Petrographic investigation of Coptic limestone sculptures and reliefs in the Brooklyn Museum of Art

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Abstract

The so-called 'Coptic' limestone sculptures and reliefs of the Sheikh Ibada group were originally thought to date from Egypt's Late Roman and Early Byzantine periods, but are now considered to be modern forgeries by most scholars. This conclusion is based on their anomalous stylistic characteristics. The limestone from which these objects are carved has not been previously studied, however. Such a study was undertaken for 31 objects in the Brooklyn Museum of Art's Coptic collection. The objective was to locate the geographic source(s) of the limestone varieties through identification of the geologic formation(s) that supplied them. Most of the limestone almost certainly comes from Egypt's Mokattam Formation, which is widely distributed within and beyond the Nile Valley from Cairo in the north to Maghagha 160 km to the south. The limestone for four of the objects could have come from other formations further south but may also originate from the Mokattam. It is within the part of Egypt where Mokattam outcrops occur that most of the demonstrably genuine Coptic limestone sculptures and reliefs have been excavated. The modern forgers who copied these ancient works used the same limestone and probably had their workshops within the Mokattam region.

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1. Introduction

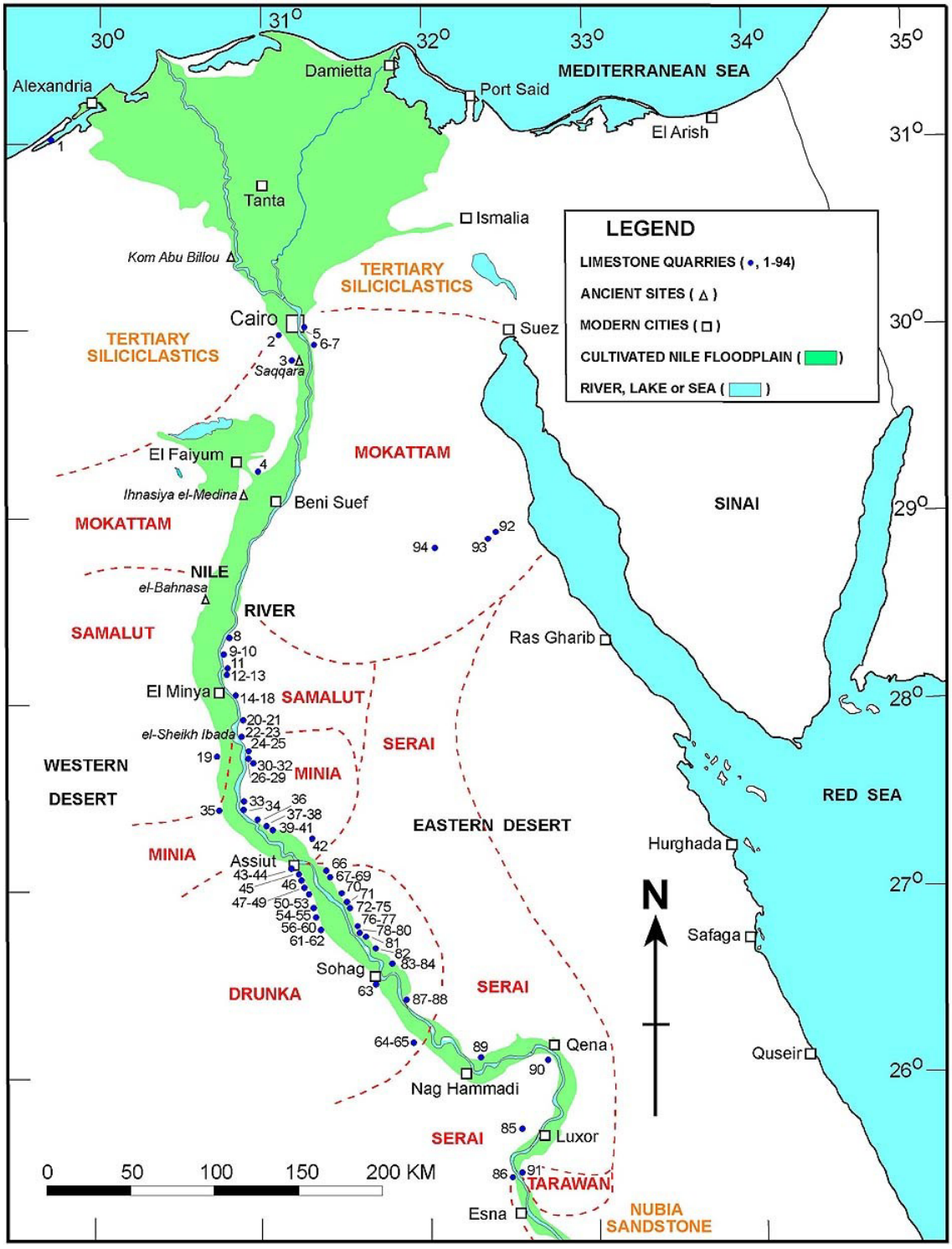

Figure 1. Map of a portion of Egypt showing the distribution of limestone formations and locations of ancient limestone quarries. The formations are described in table 3 and the numbered quarries are described in table 4.

Beginning in the 1940's and continuing into the 1970's, hundreds of so-called 'Coptic' sculptures and reliefs, carved from limestone, appeared on the global art market. These are also commonly referred to as the 'Sheikh Ibada group' after the village of el-Sheikh Ibada (ancient *Antinopolis* or *Antinoë*) in Middle Egypt (figure 1), near where these objects were rumoured to have been found in illicit excavations. Although originally hailed as genuine, the Sheikh Ibada group are now considered to be modern forgeries by most scholars (e.g., Thomas,

1990; Severin, 1995; Spanel, 2001). Some appear to be entirely new carvings and others are thought to be recarved ancient works. All of them apparently originated with Egyptian dealers and lack a verifiable archaeological context. They purport to date from Late Roman to Early Byzantine times (i.e., the 'Coptic' or pre-Islamic period), and display an eclectic mix of Christian symbols and imagery as well as Classical motifs. They are similar to demonstrably genuine Late Roman-Early Byzantine works from such sites as Ihnasiya el-Medina (ancient Herakleopolis), Kom Abu Billou (ancient Terenuthis), el-Bahnasa (ancient Oxyrhynchus) and Saqqara (figure 1).

It is not universally accepted that the Sheikh Ibada group are modern forgeries. Many of these objects are still exhibited in major museums as genuine. The art historical aspects of the sculptures and reliefs have been investigated (see Spanel, 2001 for a summary) and this is the basis on which their authenticity has been challenged. However, the limestone that they are carved from has not received any study. The geographic origin of this rock is relevant for two reasons. First, if the limestone is not Egyptian then this is obviously proof of forgery. And second, if Egyptian, recognition of the geographic region or even the quarry supplying the limestone would help to identify where the objects were carved, and so may indicate whether they are ancient or modern works. The Brooklyn Museum of Art (BMA) has a collection of 'Coptic' sculptures and reliefs (e.g., figures 2-11), and at its invitation the present author undertook a study of the limestone they are carved from.

Figure 2 (left). Coptic relief BMA 16.105. Height 35.7 cm, width 25.9 cm and depth 4.6 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.
Figure 3 (middle). Coptic relief BMA 40.301. Height 38.1 cm, width 29.2 cm and depth 10.8 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.
Figure 4 (right). Coptic sculpture BMA 63.36. Height 35.6 cm, width 15.9 cm and depth 10.2 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.

Figure 5 (left). Coptic relief BMA 67.176.2. Height 24.8 cm, width 47.0 cm and depth 10.2 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.
Figure 6 (right). Coptic relief BMA 68.3. Height 25.4 cm, width 51.4 cm and depth 10.8 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.

Figure 7 (left). Coptic relief BMA 68.150.2. Height 17.5 cm, width 43.8 cm and depth 8.3 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.
Figure 8 (right). Coptic relief BMA 68.153. Height 24.0 cm, width 44.4 cm and depth 13.3 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.

Figure 9 (left). Coptic relief BMA 69.74.2. Height 44.9 cm, width 34.0 cm and depth 8.6 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.
Figure 10 (right). Coptic relief BMA 72.10. Height 24.1 cm, width 41.3 cm and depth 10.2 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.

Figure 11. Coptic relief BMA 86.226.27. Height 20.8 cm, width 53.0 cm and depth 6.8 cm. Scale bar in cm. Photograph courtesy of the Brooklyn Museum of Art.

2. Methods

The BMA provided thin sections (glass-mounted rock slices 30 microns thick) of 31 objects from its 'Coptic' collection (including those in figures 2-11). Six of these are ones mentioned by Spanel (2001) as definite forgeries: numbers 58.80, 60.212, 62.44, 63.36 (figure 4), 72.10 (figure 10) and 77.129. The thin sections were

examined under a polarizing petrographic microscope, and mineralogy, texture and fossil content were noted (see remarks at the end of table 1). These observations were combined with a synthesis of the literature on Egyptian limestone formations and quarries, and from this general conclusions were made regarding limestone provenance.

3. Petrography

A petrographic summary of the thin sections is given in table 1. All the rocks are varieties of bioclastic limestone. In table 2 these have been grouped according to their textures and compositions. Two other thin sections, both from the University of Toledo (UT) collection, have been added to the tables. These are limestones from the ancient quarries at el-Sheikh Timay and Deir el-Bersha (a.k.a. Wadi el-Nakla), which are 5 km north and 8 km south, respectively, of el-Sheikh Ibada (22, 25 and 23, respectively, in figure 1). A sample from the latter locality was not available to the present author, but Klemm & Klemm (1993: 109-113) collected one, and their description of the limestone shows it to be very similar to the UT sample from el-Sheikh Timay.

4. Limestone sources

4.1. Geologic formations

All the limestones, in terms of both texture and composition, are identical to varieties commonly found in the Lower to Middle Eocene limestone sequence of the Nile River Valley between Cairo in the north and Edfu in the south (Amer *et al.*, 1970; Boukhary & Abdelmalek, 1983; Mansour & Philobbos, 1983; Hermina *et al.*, 1989; Said, 1990; Harrell, 1992; Issawi *et al.*, 1999: 232-272; Tawadros, 2001: 126-144). There is no reason to doubt that these limestones came from Egypt. It must be noted, however, that the same stratigraphic sequence also occurs in Libya, Syria, Jordan and Iraq, and so limestones of similar character may occur in these countries as well.

Except for those near Alexandria, the limestones used anciently in Egypt come from six geologic formations. Generalized descriptions of these are given in table 3, and their approximate geographic distributions are shown in figure 1. For each group of limestones in table 2, the most likely geologic formation is indicated. These assignments are based on both the textures (Dunham classification and allochem size) and compositions (allochems, especially fossil types). To identify the geologic formations with certainty would require recognition of index fossils down to the species level and this is not possible in thin sections. The formation assignments are, therefore, probabilistic rather than definite. The vast majority of limestones (1-21 and 23-28 in table 2) are almost certainly from the Mokattam Formation. The other four limestones probably come from the Samalut (29-31) and Minia or Drunka (22) formations, but could conceivably come from Mokattam, which is heterogeneous enough to accommodate all the limestone varieties in this study. The absence of dolomite and clay impurities in the samples largely preclude the Tarawan and Serai formations from being sources. Limestones from the Drunka and Minia formations are almost always rich in echinoid fossils or non-skeletal grains (e.g., ooliths, intraclasts, coated grains and peloids), respectively, and so only one of the samples (22) could have come from these sources. The Samalut Formation consists largely of nummulitic limestones that are almost always coarser grained than the samples in this study with the exceptions of 29-31. None of the limestones in this study even remotely resemble those from the el-Sheikh Ibada and neighboring quarries, all of which are in the Minia formation.

Only the Mokattam is a good fit for most of the limestones in this study. This formation forms the walls of the Nile Valley between Cairo in the north and Maghagha 160 km to the south. It also underlies most of the Faiyum Depression and is widely distributed across the Eastern Desert to the Red Sea coast, ranging along the Gulf of Suez between Suez to the north and Zafarana in the south (figure 1).

4.2. Ancient quarries

There are currently 94 known ancient limestone quarries in Egypt. These are listed in table 4 and shown on the map in figure 1.[1] Only about half of these have received any petrographic study and of these relatively few have been extensively investigated (Harrell, 1992; Klemm & Klemm, 1993: 29-197). Thus, there is not much information on the limestones for most of these quarries. They are known mainly from the geologic formations in which they occur and the latter have been well studied by geologists (see references in previous section). Most of the limestone quarries are not well dated and none are known specifically to have been active during the Late Roman-Byzantine period. Moreover, this list of quarries is incomplete in that many small

[1] This information comes from the author's website at http://www.eeescience.utoledo.edu/egypt/

workings have surely gone unrecognized. It is possible, and perhaps even likely, if the 'Coptic' sculptures and reliefs are forgeries that the limestones did not come from ancient quarries but rather were collected from natural outcrops near the workshops where the carving was done.

5. Conclusions

The vast majority, and possibly all, of the limestones investigated in this study come from the Mokattam Formation in Egypt, which is widespread between the latitudes of Cairo and Maghagha. Only four of the 31 limestones could have come from other, more southernly formations. Three of the four well-known Late Roman-Early Byzantine sites that are sources of genuine 'Coptic' sculptures and reliefs (Saqqara, Ihnasiya el-Medina and el-Bahnasa) lie either within or very close to the Mokattam Formation. If the Sheikh Ibada group are modern forgeries then the workshops probably existed within the same part of the Nile Valley as the ancient sites. This makes sense as the sculptors were clearly familiar with and inspired by the genuine works, and so must have lived in close proximity to their sources. The limestone probably did not come from ancient quarries, very few of which are known from the Mokattam Formation, but could easily have been obtained from natural outcrops and modern quarries, both of which abound in this region.

It is clear that the forgers intentionally used Mokattam limestone in order to make the Sheikh Ibada group as authentic appearing as possible. Petrographic analysis cannot, therefore, distinguish genuine sculptures and reliefs from the fake ones. The latter can only be recognized through an art historical analysis of their stylistic features.

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BMA No.	Dunham classification*				Allo-chem size**		Allochems***, #								Comments##
	M	W	P	G	F	C	Gl	Nu	Op	Eh	Pe	Gh	Fi	qS	
16.105		●			●		A	A				C		T	part. recryst.
40.299	●				●								T		larg. recryst.
40.300	●				●			A					T	T	part. recryst.
40.301			●		●		C	A		T	T		T	T	part. recryst.
40.302	●				●								T		larg. recryst.
41.1226		●			●		A	A				C	T	T	part. recryst.
41.1266		●			●		A	C				C		T	part. recryst.
41.891		●			●		A	A				C	T	T	part. recryst.
43.55				●		●		A						T	
45.131A###			●		●		S	A	S				T	T	
45.131B			●		●		C	C	A				T	T	
45.131D			●		●		A	A	S				S	T	
45.131E			●		●		C	A	S	T					
55.2.1			●		●		A	T	A	T			T	T	
55.2.2			●		●		A	T	A				T	T	
55.2.3		●			●		A	S					S	T	
58.129			●		●		A	C	C				T	T	
58.80			●		●		A	S	A				T	T	
60.212			●		●		A	S	A				T		
61.128		●			●		A	T				C	T	T	part. recryst.
62.44			●		●		A	S	A				T	T	
63.36			●		●		C	A	C	T	T		T		
67.176.2				●		●		A							
68.150.2			●		●		C	A	S	T			T		
68.153			●		●		C	A	S	T			T	T	
68.3		●			●					A			T		
69.74.2			●		●		A						T		
70.132				●		●	T	A		T					
71.39.1		●			●		S	A					T	T	part. recryst.
71.39.2		●			●		A	A	C				T	T	
72.9			●		●		A	C	C	T			T	T	
72.10	●				●			A							larg. recryst.
77.129	●				●			A							part. recryst.
86.226.27	●				●			A							larg. recryst.
el-Sheikh Timay			●			●		C	T	A	T				+calcareous algae, coral, bryozoa & gastropods
el-Bersha			●		●			A		A	T		T		

Table 1. Limestone thin section summary (samples arranged numerically by BMA number). Key: part.recryst. = partially recrystallized; larg. recryst. = largely recrystallized

**Dunham classification: M = mudstone (mud matrix supported with less than 10% allochems), W = wackestone (mud matrix supported with more than 10% allochems), P = packstone (allochem supported with mainly interstitial mud matrix), and G = grainstone (allochem supported with mainly interstitial sparry calcite cement). Note that 'allochem' refers to detrital grains, excluding the mud matrix (i.e., bioclasts or fossils and various nonskeletal grains).*

***Allochem size: F = fine grained (<2 mm), and C = coarse grained (2 mm – 1 cm).*

****Allochems: Foraminifera: Gl = globigerinids and globoratalids, Nu = nummulitids, and Op = operculinids; Other Bioclasts: Eh = echinoids, Pe = pelecypods, Gh = ghosts (outlines of grains that have been replaced by sparry calcite; mostly foraminifera), and Fi = fish bones, teeth and scales; and Nonskeletal gains: qS = quartz sand and silt.*

#Abundance codes: in terms of total allochems, A = abundant (>25%), C = common (5-25%), S = scarce (1-5%), and T = trace (<1%). All amounts are visually estimated.

Table 1. Continuation.

[##]Comments: recrystallization is said to have occurred when the allochems and mud matrix are replaced by coarse sparry calcite, which consequently largely or partially obscures the original depositional texture.
[###]Numbers 45.131A, 45.131B, 45.131D and 45.131E refer to different parts of the same object (BMA 45.131). Another slide in this series, 45.131C, was of a ceramic, rather than limestone, and so was omitted from this study.

Sample & BMA No.	Dunham classification				Allo-chem size		Allochems								Rock variety & geological formation
	M	W	P	G	F	C	Gl	Nu	Op	Eh	Pe	Gh	Fi	qS	
1) 16.105		●			●		A	A				C	T		
2) 40.301			●		●		C	A		T	T		T	T	
3) 41.891		●			●		A	A				C	T	T	
4) 41.1226		●			●		A	A				C	T	T	
5) 41.1266		●			●		A	C				C		T	
6a) 45.131A			●		●		S	A	S				T	T	
6b) 45.131B			●		●		C	C	A				T	T	
6c) 45.131D			●		●		A	A	S				S	T	
6d) 45.131E			●		●		C	A	S	T					
7) 55.2.1			●		●		A	T	A	T			T	T	
8) 55.2.2			●		●		A	T	A				T	T	fine-grained, foraminiferal wackestone to packstone [probably Mokattam fm.]
9) 55.2.3		●			●		A	S					S	T	
10) 58.129			●		●		A	C	C				T	T	
11) 58.80			●		●		A	S	A				T	T	
12) 60.212			●		●		A	S	A				T		
13) 61.128		●			●		A	T				C	T	T	
14) 62.44			●		●		A	S	A				T	T	
15) 63.36			●		●		C	A	C	T	T		T		
16) 68.150.2			●		●		C	A	S	T			T		
17) 68.153			●		●		C	A	S	T			T	T	
18) 69.74.2			●		●		A								
19) 71.39.1		●			●		S	A					T	T	
20) 71.39.2		●			●		A	A	C				T	T	
21) 72.9			●		●		A	C	C	T			T	T	
22) 68.3		●			●					A			T		fine-grained, echinoidal wackstone [probably Minia or Drunka fm. ; possibly Mokattam fm.]
23) 40.299	●				●								T		fine-grained, nummulitic mudstone [probably Mokattam fm.]
24) 40.300	●				●			A					T	T	
25) 40.302	●				●								T		
26) 72.10	●				●			A							
27) 77.129	●				●			A							
28) 86.226.27	●				●			A							

Table 2. Continuation.

29) 43.55			●	●		A					T	coarse-grained, nummulitic grainstone [probably Samalut fm.; possibly Mokattam fm.]
30) 67.176.2			●	●		A						
31) 70.132			●	●	T	A		T				
El-Sheikh Timay		●		●		C	T	A	T			fine- to coarse-grained nummulitic-echinoidal packstone [Minia fm].
El-Bersha		●		●		A		A	T		T	

Table 2. Limestone thin section interpretation (samples grouped by rock variety and geologic formation). For key see table 1.

MOKATTAM FORMATION (Middle Eocene, Lutetian stage)	Limestone: fine-grained, silty/sandy (quartzose), occasionally clayey mudstones, wackestones and packstones with mainly foraminifera (globigerinids, globoratalids, operculinids and especially nummulitids) and lesser amounts of other invertebrates, especially echinoids [0-10% dolomite].
SAMALUT FORMATION (Middle Eocene, Lutetian stage)	Limestone: coarse- to mainly very coarse-grained, highly porous packstones and grainstones with mainly nummulitid foraminifera, and lesser amounts of other invertebrates, especially echinoids and alveolinid foraminifera [0-5% dolomite].
MINIA FORMATION (late Lower Eocene to early Middle Eocene, Ypresian to Lutetian stages)	Limestone: fine- to coarse-grained packstones and grainstones with mainly echinoids and foraminifera (nummulitids, alveolinids and orbitolids), and lesser amounts of other invertebrates, especially pelecypods (mainly oysters) [0-5% dolomite].
DRUNKA FORMATION of the THEBES GROUP (Lower Eocene, Ypresian stage)	Limestone: fine-grained mudstones, wackestones, packstones and grainstones with mainly echinoids, foraminifera (nummulitids, alveolinids and operculinids) and nonskeletal carbonate grains, and lesser amounts of other invertebrates, especially pelecypods (mainly oysters) [0-5% dolomite].
SERAI FORMATION of the THEBES GROUP (Lower Eocene, Ypresian stage)	Dolomitic limestone: fine-grained, sometimes silty/sandy (quartzose) and clayey, abundantly to mostly sparsely fossiliferous mudstones, wackestones and packstones with mainly foraminifera (globigerinids, globoratalids, nummulitids and operculinids) and lesser amounts of other invertebrates, especially pelecypods (mainly oysters) and echinoids [15-40% dolomite].
TARAWAN FORMATION (Upper Paleocene, Landenian stage)	Dolomitic limestone: fine-grained, sometimes clayey, sparsely fossiliferous, micritic mudstones with mainly globigerinid foraminifera, and lesser amounts of other invertebrates, especially nummulitid foraminifera [15-20% dolomite].
NOTE ON FOSSILS: invertebrate fossils found within Egyptian limestones include the larger benthic foraminifera (nummulitids, alveolinids and operculinids), smaller planktonic foraminifera (globigerinids and globoratalids), molluscs (pelecypods – especially oysters, and gastropods), echinoids, bryozoa, ostracods and, less commonly, coral, calcareous algae, and crustaceans. The only vertebrate fossils seen are fish bone, teeth, and scales.	

Table 3. Generalized petrographic description of the principal limestone formations quarried anciently within Egypt's Nile Valley.

ALEXANDRIA FORMATION	
Mediterranean Coast	**1. numerous quarries on both sides of Mallahet Mariut marsh near Alexandria**: between Abu Sir [30d 56.8m N, 29d 30.0m E] and Burg el-Arab [30d 55.0m N, 29d 32.7m E] villages to the SW and Mex village [31d 9.25m N, 29d 50.6m E] to the NE *(Pt-R)*

MOKATTAM FORMATION	
West Bank of Nile Valley	**2. at Giza pyramids** [29d 58.5m N, 31d 7.95m E] *(OK:4)* **3. near Saqqara pyramids**: at Djoser pyramid [29d 52.15m N, 31d 12.9m E] *(ED:3)* and in the desert to the west [29d 50.9m N, 31d 9.9m E] *(ED-OK)* **4. near el-Lahun pyramid** [29d 14.2m N, 30d 58.0m E] *(MK:12)*
East Bank of Nile Valley	**5. at Zawyet Nasr on Gebel Mokattam near the Citadel** [30d 1.6m N, 31d 16.2m E] *(OK/MK-NK ?)* **6. on Gebel Tura near Tura village** [29d 56.0m N, 31d 17.7m E] *(ED:3, OK-R)* **7. on Gebel Hof near el-Masara village** [29d 54.9m N, 31d 19.2m E] *(MK-R ?)*
Wadi Arab area, Eastern Desert	**92. in Wadi Umm Zanatir near St. Antony Monastery** [28d 56.3m N, 32d 23.7m E] *(Is: unknown c.)* -- orange calcareous dolostone (mudstone) **93. in Wadi Abu Mu'aymil near St. Antony Monastery** [28d 53.9m N, 32d 19.5m E] *(Is: unkown c.)* -- dark gray and black limestones (mudstone) **94. in Wadi Umm Damarana near Bir Buwayrat** [28d 49.5m N, 32d 3.9m E] *(Is: unknown c.)* -- mottled white and purple/pink limestone (coarsely crystalline)

SAMALUT FORMATION	
Nile Valley — all are on the East Bank except 19	**8. near el-Sawayta village** [28d 22.5m N, 30d 48.0m E] *(NK-L ?)* **9. at el-Babein tomb near Beni Khalid village** [28d 18.1m N, 30d 44.9m E] *(NK:19-20)* **10. at and near Deir Gebel el-Teir village** [28d 16.9m N, 30d 45.0m E] *(OK/MK ?)* **11. near Tihna el-Gebel village and Akoris ruins** [28d 11.05m N, 30d 46.45m E] *(NK:20, L-R ?)* **12. near el-Hawarta village** [28d 9.95m N, 30d 46.55m E] *(R ?)* **13. near Nazlet Husein Ali village** [28d 8.4m N, 30d 46.6m E] *(R ?)* **14. near Sawada village in Zawyet Sultan district** [28d 4.6m N, 30d 48.3m E] *(NK:18)* **15. near Nazlet Sultan Pasha village in Zawyet Sultan district** [28d 4.1m N, 30d 48.9m E] *(NK-R)* **16. near Zawyet el-Amwat village in Zawyet Sultan district** [28d 3.2m N, 30d 49.8m E] *(NK-R)* **17. in Wadi Sheikh Yasin in Zawyet Sultan district** [28d 3.1m N, 30d 50.7m E] *(NK-R)* **18. near Darb Tila Nufal track in Zawyet Sultan district** [28d 2.55m N, 30d 51.25m E] *(NK-R ?)* **19. near Dirwa village and Petosiris tomb** [27d 44.1m N, 30d 41.55m E] *(Pt-R)*

Table 4. Continuation.

MINIA FORMATION	
Nile Valley — all are on the East Bank except 35	**20. near Nazlet el-Diyaba village** [27d 56.5m N, 30d 52.85m E] *(R ?)* **21. near Beni Hasan tombs** [27d 54.9m N, 30d 52.2m E] *(OK/MK-R ?)* **22. near el-Sheikh Timay village** [27d 51.7m N, 30d 50.7m E] *(OK/MK-Pt ?)* **23. near el-Sheikh Ibada village and Antiopolis ruins** [27d 49.6m N, 30d 52.2m E] *(MK-R ?)* **24. near Deir Abu Hennis village** [27d 47.2m N, 30d 54.8m E] *(NK ?)* **25. in Wadi el-Nakla near Deir el-Bersha village** [27d 44.9m N, 30d 55.4m E] *(NK:18, L:30, Pt)* **26. near el-Bersha village on Gebel Sheikh Said** [27d 43.24m N, 30d 53.57m E to 27d 43.05m N, 30d 53.54m E] *(NK: 18 ?)* **27. near Wadi el-Zebeida on Gebel Sheikh Said** [27d 42.36m N, 30d 53.40m E] *(NK:18 ?)* **28. near Sheikh Said tomb on Gebel Sheikh Said** [27d 41.98m N, 30d 53.22m E to 27d 41.70m N, 30d 53.31m E] *(NK:18)* **29. in western Wadi el-Zebeida** [27d 41.57m N, 30d 54.05m E] *(MK ?)* **30. in central Wadi el-Zebeida (a.k.a. Abd el-Azziz Quarry)** [27d 41.37m N, 30d 54.30m E] *(MK ?)* **31. near eastern Wadi el-Zebeida (a.k.a. Queen Tiy Quarry)** [27d 41.01m N, 30d 54.13m E to 27d 40.38m N, 30d 55.07m E; 1.8 km long NW to SE and up to 0.6 km wide; ~0.7 square km] *(NK: 18)* **32. near Northern Tombs at Amarna ruins** [27d 39.72m N, 30d 55.68m E] *(NK: 18)* **33. near Deir el-Quseir village on Gebel Abu Foda** [27d 29.6m N, 30d 52.2m E] *(age ?)* **34. in and near Wadis Abu Helwa and Magberi on Gebel Abu Foda** [27d 25.3m N, 30d 52.7m E] *(OK/MK-NK ?)* **35. near Meir village** [27d 26.0m N, 30d 42.2m E ?] *(OK/MK ?)* **36. at and near Deir el-Amir Tadros monastery on Gebel Abu Foda** [27d 22.6m N, 30d 57.8m E] *(OK/MK ?, NK:19)* **37. at and near Deir Abu Mina monastery on Gebel el-Harrana** [27d 21.3m N, 31d 0.9m E] *(age ?)* **38. near el-Maabda village on Gebel el-Harrana** [27d 20.3m N, 31d 1.9m E] *(age ?)* **39. near Deir el-Gabrawi village on Gebel el-Tawila** [27d 20.3m N, 31d 5.9m E] *(NK:19)* **40. on el-Ketf promontory on Gebel el-Harrana** [27d 19.6m N, 31d 2.8m E] *(NK:19)* **41. near Arab el-Atiat el-Bahariya village on Gebel el-Harrana** [27d 20.0m N, 31d 3.9m E] *(Pt-R ?)* **42. on Talet el-Hagar promontory near Wadi el-Assiut** [27d 17.45m N, 31d 18.15m E] *(age ?)*

Table 4. Continuation.

DRUNKA FORMATION of the THEBES GROUP	
West Bank of Nile Valley	**43. below el-Izam monastery near Assiut city** [27d 9.2m N, 31d 8.9m E] *(age ?)* **44. between Assiut city and Drunka village** [27d 9.4m N, 31d 10.4m E] *(OK/MK ?)* **45. at and between el-Aldra Maryam and Sawiris monasteries near Deir Drunka village** [27d 6.2m N, 31d 10.0m E] *(OK/MK ?)* **46. near Deir Rifa village** [27d 4.55m N, 31d 10.9m E] *(OK/MK-NK ?)* **47. near Sidi Abu el-Haris tomb** [27d 2.7m N, 31d 13.55m E] *(age ?)* **48. between Sidi Abu el-Haris tomb and Deir el-Bileida ruins** [27d 2.3m N, 31d 13.65m E] *(age ?)* **49. at Deir el-Bileida ruins** [27d 1.95m N, 31d 13.85m E] *(age ?)* **50. near el-Balyza village** [27d 1.25m N, 31d 14.2m E] *(age ?)* **51. between el-Balyza and Abu Khurs village** [27d 0.4m N, 31d 14.55m E] *(age ?)* **52. between el-Abu Khurs and el-Zaraby villages** [26d 59.2m N, 31d 14.7m E] *(age ?)* **53. near el-Zaraby village** [26d 58.45m N, 31d 15.1m E] *(OK/MK-NK ?)* **54. at el-Adra Maryam monastery near Wadi Sarga and Deir el- Ganadla village** [26d 55.65m N, 31d 16.8m E] *(OK/MK ?)* **55. near el-Mashaya village** [26d 54.9m N, 31d 17.2m E] *(age ?)* **56. near el-Ghanayim Bahari village** [26d 53.4m N, 31d 18.25m E] *(R ?)* **57. near Sidi Mansur tomb** [26d 52.85m N, 31d 18.65m E] *(age ?)* **58. near el-Ghanayim Qibli village** [26d 52.15m N, 31d 19.15m E] *(age ?)* **59. near el-Aghana village** [26d 51.6m N, 31d 14.7m E] *(age ?)* **60. near el-Qarya Bil Diweir village** [26d 50.55m N, 31d 19.9m E] *(age ?)* **61. near Sidi Abu Khiris tomb and Nazlet Imara village** [26d 47.05m N, 31d 21.4m E] *(age ?)* **62. near Nag el-Tawalib village** [26d 46.5m N, 31d 22.45m E] *(age ?)* **63. near Nag Hamad village and Athribis ruins** [26d 30.65m N, 31d 39.55m E] *(Pt-R ?)* **64. near el-Salmuni village and Abydos ruins** [26d 12.25m N, 31d 52.55m E] *(MK-L ?)* **65. in Wadi Naqb el-Salmuni near Abydos ruins** [26d 11.75m N, 31d 51.95m E] *(MK-L ?)*

Table 4. Continuation.

East Bank of Nile Valley	**66. near Wadi Emu** [27d 7.15m N, 31d 21.35m E] *(age ?)* **67. near el-Khawalid village** [27d 5.6m N, 31d 23.2m E] *(age ?)* **68. near el-Nazla el-Mustagidda village** [27d 4.65m N, 31d 23.65m E] *(age ?)* **69. between el-Nazla el-Mustagidda and Deir Tasa villages** [27d 3.8m N, 31d 24.1m E] *(age ?)* **70. near el-Iqal Bahari village** [26d 59.55m N, 31d 27.4m E] *(age ?)* **71. near el-Baiyadiya village** [26d 57.55m N, 31d 27.75m E] *(age ?)* **72. near el-Iqal el-Qibli village** [26d 56.65m N, 31d 28.75m E] *(R ?)* **73. at el-Hammamiya village** [26d 56.25m N, 31d 29.25m E] *(age ?)* **74. between el-Hammamiya village and Antaeopolis ruins** [26d 55.45m N, 31d 29.55m E] *(NK:18)* **75. at and near Qaw el-Kebir/Antaeopolis ruins** [26d 55.5m N, 31d 30.05m E] *(OK/MK-NK ?, Pt-R)* **76. near el-Nawawra village** [26d 50.1m N, 31d 32.1m E] *(age ?)* **77. near el-Khazindariya village on Gebel el-Haridi** [26d 47.7m N, 31d 32.45m E] *(NK:20)* **78. near Nazlet el-Haridi village on Gebel el-Haridi** [26d 46.35m N, 31d 33.25m E] *(age ?)* **79. near Abu el-Nasr village on Gebel el-Haridi** [26d 45.75m N, 31d 33.85m E] *(Pt)* **80. between Abu el-Nasr and el-Galawiya villages on Gebel el- Haridi** [26d 45.75m N, 31d 35.6m E] *(OK/MK ?)* **81. near el-Galawiya village** [26d 45.6m N, 31d 37.1m E] *(age ?)* **82. at Istabl Antar between el-Haradna and Urban Beni Wasil villages** [26d 42.8m N, 31d 40.35m E] *(age ?)* **83. near Qurnet Salamuni village** [26d 37.15m N, 31d 45.3m E] *(age ?)* **84. at el-Salamuni village** [26d 37.1m N, 31d 45.75m E] *(NK ?)* **87. near Nag el-Ahaywa village** [26d 26.0m N, 31d 50.3m E] *(age ?)* **88. near Sidi Musa tomb on Gebel Tukh** [26d 24.9m N, 31d 50.65m E] *(OK/MK-R ?)*

SERAI FORMATION of the THEBES GROUP	
West Bank of Nile Valley	**85. near Wadi el-Muluk (Valley of Kings)** [25d 44.85m N, 32d 37.3m E] *(NK:18, L:26, R)* **86. near el-Ghrera village in el-Gebelein district** - now destroyed [25d 29.65m N, 32d 28.1m E] *(MK-Pt ?)*
East Bank of Nile Valley	**89. near Nag el-Buza village** [26d 5.75m N, 32d 18.1m E] *(age ?)*

ISSAWIA FORMATION	
West Bank of Nile Valley	**90. on Gebel el-Gir near Tentyris/Dendara ruins** [26d 6.3m N, 32d 41.7m E] *(L:30-R ?)*

TARAWAN FORMATION	
East Bank of Nile Valley	**91. near el-Dibabiya village** [25d 30.25m N, 32d 31.3m E] *(NK:19, 3IP:21, R)*

Table 4. Ancient Egyptian limestone quarries.

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