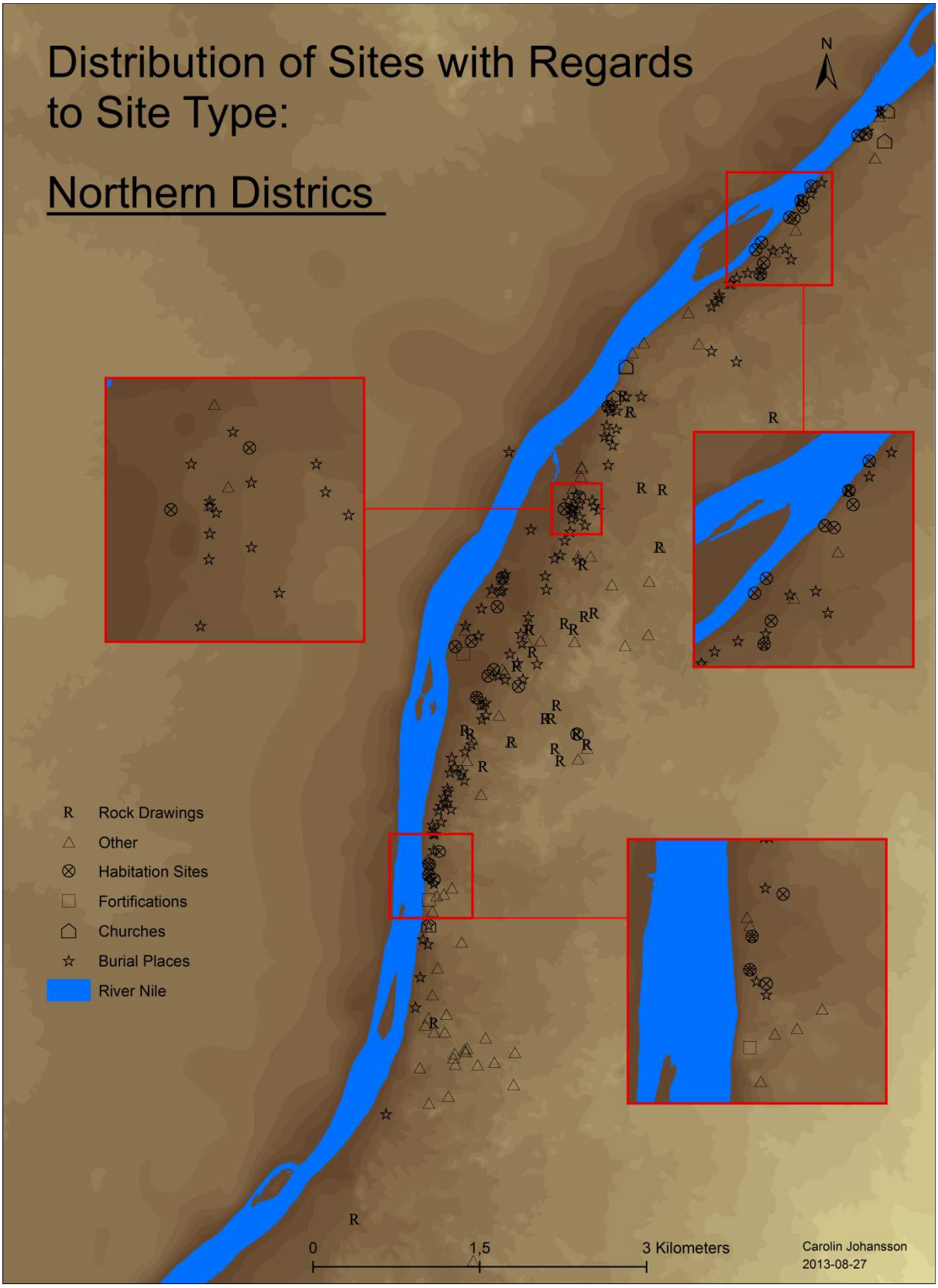


Figure 43. Map illustrating the distribution of sites with regards to type of site in the northern districts. The legend on the left side of the map indicates the order into which the different classes of sites have been drawn. The insets details the crowded areas of the district of Faras (north), Nag el-Leithi (centre) and Kashkush (south).

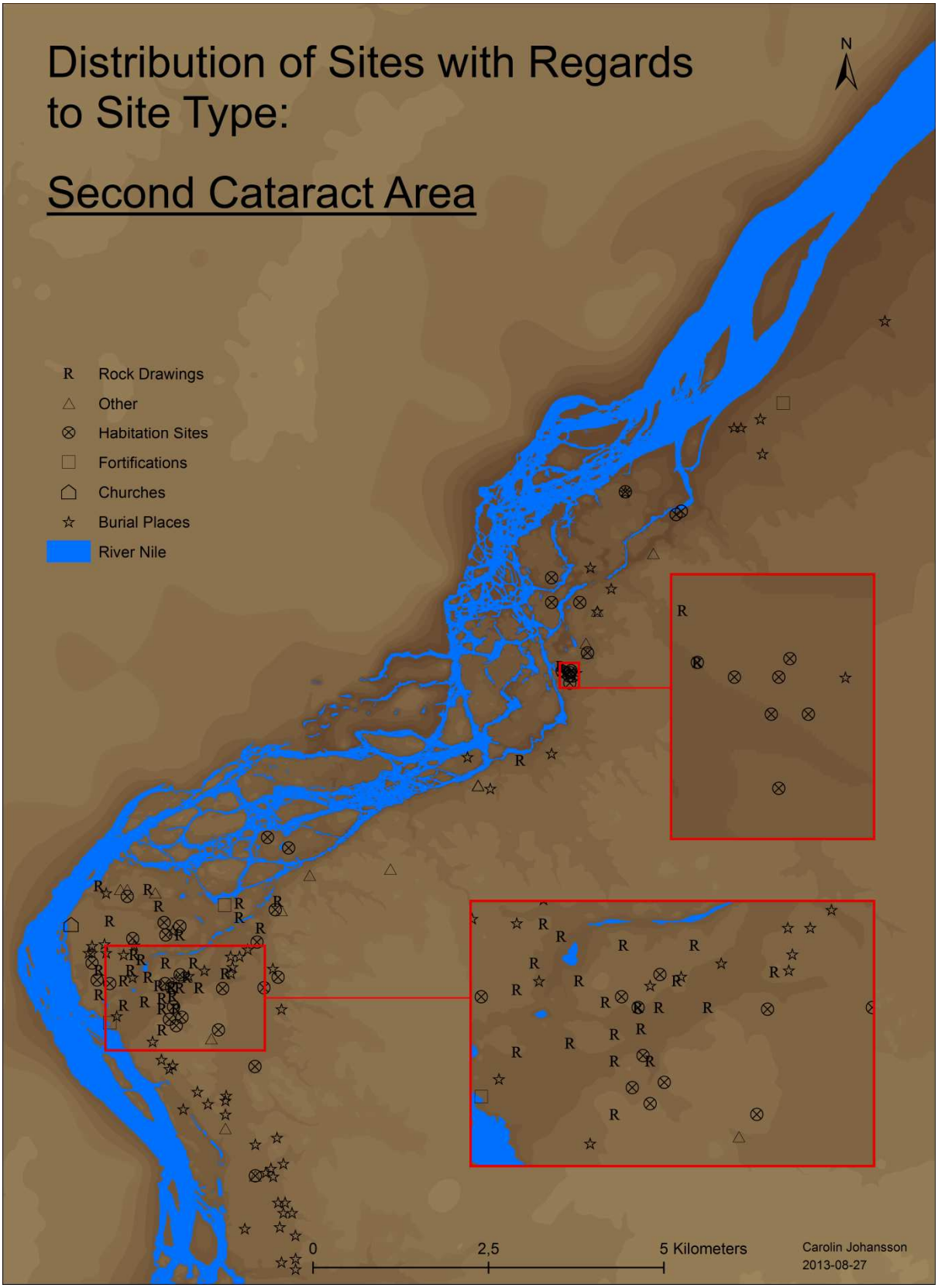


Figure 44. Map illustrating the distribution of sites with regards to type of site in the area around the Second Cataract. The legend on the left side of the map indicates the order into which the different classes of sites have been drawn. The insets detail the crowded areas of Farki (north) and an area in the district of Gamai (south).

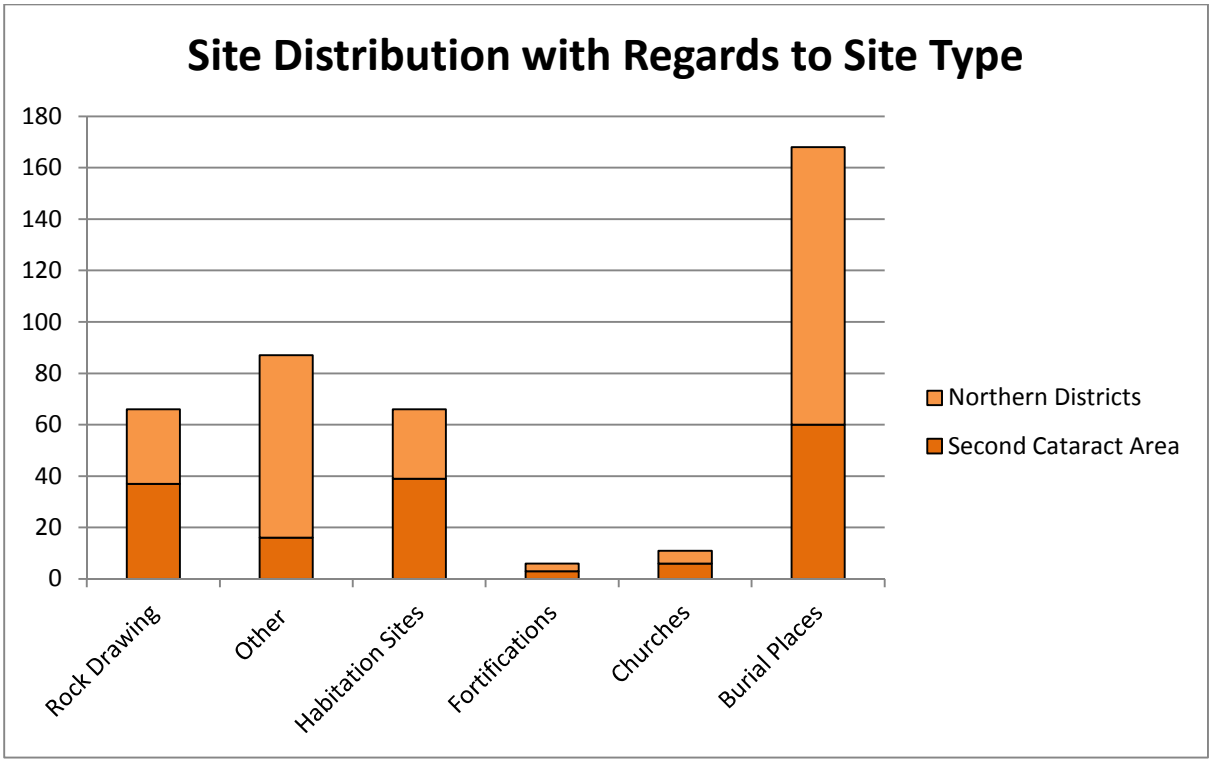


Figure 45. Diagram illustrating the distribution of sites with regards to type and location among all classified archaeological sites. The geography refers to that presented by maps in figures 43 and 44.

4.6.1. Spatial Autocorrelation in Habitation Sites and Burial Places

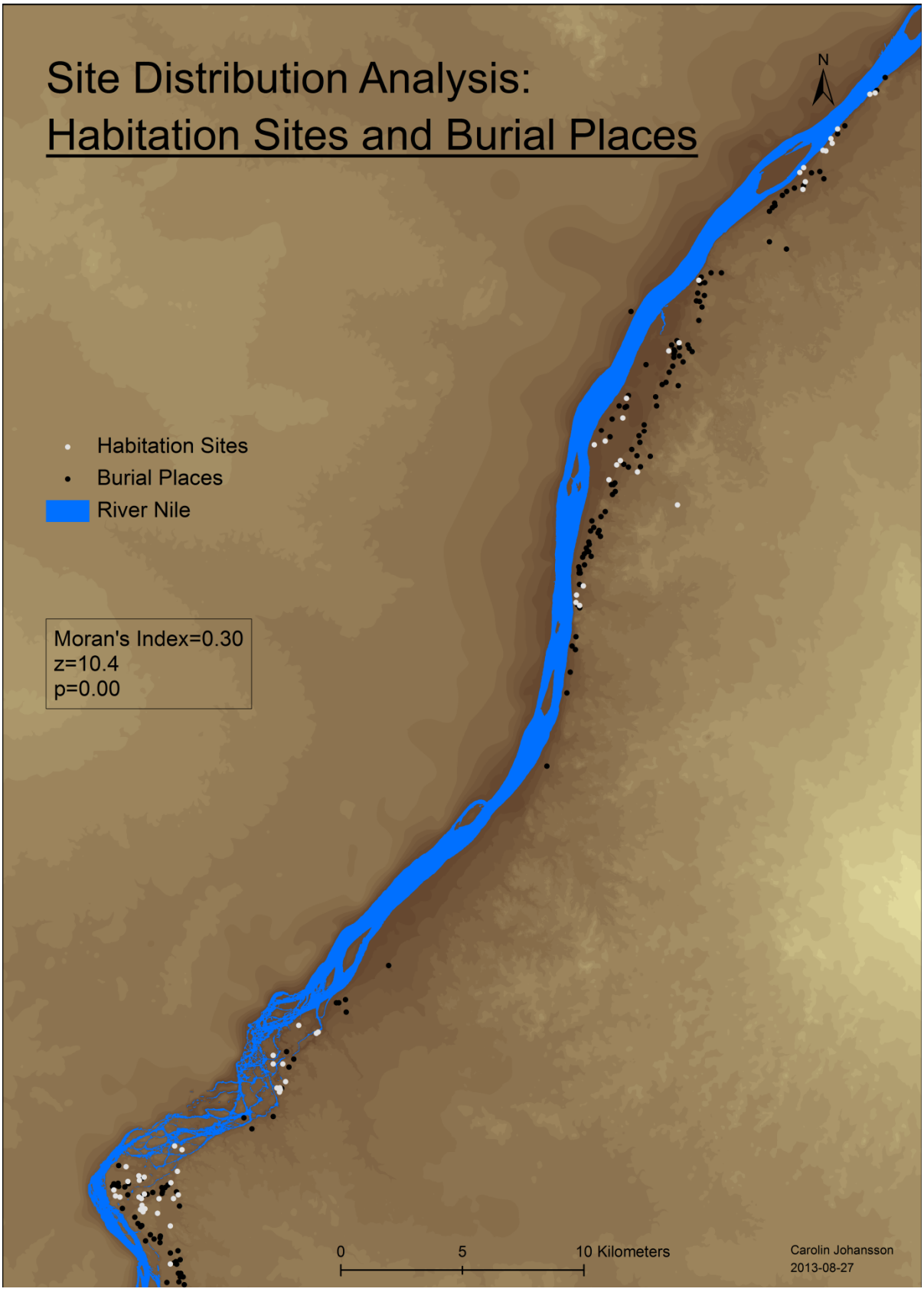


Figure 46. Map illustrating the distribution of sites classified as Habitation Sites or Burial Places. The textbox indicates the result of a calculation of Moran's Index of clustering with regards to type of site.

4.7. Seasonal Habitation Patterns in the A- and C-group Sites

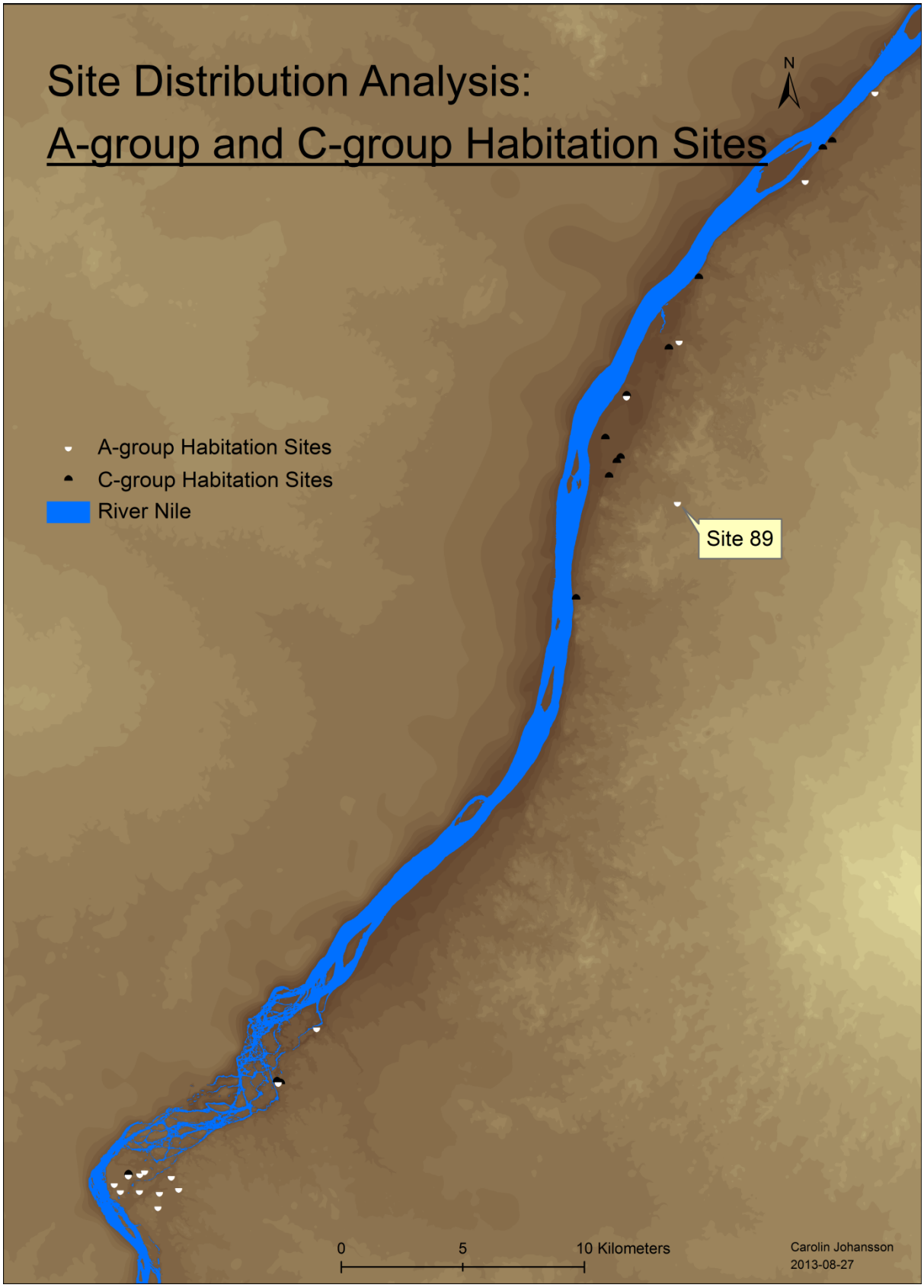


Figure 47. Map illustrating the distribution of the habitation sites of the A-group and C-group. The two classes are symbolised as semi-circles in order to enable visualisation of identical sites, that is, sites including evidences of habitation of both A-group and C-group.

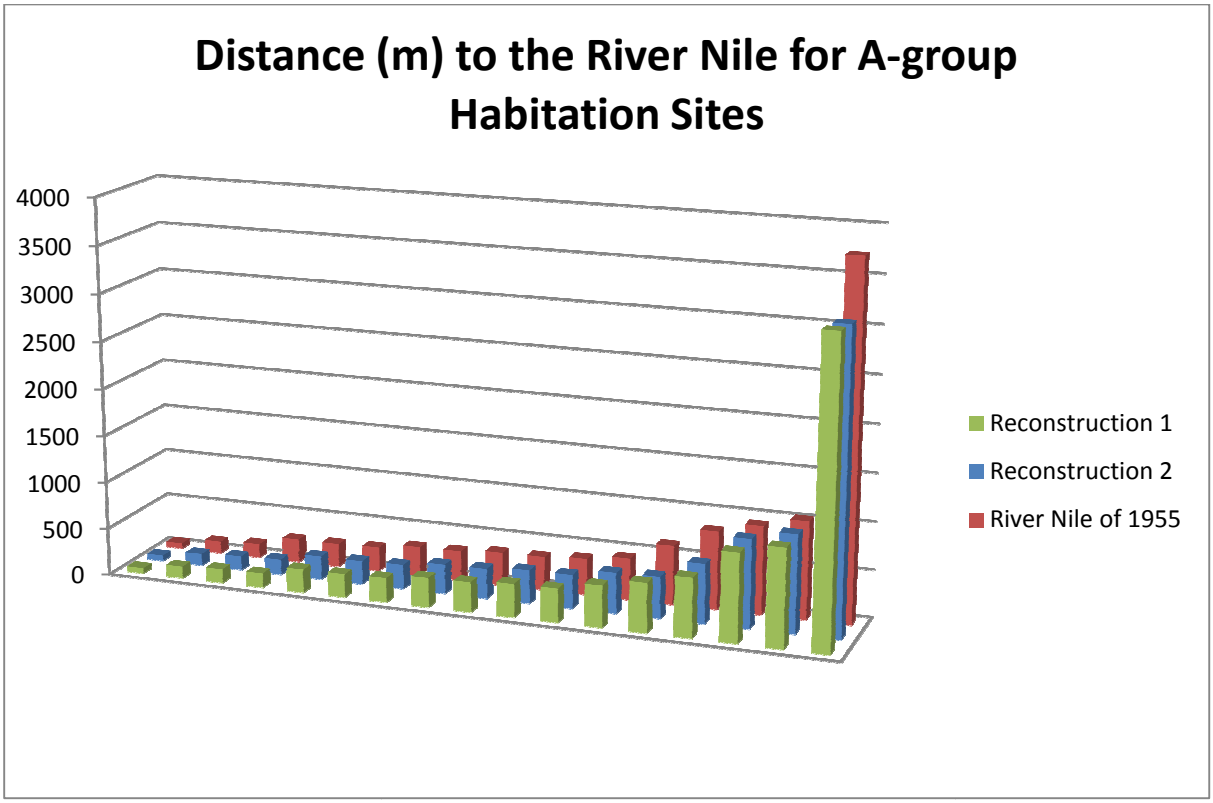


Figure 48. Diagram illustrating the shortest distance to the river from each of the A-group habitation sites. The modern Nile stretch of 1955 and the two reconstructions of figures 37c and 37d were used as indata. The site to the far right is number 89.

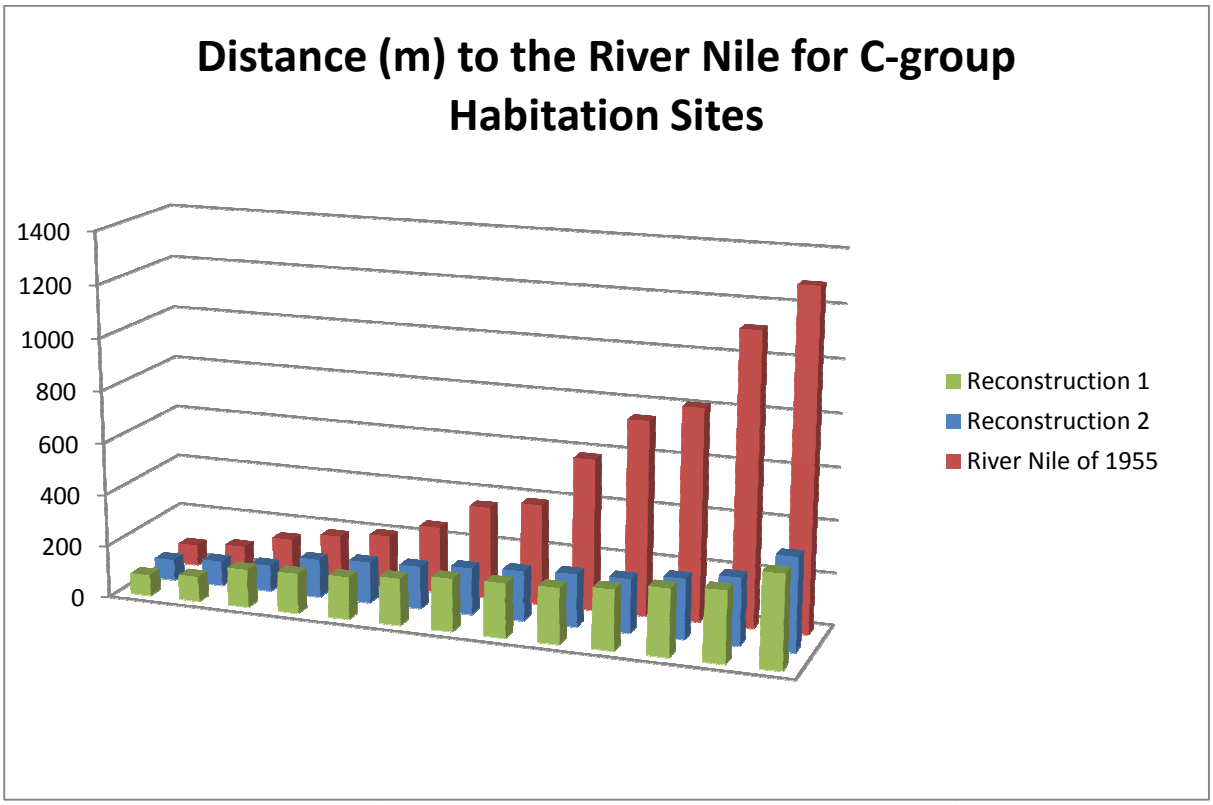


Figure 49. Diagram illustrating the shortest distance to the river from each of the C-group habitation sites. The modern Nile stretch of 1955 and the two reconstructions of figures 37c and 37d were used as indata.

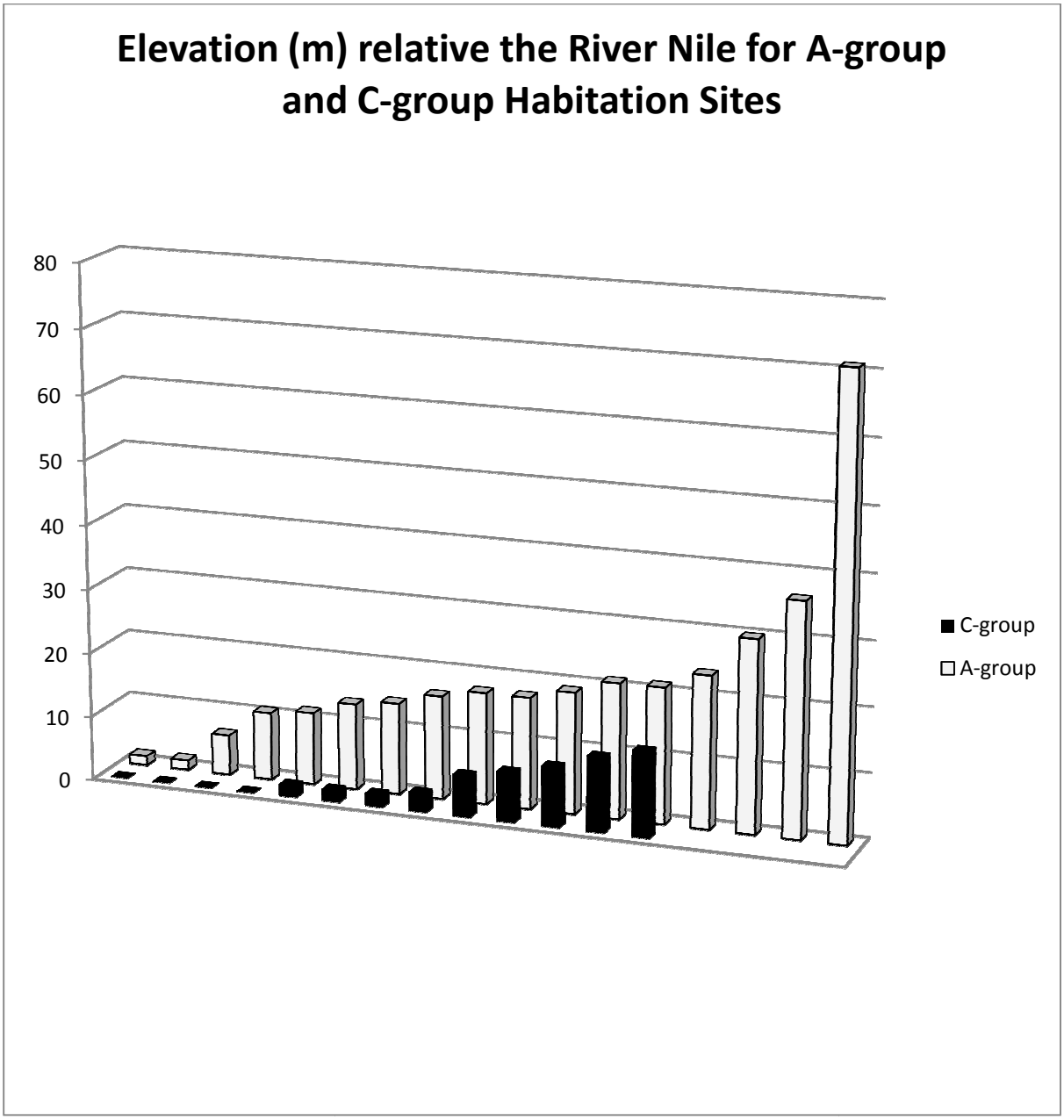


Figure 50. Diagram illustrating the elevation values relative to the river from each of the A-group and C-group habitation sites. The A-group site to the far right is number 89.

4.8. Spatial Correlation between New Kingdom Pharaonic and C-group Burial Sites

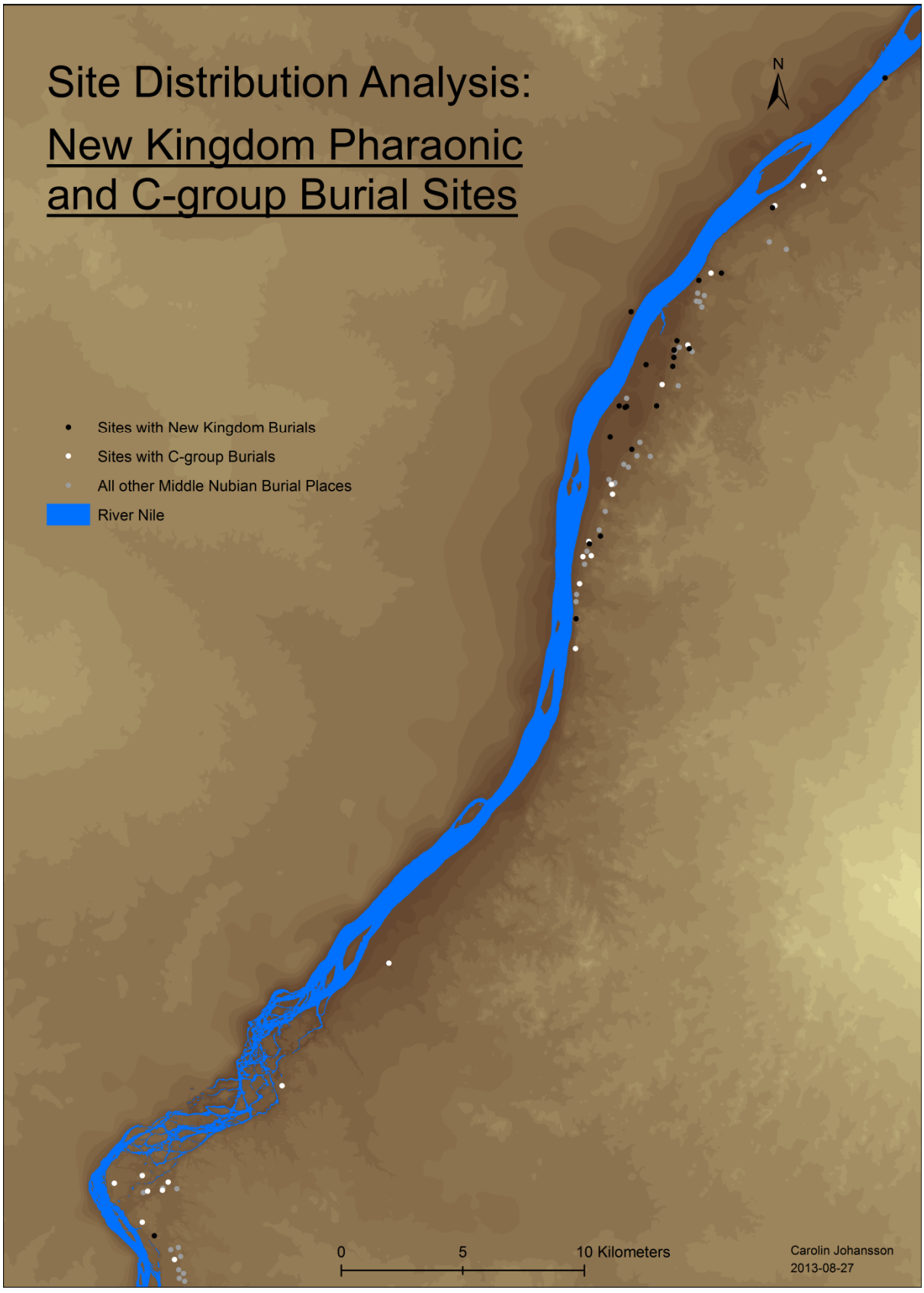


Figure 51. Map illustrating the distribution of sites with New Kingdom Pharaonic burial or C-group burial content.

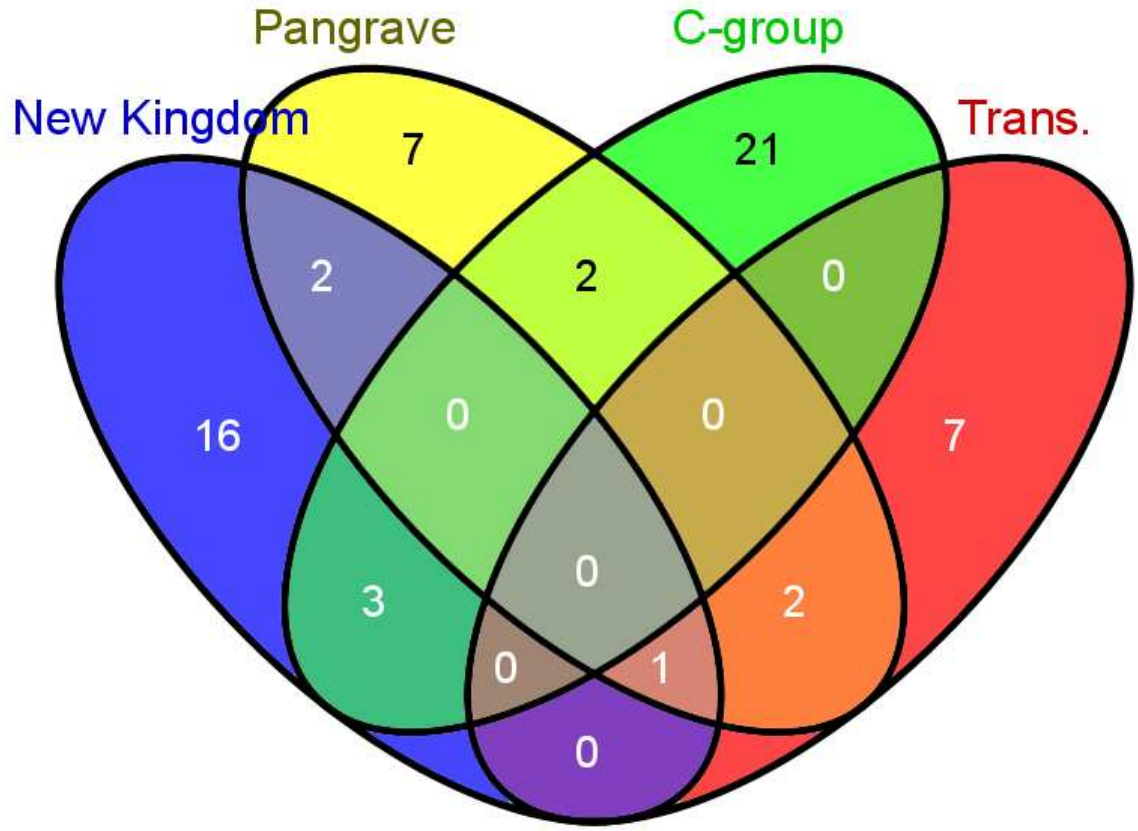


Figure 52. 4-set Venn diagram illustrating the inter-relationships of sites representing Middle Nubian burial places. Figures refer to number of sites. Kerma sites (n=4) were excluded as those only shared sites with the burial places classified as Pangrave (n=2) and C-group (n=1) and not with the New Kingdom Pharaonic burial places as are the subjects of the issue in question.

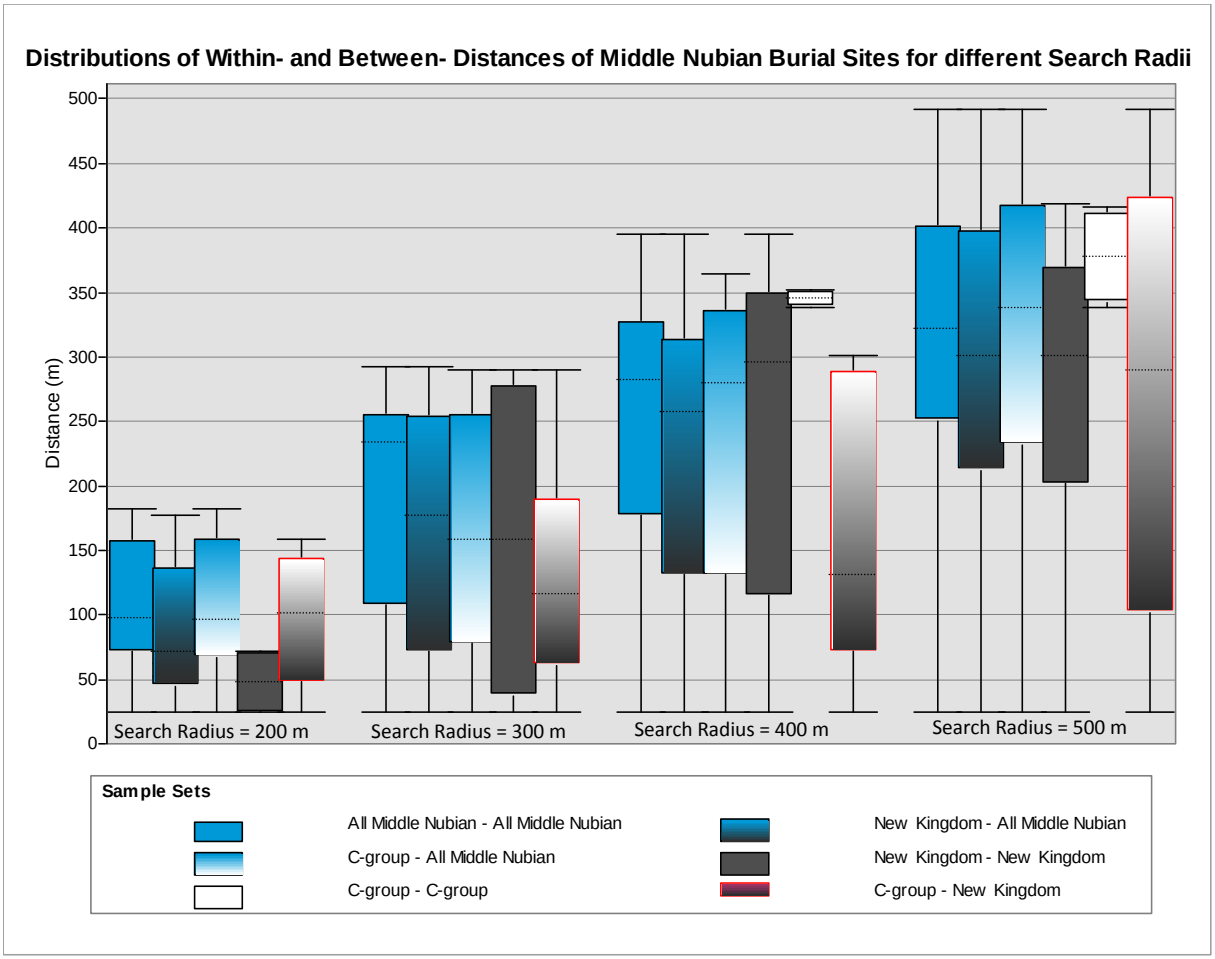


Figure 53. Diagram illustrating the distribution of distances within and between New Kingdom Pharaonic burial sites, C-group burial sites and all Middle Nubian burial sites. New Kingdom Pharaonic burial sites are colour coded as black boxes, C-group burial sites as white boxes and Middle Nubian as blue boxes. Boxes with gradients thus demonstrates distances between groups represented by the two colours. The extent of boxes indicate the second and third quartile, the dotted line in each box represents the median value and the vertical lines shows the range. The bars are grouped into clusters based on the search radius used in the respective calculations and are indicated on the bottom axis. Results for search radii larger than 500 m are not shown. The boxes representing the distance between the New Kingdom Pharaonic and C-group burial sites are highlighted with red borders. The sample sizes for each set are indicated in table 11.

Sample Set\Search Radii	200m	300m	400m	500m
Within All Middle Nubian	28	56	94	164
Between New Kingdom and All Middle Nubian	10	19	31	41
Between C-group and All Middle Nubian	10	13	27	44
Within New Kingdom	4	8	16	18
Within C-group	0	0	4	8
Between C-group and New Kingdom	5	6	7	11

Table 10. Sample set sizes for the calculations accounted for in figure 53.

4.9. Intervisibility of the Tombs of the two Brothers

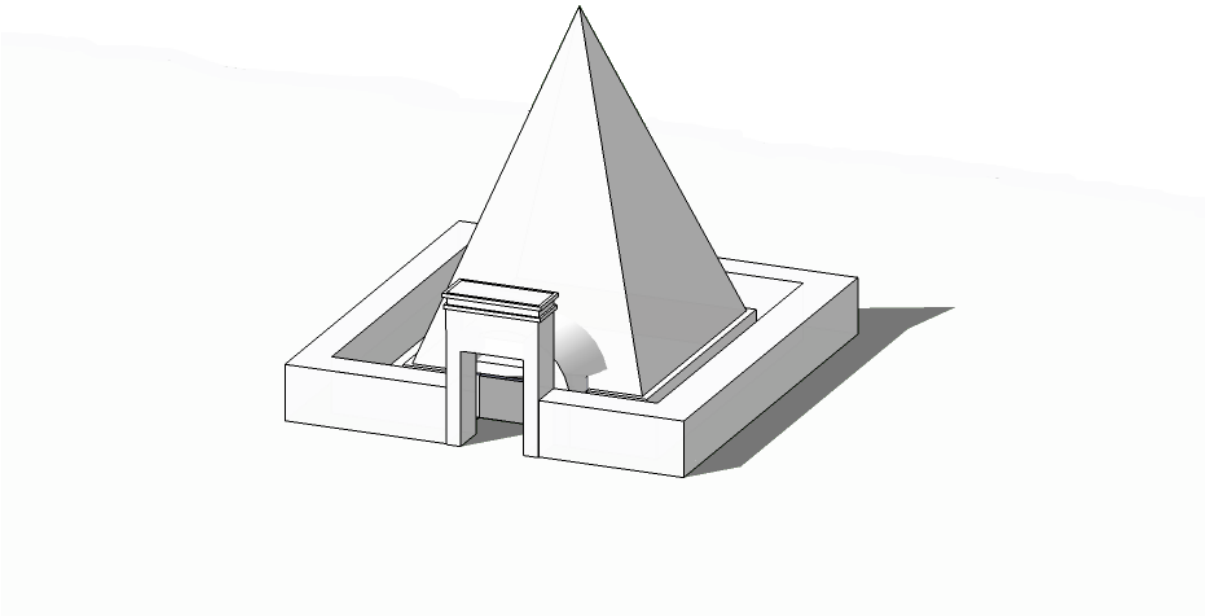


Figure 54. 3D model reconstruction of the pyramidal superstructure of the tomb of Amenemhet.

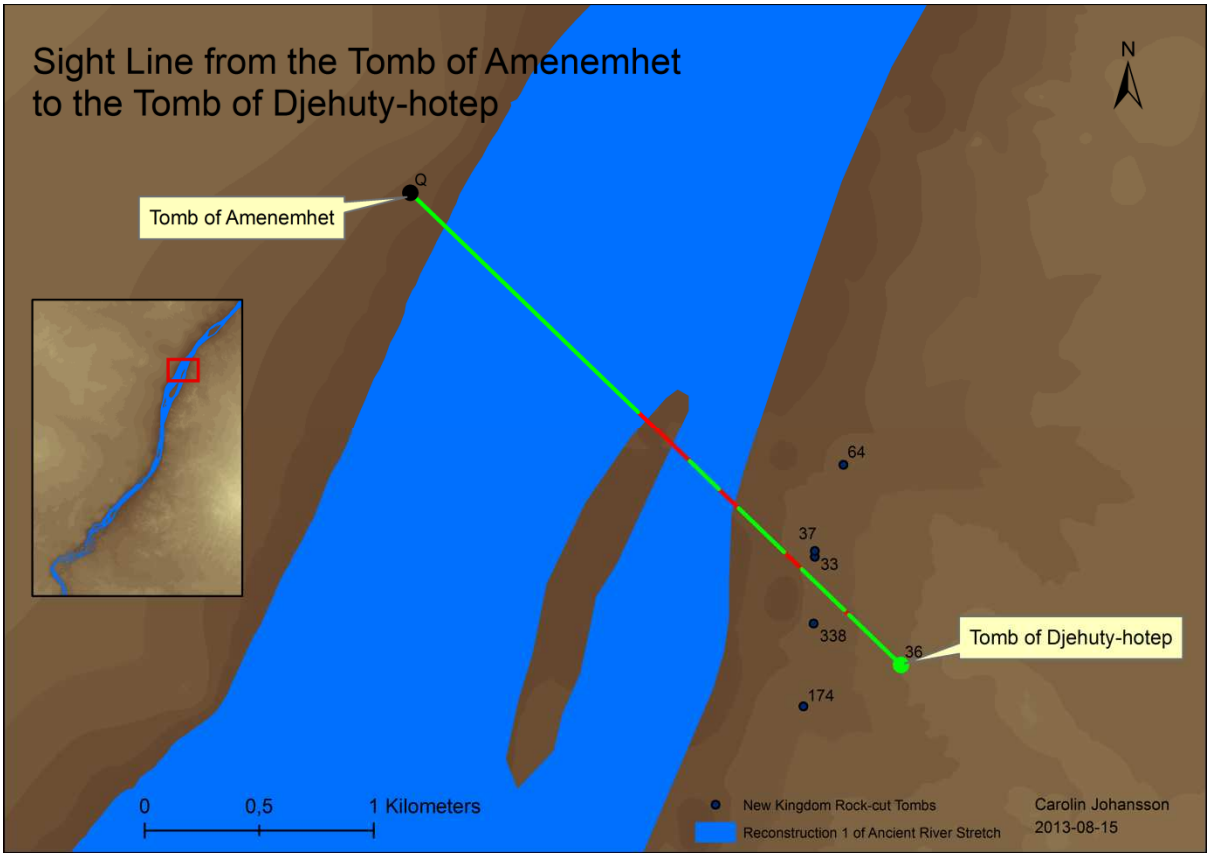


Figure 55. Map illustrating the sight line from the tomb of Amenemhet (site number Q) to the tomb of Djehuty-hotep (site number 36). Nearby sites containing tombs attributed to New Kingdom Pharaonic culture have been plotted for

reference. The sight line is colour-coded as following: green symbolises visible stretches, red symbolises invisible stretches. The corresponding line starting at the tomb of Djehuty-hotep, finishing at the tomb of Amenemhet, that is in reverse direction to the one plotted above, was also calculated with nearly identical result (data not shown). The river is represented as in the reconstructed alternative 1 of figure 37c.

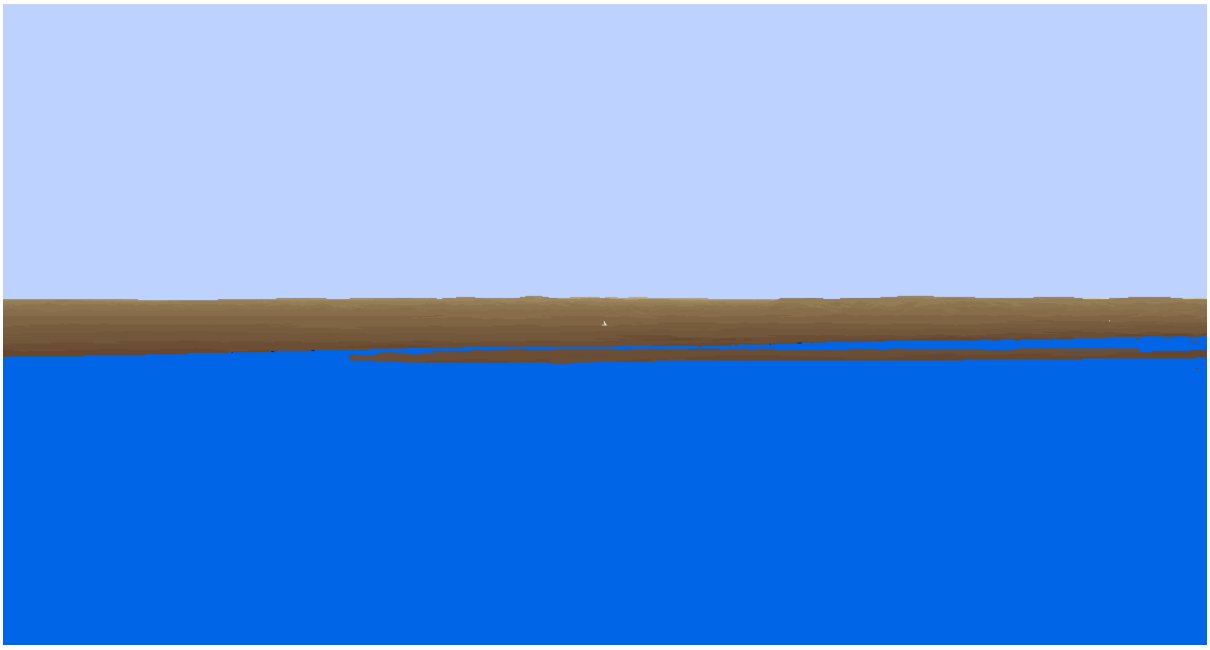


Figure 56. Digitally reconstructed view from the tomb of Amenemhet towards the tomb of Djehuty-hotep. The modelled superstructure is visible in white in the centre of the image.

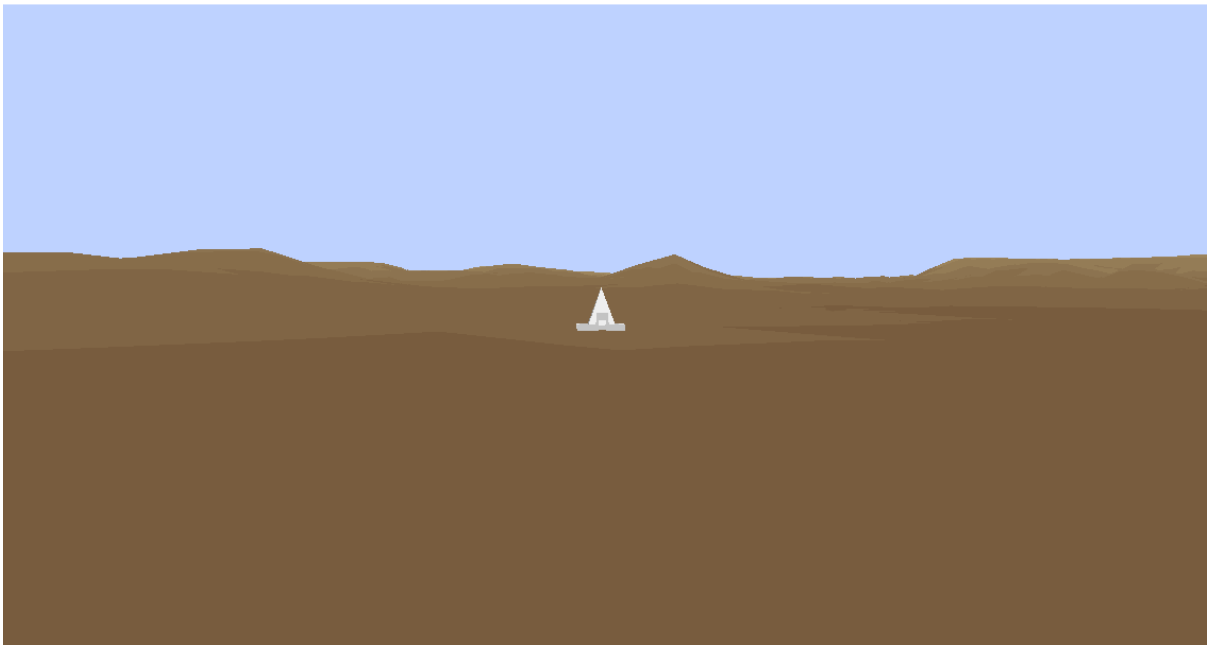


Figure 57. Close-up of the reconstructed view in the direction from the tomb of Amenemhet towards the tomb of Djehuty-hotep. This theoretical view corresponds to observing the target at a half-way distance and can be approximated with the same as in figure 56 observed through a pair of binoculars.

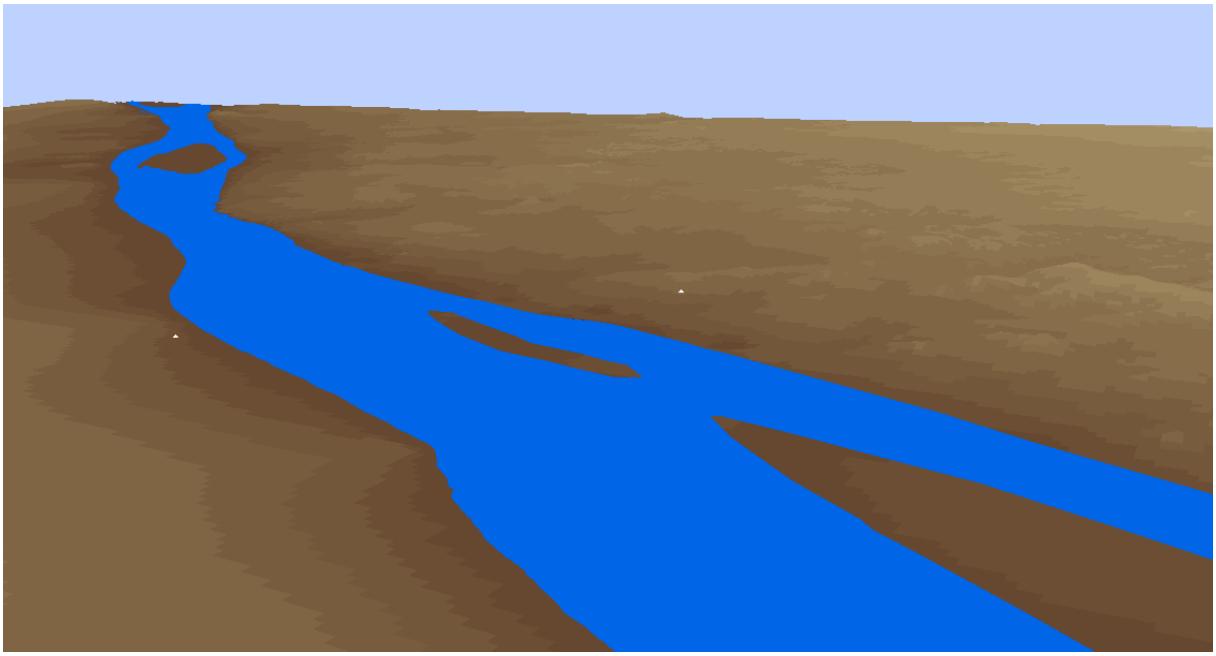


Figure 58. Reconstructed oblique aerial view of the region of Teh-Khet looking towards the North-East. The pyramids representing the two brothers' tombs are visible at each side of the river.

5. Discussion

5.1. Data Collection and Compilation

The site-specific information of the SJE Archaeological sites turned out to be rather difficult to classify into a simple list. This is mainly because the SJE established site numbers for locations often including more than one type of remains and/or attributed to several time periods or cultures. However, the system of organising the data was retained in order to simplify the information import into a GIS even though other database structures could have been more suitable to intuitively handle the data.

Other problems arose during the course of the work due to uncertain classifications, missing data and discrepancies between the sources. Information with obvious errors was deleted. Despite those issues, it was possible to establish location for 460 of the 481 indexed sites which means that 96% of the sites were possible to map in a GIS, thereby fulfilling objective 1b. 80% of the sites could be assigned to at least one type (figure 9) and 57% were assigned at least one time period (figure 10).

Digitalisation of the topography features was straightforward albeit time-consuming (see table 9), in particular in the complex area of the Second Cataract (see insets in figures 11 and 12). The basemaps contributed sufficient coverage in the area of interest and the features corresponded well with those recorded by satellite imagery in areas above current sea level (see insets in figures 13 and 14 as well as figure 16a). An obvious problem though was the approximation of the boundary of the river as the elevation contour of 120 m.a.s.l. (uncorrected value) because the water level is higher upstream of, and through most of, the Second Cataract. The approximation of the shores with the next elevation contour in that latter area thus creates an infinite slope in the middle of the cataract. This artefact made it unsuitable to include the digitalised Nile as a *Lake* into the interpolation process with the result that the Nile is not completely flat inside the model where one would expect it to be. However, no interpretative issues are anticipated due to this error within the contexts in which the model is intended to be used.

The interpolation of the digitalised features was chosen to include, in addition to the SJE concession area, parts of the surrounding deserts as well as the inundated West Bank (see the map in figure 15). This was due to a desire to put the area of interest into a wider topographical context and thereby also producing more visually satisfying illustrations. The resolution of the DEM was set very high (table 7) in order to, as carefully as possible, reflect complex topographical features such as steep slopes that were prominent in the SJE area, and symbolised with overlapping contours in the basemap. It is important to note though that the high resolution is irrelevant in several areas as the West Bank where only spot elevations were set as indata or in the deserts where the DEM was based on contours extracted from a raster of much lower resolution. Moreover, it is acknowledged that the procedure of interpolating elevation contours once constructed from a raster (in this case the SRTM data) implies an amount of data loss even though the relevance of that data loss is limited inside this specific project. The choice to encompass all areas into the same interpolation was, despite the varying issues discussed above, justified as it was anticipated that a mosaic of separate raster datasets would have caused awkward boundary effects. Furthermore, the strategy conveniently got rid of undesirable blank areas of missing data in the SRTM raster. The resulting DEM fulfils objective 1a.

5.2. Validity of Model

In the uppermost areas of the SJE concession and the immediately surrounding desert, it was possible to assess the accuracy of the reconstructed landscape by comparing a DEM based *solely* on manually digitalised topography features with remote sensing data available for current land above the water level. Such comparison revealed that there was a correspondence in the general pattern between the two datasets (see the maps in figures 16 and 17). However, there were varying degrees of deviances in absolute values (see the map in figure 18a) between the DEM and the SRTM data (see figure 18a). In the part of the DEM where only spot elevations were available, overestimation of elevation is noted (see the black areas in the map of figure 18a). This is likely due to the non-random placement of those measured points, an effect illustrated in the upper inset of figure 14. The result is not considered of importance as the area contains little of interest with regards to the activities of the SJE and because the discrepancy is counteracted by the inclusion of SRTM data into the final model[72]. In the part of the overlapping area that was covered by manually digitalised elevation contours, there was a tendency to underestimate elevation in the DEM compared with what was given by SRTM (see the map of figure 18b and the diagram in figure 19). This effect is also apparent in the map of figure 16b where the predicted shoreline (of 179 m.a.s.l.) is located mainly on current land at a distance from the actual border between land and water[73]. The latter discrepancy of underestimation can be attributed to several possible causes:

1. The correction of elevation values due to the error noted in SJE 1:1 (Säve-Söderbergh, 1970:17, also described in section 3.3.2.) is wrong or misinterpreted by the author. However, such a systematic error cannot solely account for the deviance in the diagram of figure 19 as a relatively narrow peak would have been expected at three or six meters of positive discrepancy (underestimation). Instead, a peak close to nine meters is noted with a standard deviation of nearly six meters.
2. It is likely that landscape processes may have altered the area of the present shoreline during the transformation of the river into a lake and the half decade that has elapsed since then until the time of the data collection of the SRTM. A possible mechanism can be sediment depositions that occur in slow-flowing waters such as along an undulating shoreline. That would explain the especially high discrepancies noted in bays or wadis (see figure 16b and the white area in figure 18b) where in several locations the DEM predicts water while the satellite data indicates dry land. Such deposition process would be different in magnitude in different parts of the shore which would explain, together with partial erosion, the wide distribution of errors in the diagram of figure 19.
3. Lastly, it should be noted that artefacts are expected due to the great (almost 50-fold) difference in resolution between the datasets compared. That may have caused the skewed error distribution of figure 19 and certainly contributed to its spread. This artefact may solely explain the noted discrepancies and is indeed expected to contribute to any errors due to suggested cause 1 or 2 or the combination of those.

Whatever the errors noted in the overlapping area, today above water-level, are due to, it is furthermore not known to what extent, if any, those causes are affecting the accuracy of the most

[72] Contours were set as the primary type of input data (see table 7).
[73] However, the exact water level represented by this imagery (data collected 2012-03-13) has not been possible to assess, thereby is the comparison considered approximate.

important area in question, namely that of the SJE concession that is today *almost* exclusively inundated. The validity of that, major part of the, reconstructed landscape can be assessed by comparisons with data given by the SJE.

The selected scenes of a 3D visualisation shows that the general features can be recognised as given in photography (figures 20-25) despite the difficulty of orienting the scenes in a way to correspond to the photographs with satisfaction. However, details cannot be rendered by the DEM as noted in the absence of abruptness (figure 21) noted in the cliff in the uppermost left corner of the photograph in figure 20 or the smoothness of the slope in the reconstructed view of Gebel Sahaba in figure 23 compared with the photograph in figure 22 and the graph in figure 27 compared with the one of figure 26. Likewise, the shadow of the mountain in the foreground in figure 23 is noticeably shorter than what is noted in the corresponding photograph in figure 22. That could be due to an earlier time of photography (pre-8 AM) than assumed or that the height and/or shape of that mountain is incorrectly rendered.

The model could also predict the topography and shadowing patterns roughly well as rendered in vertical aerial photographs (figures 28 and 29), except for in areas not covered by elevation contours but only spot elevations such as those on higher ground in the right side of figure 28.

Finally, the comparison between estimated and interpolated elevation values indicate how well the DEM corresponds to the basemap, which was the source of the indata, or, rather the human interpretation of it. In this case, no systematic error is suspected as the mean error is less than a meter (see the diagram in figure 30) and outliers are believed to be due to errors in the locations given for each site or to errors in the manual interpretation of the map from which the elevation values had once been estimated.

It was anticipated that the type of landscape in the SJE area would not be rendered well by the simple interpolation process that was applied because of the platform-like structure that is predicted by the geological sequence (Wendorf et al., 1965)[74]. However, as noted by Heinzelin (1968:45) that effect may not have been so prominent on the surface and thus, together with the comparisons discussed above, the DEM was considered satisfying and useful for its purpose thus fulfilling the aim of objective 2a .

5.3. Implications of General Site Distribution

After location had been established for the 460 sites, plotting readily revealed that these were concentrated mainly into two regions (see the map in figure 31) where the one located downstream constitutes a narrow band along the eastern shore of the five northerly districts (Faras until Sahaba) and the area of the Second Cataract or slightly upstream of it (see also the chart in figure 8). Even though the site distribution itself may not necessarily reflect quantifiable distribution of archaeological remains[75], there is an obvious lack of indexed sites in the region between the two high-concentration areas. This was partly explained by the presence of the settlements belonging to the town of Wadi Halfa and the nearby airfield, areas that were off-limit for the SJE (see the map in figure 32). However, also the interpolation of a line crossing the Nile Valley in the area (marked in the main map of figure 32) indicates that the profile of the landscape (see the graph in figure 33) is

[74] Cf. the last paragraph of section 1.3.1.
[75] As the different SJE sites encompass different degrees of content.

disadvantageous for preservation of archaeological remains to the east of the river. The low elevation east of the river makes it likely that the Nile has regularly inundated that plain or even had one or several previous permanent stretches there thus effectively eroding archaeological remains. It is however impossible to say if the lack of recorded sites are due to those investigational or preservational causes or to a genuine absence of past time human activity.

5.3.1. Reconstruction of ancient River Stretch(es) in the Debeira District

Another peculiarity was noted in the district of Debeira as there is a stretch, centred at about 2 km distance from the modern stretch of the river where no sites were recorded in an area otherwise densely populated by archaeological sites (see the map in figure 34). This distribution implies a scenario in which the Nile has flooded once or several times a branch through this region in ancient times. That also implies that human activity in the form that has potential to leave traces has been prevented in a strip in that area or that such traces have been obliterated by temporal flooding and/or subsequent intense cultivation. This is in concordance with the ground cover distribution given in map 2 SJE 1:2 (Hellström, 1970b) where that area in modern time was covered by cultivation (rendered in the map of figure 37b) implying presence of Nile sediments. Likewise, the interpolated line profile in the graph of figure 35 provides a margin for inundations of the plain to the east.

While studying the distribution of sites with regards to time periods (map of figure 36), those classified as Middle Nubian restrict the reconstruction of such a channel the most (see the map of figure 36c), not necessarily because the channel was at that time existing and at its narrowest extent but perhaps because those sites are most numerous in the region. Anyhow, the distribution in figure 36c acted as a reference for a reconstruction attempt of the River Nile as it was during the Middle Nubian Period. Two possible scenarios are arrived at: one in which the Nile splits into one westerly and one easterly channel leaving one or several islands in the middle (map of figure 37c), the other in which only the easterly stretch is present through the modern Debeira East district leaves those sites most closely located to the modern river on the West Bank of the contemporary Nile (map of figure 37d). The latter alternative has already been suggested as in the map of Plate 61 SJE 5:3 (Säve-Söderbergh & Troy, 1991b). Such a reconstruction can be motivated by the fact that the large, highly Egyptianised cemetery of Fadrus would then have been situated on the West Bank in concordance with Egyptian burial traditions (Säve-Söderbergh, 1991a:186; Troy, 1991:247).

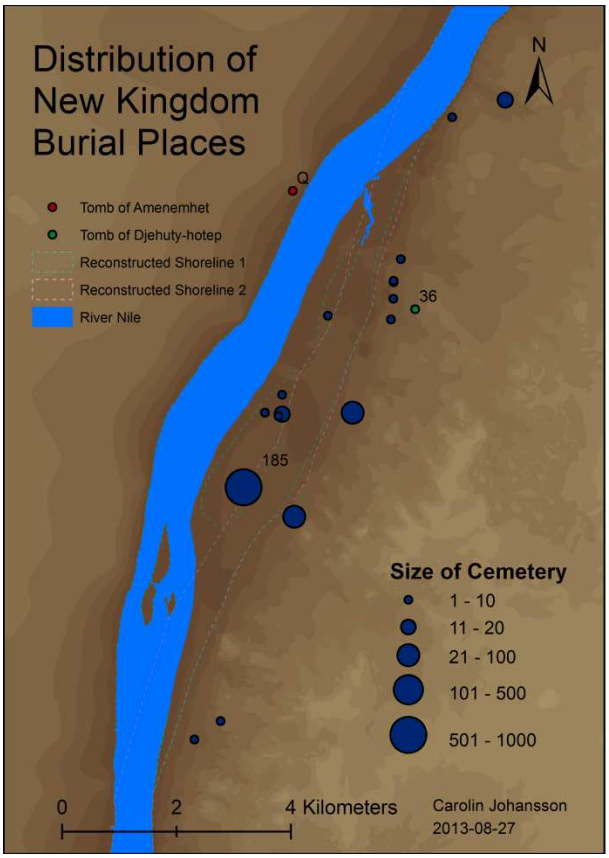


Figure 59. Map showing the distribution of New Kingdom burial sites in the Debeira District and its surroundings.

It is indeed correct that the largest New Kingdom cemetery in the region (site 185) and several minor cemeteries would have been located on the West Bank given a reconstruction as in the map of figure 37d. However, several smaller burial places would still have been located on the East Bank including the tomb of the Prince of Djehuty-hotep (site 36) which would be considered of importance (see the map in figure 59). On the other hand, the location of the tomb of Amenemhet, Djehuty-hotep's brother and successor, is placed on the West Bank but substantially further from the Nile in areas with greater elevation which would be expected in accordance with Egyptian traditions. Perhaps the time of the two brothers (Hatshepsut/Thutmosis III) marks a shift in burial practices, in which the West was favoured, as a part of the gradual Egyptianisation that took place in the region during the course of the 18th Dynasty[76]. However, cemetery 185 and cemetery 65 located nearby were in use already in the early parts of that Dynasty (Troy, 1991:220–238, 299).

Relevant to the discussion is also to consider the effects on water flow indicated by the two suggested scenarios. An easterly flow of the Nile would result in a relatively narrow Nile channel as the least distance between opposite sites are about 1 km which would make the breadth of the Nile significantly less[77]. Indeed, the river is seldom below 600 m in breadth in the whole concession area. In this sense, a scenario as suggested in the map of figure 37c is more likely as it would allow the Nile water to spread out into at least two channels into a more steady flow. Moreover, figure 5 in Heinzelin (1968:49) implies that the water level of the river at the time was at a local maximum which would favour a suggestion encompassing a broader extent and not narrower[78].

The situation proposed above is similar to what is described by the investigations of the Sudan Archaeological Research Society in the northern Dongola reach (Welsby et al., 2002). There, ancient settlement distribution patterns and geomorphological studies have proposed several palaeochannels of the Nile running east of its present stretch throughout the Holocene whose floodwaters have deposited sediments causing a relatively flat valley floor[79].

5.4. Temporal Distribution Patterns

The sites classified as Preceramic are here represented for reference but caution should be taken when interpreting the distribution of those since these are only the ones recorded by the SJE. A study focusing on this kind of sites should be complemented by the data that the CPE collected in the area of, and in conjunction with, the SJE. However, it is apparent from the pattern arising from figures 38, 39 and 40a that these sites specifically exhibit the widest spread into the desert areas distant from the river. This observation can be explained by the great time period that these sites are encompassing which implies a capacity for significant landscape shifts and climatic conditions markedly different from the more recent time periods.

[76] Cf. the discussion about the possible transfer of the burial of Djehuty-hotep to the tomb of his successor Amenemhet by Säve-Söderbergh (Säve-Söderbergh, 1991a:188).
[77] The least breadth suggested by the SJE in the map in plate 2 SJE 5:3 (Säve-Söderbergh & Troy, 1991b) is less than 500 m.
[78] The same figure also indicates a local maximum in the Christian time period which would have contributed to the erosion of archaeological remains deposited in the intervening time period (Late Nubian), leaving the area empty of traces into modern times.
[79] Cf. the practice of cultivation in a Nile paleochannel in the area of the Third Cataract (Osman&Edwards, 2012:54).

Another observation deduced from the temporal plot is the concentration of Middle Nubian sites into the northern districts in favour of the Second Cataract (see the map of figure 40c and the diagram of figure 41). This is explained by the fact that the centre of the administrative region of Teh-Khet was located somewhere in the Debeira district and was thus the hot-spot for human activity leaving well defined traces during the time of the 18th Dynasty. The notable exception among the Middle Nubian sites are those (few) that were identified as Kerma culture, which were, not surprisingly, in three cases of four, located further south in the Second Cataract area and not in the local centre of the Egyptian administration in Lower Nubia (see the map of figure 42).

5.5. Type-specific Distribution Patterns.

The distribution of sites with regards to their type classes is roughly even between the two parts described by maps in figures 43 and 44 (see the diagram of figure 45). However, patterns can be discerned outside of the North-South axis. An example of this is the distribution of rock art sites that is even between the northern districts and the Second Cataract area but exhibits a rather dispersed pattern in the former while a dense population is found in the districts of Abka-Gamai where a third of all SJE rock drawing sites are found within an area of 1 km^2. A possible explanation, in addition to the importance of the cataract in the physical and social landscape is the abundance of cliffs of igneous rocks suitable to hammered figures.[80]

A Moran's index of 0.3 (see figure 45) indicates moderate correlation between location and type of site for the two classes Habitation Sites and Burial Places. The strong statistics provided (Z=10.4 and p=0.00) means that the null hypothesis of random distribution with regards to site type can be rejected. Given that habitation sites are likely to be under-represented in the SJE records compared to Burial Places as no expropriation of modern settlements were made, the figure accounted for above may also be an underestimation[81]. However, it is important to note that these analyses do not take into account the content with regards to size of each site. The division into separate sites for nearby features may have been to some extent arbitrary and may skew such a result.

5.5.1. Seasonal Habitation Patterns

The A-group sites exhibit a significantly wider spread into areas remote from the River Nile than do the C-group sites (assuming the approximate validity of any of the River Nile palaeochannel reconstructions accounted for above) (see the map in figure 47 and the diagrams of figures 48 and 49). This is especially true considering the outlier A-group habitation site number 89 which is marked in the map of figure 47 and can be interpreted as a desert dwelling place in the model of seasonal settlement described in the methods section. It is located at the foot of an inselberg[82] (Nordström, 1972a:159-160) and was also the find spot for Nubian Middle Stone Age tools which may indicate a location with a long continuity of human activity. The fact that only one such desert site was recorded could be due to the fact that it was found close to the national border between Sudan and Egypt and thereby near the edge of the concession area. It is possible that such desert habitation sites were mainly located in areas that were outside of the SJE survey and would possible be still traceable in the current landscape above water-level.

[80] Cf. the note on distribution by Hellström in SJE 1:1 (1970a:28).
[81] Cf. the elaboration on this issue in the last sections of p. 17 in SJE 1:1 (Säve-Söderbergh, 1970).
[82] See plate 4.1. in SJE 2 (Marks, 1970).

Furthermore, studying the diagram of figure 50 it can be noted that the A-group sites are also situated on much higher ground relative the respective contemporary water level of the river than the C-group sites. Indeed, almost all recorded A-group habitation sites were located above 10 m above the river water level whereas almost none of the C-group sites were. To evaluate the lower locations in the proximity of the river is difficult since the periodical shift of water flow have shaped the landscape there but if it is assumed that 10 m is the level at which the regular inundation reached, it would leave most of the A-group sites dry year-round (see figure 50). In that sense, the majority of the recorded settlements would qualify as possible summer camps.

An alternative explanation for the larger distances to the water for the habitation sites of the two cultures is an artefact of distribution in the two major divisions of the SJE concession area. A-group habitation sites are more common in the Second Cataract area which exhibits a markedly different landscape than the districts in the North and thus provides different living conditions. As the Second Cataract area is intertwined with permanently or temporarily water-filled canals may the relation between suitability for settlement location and distance to water not look the same as in areas where the water is available in only one direction.

In addition to the sampling biases due to the geographical limitations of the SJE noted above it should be noted that for analyses requiring more detailed classification sample sizes becomes relatively small and thus statistically weak.

5.6. Spatial Correlation between C-group and New Kingdom Pharaonic Burial Sites

Support for the claim about the relative isolation of Pharaonic tombs (here interpreted as belonging to the New Kingdom Pharaonic class) by Vagn Nielsen, cited above (section 3.7.7.), could not be found in the dataset of this study. Indeed, the Venn diagram of figure 52 illustrates how the New Kingdom Pharaonic burial places are shared with the other cultural affiliations to an extent similar to what is observed of the C-group for which about three quarters of the burial sites are exclusive. New Kingdom Pharaonic burials share site numbers with both C-group, Transitional and Pan-grave burials but no shared sites exist with those classified as Kerma. The latter is likely to be explained by the geographical distinction of the two noted above and also the low number of Kerma burial sites represented in the material.

A subtle effect that indicates weak support for the second part of the cited statement was found in which the proximity of New Kingdom Pharaonic burial sites and C-group sites is indicated when the search radius is set at 300 m or 400 m (see the diagram of figure 53). However, the difference in distances relative to distances within respective groups and to distances to all Middle Nubian burial sites is not statistically significant as the distribution of distances between the groups in question (129+/-83.24 m and 154+/-98 m) does not fit below one standard deviation of the distances within the groups or to random burial sites of Middle Nubian age (data not shown)[83]. The null hypothesis of random distribution of distances can therefore *not* be rejected.

[83] Moreover, the effect is not visible when including larger search distances, calculations were performed for 1 km, 5 km, 10 km and infinity but none of those displayed any substantial difference in distribution between the groups (data not shown).

It should be noted though that in the present analysis, all sites were included regardless of their size in terms of number of tombs and geographical extent. There is in other words no weight given to the importance of a site due to the number of interments of the given cultural affiliation and all sites are treated as points and not as polygons of different sizes. Both these issues are likely to have an influence on the results but no assessment of the size of that effect has been made. The issue is further complicated by the fact that the sample sizes become small when applying smaller search radii (see table 10) which further affects the uncertainty of the results.

5.7. Intervisibility of the Tombs of the two Brothers

The sightline analysis (map of figure 55) and the reconstructed view (figures 56 and 57) show that the tomb of Djehuty-hotep would indeed have, theoretically, been visible for a spectator standing at the tomb of Amenemhet although the pyramid would appear quite small. The length of the sightline is close to 3 km which is comparable to viewing the Karnak temple pylons[84] from the Theban hills across the river, or the sighting of the Thoth hill temple from the site of Karnak. Those observations of approximately 4 km distance are fully feasible at clear weather[85].

It should be questioned though if this implies that the four statues in the back of the chapel of the tomb of Amenemhet were actually supposed to be viewing the tomb of the, presumably elder, brother. It has been noted that the axis perpendicular to the wall behind the statues, and thereby their theoretical sightline (as they are facing front), deviated 2° from the line connecting the two sites[86]. However, it is not stated anywhere to the knowledge of the author into which direction that deviation was observed. A deviation of 2° would correspond to about a 100 m shift in roughly northward or southward direction from the target tomb. Whether this deviance was intentional or due to inaccuracy it means that any point in the vicinity of the hill where the tomb of Djehuty-hotep is located could have been aimed at (see figure 60).

This leads to the question on what symbolic meaning the orientation of the tomb of the, probably younger, brother towards that of the, probably elder, brother had. Objects with the name of Djehuty-hotep, including canopic jars (Säve-Söderbergh, 1991b:189), were found in the shaft below the pyramid of Amenemhet's tomb which indicates that, if not being the original burial of Djehuty-hotep, his burial remains may at some time have been transferred to the tomb of his brother (Säve-Söderbergh, 1991a:188; Säve-Söderbergh, 1991b:188). It can only be speculated upon if this was due to the Egyptianisation process described above in which the West came to be employed as the ideal burial place, affinity reasons or security. For whatever cause, the effect would be that the four statues would be looking at an empty tomb if the monument of Djehuty-hotep was aimed at.

This further leads to a consideration in which *another* target monument may have been intended. A reasonable suggestion could be the tomb of the father of Amenemhet and Djehuty-hotep, known as the prince of Teh-Khet, *Rwiw*, whose tomb has never been located or identified (Säve-Söderbergh, 1963b:172–173)[87]. Indeed there is no evidence that speaks against a hypothesis in which the

[84] However, the first pylons at Karnak are about four times higher than the pyramid reconstruction.
[85] Observation by the author.
[86] It was not attempted to reassess that deviance in the current project as it was deemed that the plan sketches provided by the SJE could not be oriented into the GIS with adequate accuracy.
[87] If this is the case, it is reasonable to believe that the four statues were meant to depict Amenemhet and Djehuty-hotep together with their respective wives, Hatshepsut and *tnt-nb(w)*, as no heirs to any of them are known and the statues were left unfinished.

location of the tomb of the parents of the two brothers was aimed at. A theory in which *that* tomb was the target of view would predict the site for the original burial of *Rwiw* somewhere close to the sightlines in the maps of figure 60. Indeed, there are several rock-cut tombs with sizes indicating status and wealth in the SJE record in the area in question. Of these, tomb number 2 of site 37 (Nigm ed Din Mohammed, 1960; Säve-Söderberg & Troy, 1991a, p. 294–296) is one of the possible candidate tombs hereby suggested belonging to *Rwiw*. This tomb would indeed have been visible (given a substantial superstructure) from across the river (see the northernmost sightline in the map of figure 60).

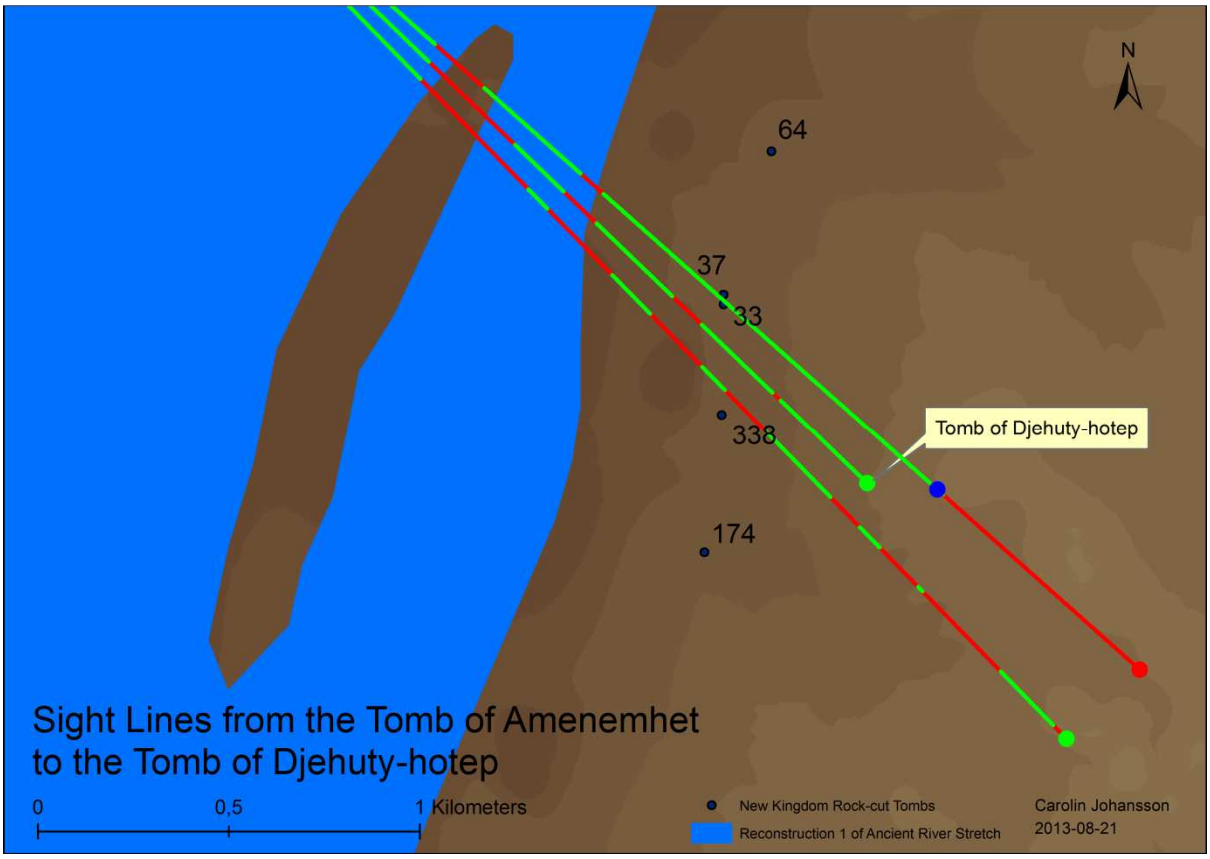


Figure 60. Detail map of the sight line analysis as shown in figure 55 with the addition of two sight lines with a 2° deviance in positive and negative direction respectively. The sight lines are colour-coded as following: green symbolises visible stretches, red symbolises invisible stretches.

6. Conclusion

The diverse character of the SJE data was found possible to fit into a GIS in a process in which generalisation and detail were carefully balanced. This resulted in a comprehensive digital dataset onto which visualisations and analyses can readily and efficiently be performed. However, there are obvious limitations both with regards to the created system and the original data itself. The applicability of the GIS is highly dependent on scale. Geographical analyses on a local level might suffer from lack of accuracy of the reconstructed landscape and may need to be complemented by data in other formats such as written descriptions and photography whenever available. Moreover, detailed analyses may also be hindered by the simplification of site locations as points. On the other hand analyses on a regional scale might need to be complemented with data of adjacent regions, most obviously the West Bank of the Nile that mirrors the SJE concession.

The wide range of data covered by the SJE record enables broad comparative analyses onto a single geographical region but fails in contexts requiring narrow categories as the statistical power decreases with smaller sample sizes. Another issue is the vast time span represented which makes it reasonable to argue that it may be inappropriate to apply a single landscape model, in this case based on the topography of the middle of the 20th century, to archaeological queries related to vast time periods.

Thematic maps and geographically related analyses on the SJE data have certainly been done previously as the original publication exhibits plenty of those. The digitalisation of the data has not significantly contributed with new methodology or ground-breaking results, rather, the shift of technology have resulted in the possibility of conducting those tasks with a completely different degree of efficiency. Advanced queries and time-consuming calculations, previously too laborious or practically impossible to perform, may in this format be achieved with ease, thereby enabling completely new kinds of investigations.

All these properties of the system created in this project noted in this section have been demonstrated by the analyses applied to it, thereby fulfilling the last sub-objective, 2b.

7. Future Investigations

Although a roughly complete system of compiled data, there is indeed capacity for improvement and refinement, as well as expansion, of the work accounted for in the present report.

The recreated landscape could further be complemented by classifying ground cover, which is to some extent indicated in the SJE publication. The representation of sites could be further elaborated as well by inclusion of their physical extension and within-site distributions. Analyses of Preceramic sites would benefit from complementation of the data collected by the CPE.

A natural extension to the present project is to include the West Bank sites and landscape into the dataset. The current situation only accounts for half of a landscape of which in ancient times were composed of the two natural components, East and West. An especially intriguing area is the district of Debeira which housed the seat of an administrative unit in the New Kingdom Egyptian colony. A comparison of the archaeology and landscape of the West may contribute to the discussion above regarding the validity of different reconstructions of Nile channels and the strategic placements of New Kingdom cemeteries with regards to cardinal direction relative the River Nile.

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9. Accessibility of Material

The data collected and created in this project is available in the form of annotated files upon request for research or study purposes. These may be obtained from the Swedish National Data Service by the study number SND 0944 http://snd.gu.se/en/catalogue/study/SND0944. Alternatively, one may contact the author directly at nubianlandscape@gmail.com for requests or further enquiries.

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Appendix

List of Tables

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
1	665275	-54575	F																			
2	665125	-54800	F	Chu		LN		Chr														
3	665075	-54075	F																			
4	663025	-54250	F																			
5	664825	-54500	F																			
6	665200	-54250	F																			
7	665025	-54300	F																			
8	665400	-54725	F																			
9	665010	-53970	F	BP	Cem	MN	<30	NKP							RD							
10	664975	-54101	F	O	SL																	
11	664375	-54650	F	HS		LN									O	WB						
12	664425	-54650	F	O	SL	EN		N	MN		C											
13	664150	-55000	F																			
14	664300	-55450	F																			
15	663175	-56200	F																			
16	663050	-56075	F	HS		LN									O	WB						
17	662625	-56875	F																			
18A	662575	-56975	F	HS		EN		N														
18C	662450	-56950	F	HS		MN		C														
19	663050	-56275	F	BP	ST	LN	1	X														
20	663600	-55625	F																			
21	662625	-57300	F	O	SL	EN		N														
22	662775	-56475	F	RD											HS		LN				O	WB
23	664850	-55275	F	O	LF	LN		Chr														
24	661650	-58400	Ser	BP	Cem	MN	24	C														
25	660463	-59113	Ser	BP	Cem	LN	315	M, X, Chr, M														

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
26	659600	-59625	Ser	O	LF	LN		Chr														
27	658475	-60525	Ser																			
28	658350	-60475	Ser	O	LF	LN																
29	658025	-60750	Ser	O	LF																	
30	656600	-63975	D	O	LF	MN		NKP														
31	656600	-64025	D	O	LF	MN		NKP														
32	656575	-64250	D	O	LF	MN		NKP														
33	656325	-65150	D	BP	Cem	MN	2	C, NKP							O	LF	MN		C, NKP			
34	656350	-64600	D	O	LF																	
35	656550	-65025	D	BP	Cem	MN		T, C?														
36	656700	-65625	D	BP	ST	MN	1	NKP														
37	656325	-65125	D	BP	Cem	MN		NKP														
38	657850	-61975	Ser	BP	Cem	MN		C														
39	657850	-61150	Ser	Chu		LN		Chr							F							
40	657500	-62025	Ser	Chu		LN		Chr														
41			Ser	O	LF																	
42			D	O	LF	MN		NKP														
43			D	O	LF	MN		NKP														
44	654375	-69675	D	O	LF																	
45			D																			
46	656900	-64925	D	BP	Cem	MN	5	C														
47	656950	-65075	D	BP	Cem	MN	159	Pan, NKP														
48	656225	-64925	D	BP																		
49	659825	-61200	Ser			P																
50	657825	-69010	D	O	LF																	
51	652300	-76200	Sah	F		MN		NKP	LN		Chr											
52	652625	-75975	Sah																			
53	652450	-75625	Ash	HS		LN		Chr, M?														

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
54	652950	-75850	Sah	O	LF	P																
55	652675	-75825	Sah																			
56	652750	-75800	Sah																			
57				O	LF																	
58	652725	-76025	Sah	O	LF																	
59	652675	-74325	Ash																			
60	653050	-73750	Ash																			
61	656500	-66500	D	O	LF	P		ESA														
62	657250	-66275	D																			
63	652410	-74050	Ash	BP	Cem	LN	12	X, Chr														
64	656450	-64750	D	BP	Cem	MN	5	NKP														
65	654375	-67450	D	BP	Cem	MN	208	C, Pan, NKP														
66	653300	-68950	D																			
67	653050	-69050	D	HS		LN		X														
68	654800	-69500	Ash	BP	Cem	MN	6															
69	655075	-69125	D																			
70	655650	-69025	D																			
71	655275	-69900	Ash																			
72	655425	-69775	Ash																			
73	655825	-69675	D																			
74	655100	-68675	D																			
75	655350	-68375	D																			
76	653325	-71400	Ash	RD																		
77	653475	-71500	Ash	RD																		
78	653475	-71375	Ash																			
79	653550	-71150	Ash																			
80	654300	-71100	Ash																			
81	654275	-70975	D	O	LF	P		ESA														

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
82	653525	-71650	D	O	LF	P		MSA														
83	654425	-71175	Ash																			
84	652950	-72165	Ash	BP	Cem	LN	10	M? X, Chr														
85	653300	-71625	Ash																			
86	653500	-71787	Ash	BP	Cem	MN	9	T														
87	655580	-71070	Ash	RD																		
88	655750	-71075	Ash	RD																		
89	656470	-71510	Ash	HS		P		MSA	EN		N				RD							
90	653025	-72430	Ash	BP	Cem	EN	6	A	LN	1	M											
91	653025	-72430	Ash	O	LF																	
92	653300	-72800	Ash	BP	ST	MN	1	NKP	LN	1	X											
93	?	?	?	O	LF	P																
94	652900	-72575	Ash	BP	Cem	LN	2															
95	652825	-73025	Ash	BP	Cem	EN	7	A	MN	162	C, Pan											
96	653250	-72550	Ash	BP	Cem	MN?	6															
97	652575	-73650	Ash	BP	Cem	MN	159	C														
98	652750	-73425	Ash	BP	Cem	MN?	17															
99	654925	-68950	D	BP	Cem	MN	33	Pan														
100	652300	-76900	Sah	Chu		LN																
100A	652300	-76900	Sah																			
100B	652300	-76900	Sah			LN		M														
100C	652300	-76900	Sah																			
100D	652300	-76900	Sah	BP	Cem	LN	20	Chr														
101	652063	-78352	Sah	BP	IG	LN	2	M, X														
102	652275	-75025	Ash	O	MC																	
103	652725	-77925	Sah																			
104	652800	-79400	Sah	O	LF	P		ESA														
105	653375	-80350	Sah	O																		

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
106	653350	-80450	Sah	O	LF																	
107	653300	-80400	Sah	O	LF	P		MSA														
108	652400	-78850	Sah	O	SL	EN?																
109	652300	-78750	Sah																			
110	652775	-78600	Sah																			
111	653675	-80825	Sah	O	LF																	
112	652300	-79500	Sah	O	SL	EN?		N?														
113	652750	-79900	Sah	O	LF	P																
114	653025	-80500	Sah	O	LF	P																
115	653000	-80625	Sah	O	LF	P																
116	653050	-80800	Sah	O	LF	P																
117	653375	-72250	Ash	O																		
118	651925	-79200	Sah	BP																		
119	651100	-79700	Sah																			
120	651650	-80725	Sah																			
121	651875	-80975	Sah																			
122	651250	-81050	Sah																			
123	651100	-82200	WH	BP	Cem	LN	15	X														
124	651125	-81900	WH																			
125	656125	-66050	D	BP	Cem	LN	5															
126	654738	-80100	Sah			P		MSA														
127	654725	-80475	Sah	O	LF	P		MSA														
128	654688	-81375	Sah	O	LF	P		MSA														
129	653900	-80062	Sah	O	LF	P																
130	654150	-80750	Sah	O	LF	P		ESA														
131	652625	-82350	WH																			
132	652200	-80700	Sah																			
133	652850	-81700	WH	O	LF	P																

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
134	652300	-81900	WH	O		P																
135	652425	-82175	WH			P		MSA														
136	653775	-73200	Ash	O	LF	P																
137			?	O	LF	P		MSA														
138	653225	-77375	Sah	O	LF	P		MSA														
139	650210	-85160	WH	RD																		
140	643150	-91550	HD	F																		
141	640500	-94525	Abk	BP	Cem	LN	12	X, Chr														
141B	640500	-94525	Abk	O		MN		NKP?														
142	640338	-94980	Abk	O	E	LN		X, Chr														
143	635188	-98725	HD	F		LN		Chr														
144	635400	-98700	Abk	RD																		
145	652525	-76075	Sah	O	LF	P																
146	656000	-66460	D	BP	Cem	LN	4	NKP														
147	656115	-65175	D	HS		MN		C?														
148	656425	-65050	D	O	LF																	
149	?	?	D	O	LF																	
150	653550	-86325	WH	O	LF	P		ESA														
151	635400	-98900	Abk	RD																		
152	635700	-99050	Abk	RD																		
153	634825	-99900	Abk	RD																		
154	634500	-100200	Abk	RD																		
155	634325	-99850	Abk																			
156	634250	-99870	Abk	RD																		
157	633900	-99430	Abk	RD																		
158	634000	-99500	Abk	RD																		
159	633550	-98950	Abk	RD																		
160	634050	-100100	Abk	RD																		

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
161	633650	-100300	Abk	BP																		
162	633975	-100975	G	F		LN		Chr														
163	634400	-101050	G	BP	Cem	LN	10	M, X														
164	634950	-101550	G	BP	Cem	MN	6	NKP														
165	635210	-101430	G	BP	Cem	EN		A														
166	635475	-103325	G	BP	Cem	EN		A	LN													
167	635880	-102580	G	BP	Cem	EN		A														
168	638800	-97012	Abk	O	E	LN		Chr?														
168A	638975	-97050	Abk	BP	Cem	LN	4	M														
169	633750	-99800	Abk	RD																		
170	656360	-65188	D	BP	Cem	MN	48	Pan, K														
171	655775	-67025	D																			
172	655608	-67425	D	BP	Cem	MN		Pan, NKP														
173	665200	-53950	F	Chu		LN		Chr														
174	656275	-65800	D	BP	Cem	MN	1	NKP														
175				BP	ST	MN	1	NKP														
176	656500	-66600	D	BP	Cem	MN	100	T														
177	654075	-67425	D	BP	Cem	MN	10	NKP														
178	653785	-67965	D	BP	Cem	LN	29	X, Chr, M														
179	660475	-59215	Ser	BP	Cem	MN	235	C	LN	2	M											
180	653340	-68450	D	BP	Cem	LN	8															
181																						
182	658500	-67200	D	O	LF																	
183	654588	-69237	Ash	BP	Cem	MN	58	C, NKP														
184	655840	-66550	D	BP	Cem	MN	>50	C														
185	653700	-68725	D	BP	Cem	MN	715	NKP														
186	655140	-68580	D	RD																		
187	652475	-74300	Ash	BP	Cem	EN	35	A														

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
188	653275	-69250	D	F																		
189	652975	-73600	Ash																			
190	652925	-73610	Ash	BP	Cem	MN	9	C?														
191	653100	-73850	Ash			P		ESA														
192	658510	-60525	Ser																			
193	660950	-61000	Ser	BP	Cem	MN	4	Pan														
194	662830	-56665	F	HS		MN		C														
195	663350	-55950	F	BP	Cem	EN	7	A	LN	34	X											
196	661275	-58500	Ser	BP	ST																	
197	660250	-60700	Ser	BP	Cem	MN																
198	659300	-61575	Ser																			
199	657400	-62400	D	BP	ST	LN	1															
200	657450	-62150	D	BP	Cem	LN	4															
201	657300	-62800	D	BP	Cem	MN	30	T														
202	657250	-63125	D	BP	Cem	MN	4															
203	657375	-63150	D	BP	Cem	MN	3															
204	657575	-62900	D	BP	Cem	MN	3															
205	654825	-70162	Ash	HS		EN		N														
206	633850	-99650	Abk	RD																		
207	657475	-63375	D	BP	Cem	MN	12															
208	657350	-63925	D	BP	IG																	
209	658290	-64580	D	RD																		
210	658880	-64630	D	RD																		
211				BP	Cem																	
212	655500	-67200	D																			
213	654450	-67000	D	BP	Cem																	
214	655100	-68201	D	BP	IG																	
215	655100	-68475	D	BP	IG																	

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
216	654890	-68680	D	BP	Cem	LN	3	Chr														
217	655220	-69200	D	RD																		
218	654450	-69965	Ash	BP	Cem	MN	14	T														
219	654950	-69950	Ash	BP	Cem																	
220	653900	-70612	Ash	BP	Cem	MN	67	T														
221	662000	-62580	Ser	RD																		
222	653325	-68575	D	O	LF	LN		Chr														
223	653975	-69875	Ash	HS		MN		C?	O	LF												
224	653325	-71990	Ash	BP	ST																	
225	653200	-72650	Ash	BP	ST																	
226	652875	-73075	Ash																			
227	653830	-72420	Ash	RD																		
228	654125	-69700	Ash	HS		MN		C														
229	652843	-73125	Ash	BP	Cem	MN	76	Pan, T, NKP	EN	1	A											
230	652638	-73512	Ash	BP	Cem	EN	20	A														
231	652138	-77287	Sah	BP	Cem	LN	2															
232	652450	-79650	Sah	RD																		
233	652450	-79900	Sah	O	LF	P																
234				O	LF	MN		NKP														
235	657075	-65200	D	BP	ST	MN?	1															
236	655850	-71920	Ash	RD																		
237	657765	-61980	Ser	RD																		
238	656640	-66740	D	RD																		
239	656680	-68200	D	RD																		
240	642825	-91770	HD	BP	Cem	LN	3															
241	642550	-91900	HD	BP	Cem	LN		M														
242	642450	-91900	HD	BP	Cem	LN		Chr														
243	642000	-92950	HD																			

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
244	641300	-93700	Abk	O	E																	
245	640700	-94200	Abk	BP	Cem																	
246	640200	-95400	Abk	BP	Cem	MN	110	C														
247	640100	-95500	Abk																			
248	639400	-96650	Abk	RD																		
249	639400	-97050	Abk																			
250	635275	-99450	Abk	BP	Cem	LN	48	M														
250B	635400	-99450	Abk	BP	IG	LN	3															
251	635935	-102030	G	BP	Cem	MN	3	K, T?	LN	1	M											
252	636200	-103750	G	BP	Cem	MN	20	Pan?														
253	636000	-100200	Abk	BP	IG	LN	2	X														
254	635875	-99625	Abk	BP	Cem	MN	20	Pan														
255	633700	-98500	Abk	O		LN		Chr, M														
256	639850	-94400	Abk	HS		LN		Chr														
257	640900	-92825	Abk	BP	Cem	LN									HS		LN					
258	640400	-93900	Abk	BP	Cem	LN		Chr														
259	634750	-101400	G																			
260	634600	-101625	G	BP																		
261	634490	-101405	G																			
262	634450	-99087	Abk	BP	Cem	MN	68	C	EN	2	A											
263	635200	-101900	G	O																		
264	635200	-101700	G	BP	Cem																	
265	635000	-100625	Abk	O	LF	P		FSA														
266	635280	-99690	Abk	BP	Cem	MN	111	C	EN	1	A											
266B	635300	-99600	Abk	BP	ST	MN	1	K														
267	633400	-99700	Abk																			
268	633250	-99400	Abk	BP	Cem	LN	15															
269	633250	-99200	Abk																			

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
270	635520	-99350	Abk	BP	Cem	MN	78	C	LN	5												
271	638650	-96600	Abk	BP	Cem	LN	15															
272	638550	-96000	Abk		Cem	LN	25															
273	636100	-97900	Abk	HS		LN		Chr														
274	635800	-97750	Abk	HS		LN																
275	635600	-98300	Abk																			
276	637550	-98210	Abk	O																		
277	642855	-92280	HD	BP	Cem	EN		A														
278	636400	-98300	Abk	O	E																	
279	636000	-98800	Abk	O	E																	
280	660375	-59300	Ser	BP	Cem	MN	5	NKP	LN	10	M											
281	644600	-90375	HD	BP	Cem	MN		C														
282	643600	-91400	HD																			
283	633000	-99000	Abk	Chu		LN		Chr														
284	633300	-99300	Abk	BP	Cem	LN		Chr														
285	633500	-98550	Abk	BP																		
286	648400	-93050	HD	RD																		
287	648550	-93810	HD	RD																		
288	652700	-78000	Sah																			
289	652400	-76500	Sah	O																		
290	656380	-68560	D	RD																		
291	660250	-59450	Ser	BP	Cem	EN		A														
292	657590	-62375	D	BP	Cem	EN	25	A														
293	654260	-69850	Ash	BP	Cem	MN	13	T														
294	656475	-65075	D			MN		NKP														
295	656550	-65375	D	BP	Cem																	
296	654440	-69770	D	O	LF	P																
297	660780	-58800	Ser	BP	Cem	LN	13	Chr, M							O	LF						

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
298	660960	-58640	Ser	BP	Cem	EN	19	A														
299	655575	-67050	D	BP	ST	EN	1	A														
300	654780	-69600	Ash	RD																		
301	656325	-65300	D	BP	ST																	
302	656750	-71800	Ash	RD																		
303	661725	-58237	Ser	HS		EN		A														
304	655900	-70700	Ash	RD																		
305	656950	-68100	D	RD																		
306	656400	-67590	D			P			LN		Chr											
307	652725	-73275	Ash	BP	IG	LN	2															
308	652825	-73425	Ash	BP	Cem	EN	58	A	LN		1											
309	652650	-73960	Ash	BP	Cem	MN	29										P		MSA			
310	653835	-70680	Ash	BP	Cem	MN	3															
311	653750	-70680	Ash	BP	Cem	MN	>5	C														
312	653910	-70960	Ash	BP	IG																	
313	653800	-71080	Ash	BP	Cem	EN		A	MN		C											
314	654630	-71730	Ash	RD											O	LF	LN		Chr			
315	655175	-65735	D	BP	ST	MN	1	NKP														
316	664600	-54600	F	HS		EN		A														
317			D																			
318	654313	-67487	D	BP	Cem	MN	10	NKP?														
319	654080	-67520	D	O	LF																	
320	662035	-57925	F	O	LF	P																
321	661630	-58550	Ser	BP	Cem	EN	8								HS?		EN					
322	656850	-66500	D	O	LF	P																
323	656750	-71900	Ash	O	LF	P																
324	658800	-66250	D	RD											O	LF	P		ESA			
325	656500	-72200	Ash	O	LF	P																

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
326	657450	-67300	D	O	LF	P																
327	654375	-67113	D	HS		EN		A	MN		C				BP	Cem	MN		NKP			
328	654375	-67150	D	O																		
329																						
330	654225	-67925	D	HS																		
331	652425	-74300	Ash	BP	Cem	LN	47															
332	652440	-74760	Ash	BP	Cem	EN	23	A	MN	11	C?	LN	32	Chr								
333	664660	-54500	F	BP	Cem	LN	64															
334	662490	-58120	F	BP	Cem	MN	2	C														
335	661980	-57875	F	BP	Cem	LN		Chr														
336	661660	-57660	F	HS?		LN		Chr														
337	661500	-57860	F	HS?		LN		Chr														
338	656320	-65440	D	BP	ST	MN?	1	NKP?														
339	652600	-74820	Ash	HS		LN		Chr														
340	656540	-64840	D	HS		EN		A														
341	656400	-68900	D	O	LF	P		MSA														
342	656120	-68400	D	RD																		
343	652440	-74170	Ash	BP	Cem	LN	45	Chr?														
344	658475	-68700	D	O	LF	P																
345	653650	-70480	Ash	HS		MN		C, Pan							BP	ST	MN	1				
346	652320	-75200	Ash	HS		MN									BP	Cem						
347	652300	-75500	Ash	HS		MN		C							BP	ST	MN	1				
348	652200	-79700	Sah	O	LF	P																
349	652450	-75720	Ash	BP	ST	LN	1	X														
350	657350	-62275	D	BP	Cem	MN	1	NKP	LN	11	X, Chr				HS		MN		C			
351	652360	-75600	Ash	BP	Cem	LN	12	X														
352	652300	-75100	Ash	O	SL	EN		A	MN		C											
353	652550	-78100	Sah	O	LF	P																

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
354	652050	-80900	Sah	O	LF	P																
355	659900	-60500	Ser	O	LF	P																
356	653500	-68900	D	HS		MN		C														
357	657970	-62420	D	RD											O	LF						
358	656000	-72260	Ash	RD																		
359	649160	-87300	WH	RD																		
360	638800	-97002	Abk	O	SL	EN		N														
361	655075	-68900	D	O	SL	EN		N														
362	655450	-68875	D	O	LF	P																
363	662325	-57825	F	BP	Cem	MN?	4	C?														
364	655350	-69525	D	BP	Cem	MN	15	Pan?														
365	634500	-100440	Abk	HS		EN																
366	635100	-100500	Abk	HS		EN																
367	634580	-100320	Abk	HS		EN																
368	634400	-100350	Abk	HS		EN		N														
369	634460	-100170	Abk	HS		EN		N														
370	633550	-99840	Abk	HS		EN		N, A														
371	633300	-99550	Abk	HS		EN		A														
372				RD																		
373	635950	-98670	Abk	RD																		
374	634300	-100500	Abk	RD																		
375	635200	-99700	Abk	RD																		
376	634450	-100020	Abk	RD																		
377	634300	-100050	Abk	RD																		
378	634550	-99900	Abk	RD																		
379	634300	-100200	Abk	RD																		
380	633750	-100150	Abk	RD																		
381	634100	-99750	Abk	RD																		

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
382	634650	-99750	Abk	RD		EN																
383	634750	-99550	Abk	RD		EN		N														
384	634350	-99550	Abk	RD																		
385	633400	-100000	Abk	RD																		
386	633400	-99650	Abk	RD																		
387	634433	-99900	Abk	HS											RD							
388	634550	-99150	Abk	RD																		
389	634250	-98740	Abk	RD																		
390	634100	-98500	Abk	RD																		
391	633395	-98450	Abk	RD																		
392	634900	-99650	Abk	BP																		
393	635560	-101970	G	BP	Cem	MN	8	K, NKP?														
394	633800	-98600	Abk	HS		P		FSA														
395	633550	-100400	Abk	F																		
396	634325	-98972	Abk	HS		LN		Chr														
397	638610	-97170	Abk																			
398	639850	-96550	Abk	BP	Cem	LN	8	X, Chr														
399				O	LF	EN		N														
400	658275	-61975	Ser	BP	Cem	MN	11	NKP														
401	652275	-77425	Sah	BP	Cem	EN		A	MN		C	LN	12	X								
402	640125	-95375	Abk	HS		EN		N	MN		Pan?											
403	640090	-95475	Abk			EN		N	MN		C											
404	640110	-95550	Abk	HS		MN																
405	640150	-95450	Abk	HS		EN		N	MN		C											
406	640100	-95450	Abk	HS		EN			MN													
407	640110	-95400	Abk	HS		EN?																
408	640050	-95400	Abk	HS		EN		A	MN													
409	640000	-95380	Abk	HS		EN		N	MN		C				RD							

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
410	634500	-99775	Abk	BP	Cem	MN	30	Pan, K														
411A	633300	-99150	Abk			MN		C														
411B	634350	-99150	Abk	HS		EN		A														
411C	634550	-99025	Abk	HS		EN		A														
412	640250	-94400	Abk	HS		P		USA														
413	640360	-95120	Abk	O	SL	EN									HS		EN		N			
414	634340	-99840	Abk	HS		EN		N														
415	634200	-98550	Abk	O		LN		Chr														
416	633500	-99400	Abk	BP	Cem	LN	29	M, X														
417	633300	-99400	Abk	BP	Cem	MN		C														
418	633475	-99275	Abk	BP	Cem	LN	7	M, X														
419	633800	-98500	Abk	O		LN		Chr														
420	639980	-95310	Abk	RD																		
421	635950	-99750	Abk	HS		EN		A														
422	635750	-99900	Abk	HS		P																
423	635620	-101020	G	HS		EN		N														
424	634555	-99715	Abk	HS																		
425	633900	-99292	Abk	BP	Cem	LN	75	X, Chr														
425A	633750	-99425	Abk	BP	Cem	LN		M														
426	634675	-99725	Abk	BP	Cem	MN	32	C														
427	633875	-99750	Abk	BP	Cem																	
428	641700	-93100	Abk	HS		EN																
429	641625	-93150	Abk	HS		EN		A														
430	635160	-99910	Abk	HS		EN		A														
431	633879	-99200	Abk	HS		MN		C	EN?		A?											
432	634163	-100662	G	BP	Cem	LN	9	M, Chr?														
433	634287	-100920	G	BP	Cem	LN	28	X, Chr														
434	634450	-101000	G	BP	Cem	EN			MN	18	C, K, Pan	LN		M								

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
435	636025	-103100	G	BP	Cem	LN																
436	636150	-103100	G	BP	Cem	MN	>11	Pan, T														
437	636050	-102950	G	BP	Cem																	
438	635775	-102525	G	BP	Cem	MN	>30	C														
439	639850	-94050	Abk	HS		LN		Chr														
440	635625	-102575	G	O	SL	EN									HS		EN			MN		
441	635625	-102125	G	BP	ST	MN?	1															
442	635850	-102470	G	BP	Cem	LN	2															
443	633370	-99790	Abk	HS		EN			MN													
444	634800	-101375	G	BP	ST	LN?		Chr?														
445	635200	-101500	G	BP	Cem	EN		A														
446	635975	-103300	G	BP	Cem	MN	2		LN													
447	636000	-103800	G	BP	Cem	MN	13															
448	636050	-103500	G																			
449	636100	-103600	G																			
450	636000	-103200	G																			
451	636025	-102400	G	BP	Cem	MN	13	Pan?, T?														
452	635900	-103200	G			LN		X?														
453	636200	-103900	G	BP	Cem	LN	8															
454	636197	-103420	G	BP	Cem	MN?																
454A	636225	-103400	G																			
454B	636165	-103410	G																			
454C	636200	-103450	G																			
455	635950	-102950	G	BP	Cem	MN?	24		LN													
456																						
457	635775	-102075	G																			
458	636500	-104000	G																			
459	635650	-99250	Abk	HS		EN		A														

Site Number	X-value	Y-value*	District	**Site Type 1**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	(No. of Units)	Cultural Affiliation(s)	Time Period 3	(No .of Units)	Cultural Affiliation(s)	**Site Type 2**	Subtype	Time Period 1	(No. of Units)	Cultural Affiliation(s)	Time Period 2	**Site Type 3**	Subtype
460	661400	-65860	D																			
461	?	-69400	D																			
462	648500	-88980	HD																			
Q	654560	-63560	D	BP	ST	MN		NKP														

Table A1. Simplified version of the database of SJE sites accounting for geographical coordinates, district and classified types, time periods and cultural affiliation. Redundant columns have been deleted. Abbreviations are listed in tables A2–A4 below.*Y-values refer to the coordinate system in which a single false northing is added (180km, cf. table 1 of the main text).

District	Abbreviation
FARAS	F
SERRA	Ser
DEBEIRA	D
ASHKEIT	Ash
SAHABA	Sah
WADI HALFA	WH
HALFA DEGHEIM	HD
ABKA	Abk
GAMAI	G

Table A2. District abbreviations used in table 1.

Time Period	Abbreviation	Cultural Affiliation	Abbreviation
PRECERAMIC	P	NUBIAN EARLY STONE AGE	ESA
		NUBIAN MIDDLE STONE AGE	MSA
		NUBIAN UPPER STONE AGE	USA
		NUBIAN FINAL STONE AGE	FSA
EARLY NUBIAN	EN	NEOLITHIC	N
		A-GROUP	A
MIDDLE NUBIAN	MN	C-GROUP	C
		PANGRAVE	Pan
		KERMA	K
		TRANSITIONAL	T
		NEW KINGDOM PHARAONIC	NKP
LATE NUBIAN	LN	MEROITIC	M
		X-GROUP	X
		CHRISTIAN	Chr
		MOSLEM	M

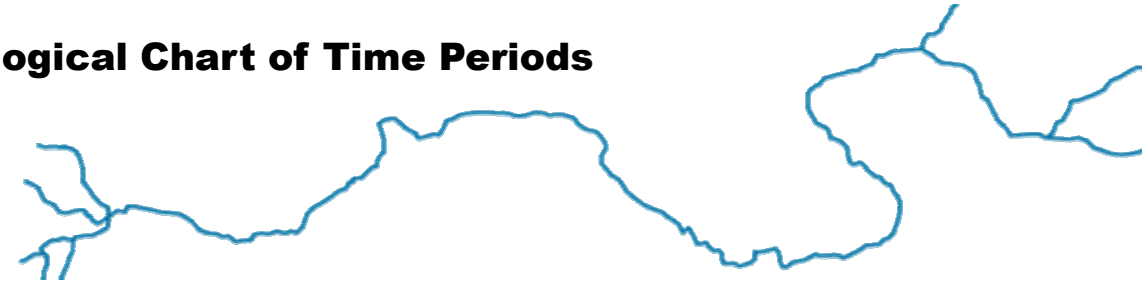
Table A3. Time period and cultural affiliation abbreviations used in table 1.

Type	Abbreviation	Subtype	Abbreviation
BURIAL PLACE	BP	SINGLE TOMB	ST
		ISOLATED GRAVES	IG
		CEMETERY	Cem
CHURCH	Chu		
FORTIFICATION	F		
HABITATION SITE	HS		
OTHER	O	SAMPLE LOCALITY	SL
		ENCLOSURE	E
		WASHING BASIN	WB
		LOOSE FIND	LF
		MUDBRICK CONSTRUCTION	MC
ROCK DRAVING	RD		

Table A4. Type and subtype abbreviations used in table 1.

Table A5 (below). Chronological chart illustrating the general time periods of ancient Nubia referred to in the main text and the corresponding chronology of ancient Egypt. The rendering of the different stages in Nubia is derived from the information accounted for in section 1.2. The chronology of the Egyptian time periods is adopted from Shaw (2000).

Chronological Chart of Time Periods



Time Scale	Egypt	Lower Nubia	Upper Nubia
4000 BCE	Palaeolithic Period	Palaeolithic Period	
		Khartoum Variant	Khartoum Mesolithic
	Maadi / Badari / Naqada I / Predynastic Period / Naqada II / Naqada III	Qadan / Abkan	Khartoum Neolithic
3000 BCE	Early Dynastic Period	A-group	Pre-Kerma
	Old Kingdom		
	First Intermediate Period	C-group	Kerma
2000 BCE	Middle Kingdom	Pan-grave	
	Second Intermediate Period		
	New Kingdom		
1000 BCE	Third Intermediate Period		
	25th Dynasty		Napata
	Late Period		
	Ptolemaic Period		Meroe
0	Roman Period		
	Byzantine Period	X-group / Ballana	
	Medieval Period	Nobadia	Makuria / Alodia
1000 CE			