MODERN EGYPTIAN POTTERY CLAYS AND PREDYNASTIC BUFF WARE*

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It has been held that the occurrence of buff ware in Predynastic Egypt is evidence for large-scale trade along the Nile Valley, since it was believed that there were only one or two areas where the specific clay necessary to produce buff ware was available.[1] A comparative study of clay sources at Qena and Fustat casts serious doubt on this inference while at the same time it suggests that examination of clay resources provides useful insights into the evaluation of pottery types in the archaeological record.

The late Alfred Lucas recognized two primary types of pottery clay, employed by both ancient and modern Egyptians.[2] One of these he described as a calcareous clay or marl, which burns to a gray, drab, or buff color. Such clays were said to be obtained from lime-rich stream deposits of the desert wadis at Qena and nearby Ballas, as well as in the area of Sohag. The light color of these clays, when fired, was attributed to the absence or quasi absence of organic matter and to the abundance of carbonates. By contrast, the second basic type of pottery clay consists of Nile mud, rich in organic materials and burning to a red or brown color.

The marly type of pottery clay occurs in a number of variants, the two most noted of which produce the modern *qulleh* ware of Qena, and the *ballali* ware from the village of Ballas.[3] The technique of introducing ash to a clay mixture in order to produce porous, 'cooling' water jars (singular *qulleh*) appears to have been discovered as late as the New Kingdom.[4] However, buff-fired pottery similar but not necessarily identical to that from Ballas has been made in Egypt since the first appearance of "decorated" ware in late Naqada I times.[5] There is a great variety of fine-grained beds rich in lime available along the margins of the Nile Valley,[6] but only a few of these appear to have been exploited as a raw material for pottery clay. These beds vary considerably in age, some dating from historical times, others from the later Pleistocene, i.e., ca. 10,000–75,000 years. The contemporary restriction of buff pottery manufacture to a few localities,

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1 For an explicit example see Sir Robert Mond and O. H. Meyers, *Cemeteries of Armant* (London, 1937), vol. 1, p. 50.

2 A. Lucas and J. R. Harris, *Ancient Egyptian Materials and Industries*, 4th ed. (London, 1962), pp. 368, 381 ff.

3 Ibid., pp. 382 and 496. Also G. Reisner, *Excavations at Kerma, IV–V*, Harvard African Studies, no. 6 (1923), pp. 320 f.

4 G. Steindorff, *Egypt* (Baedeker, Leipzig, 1929), pp. 119, 232, 239; Virginia Burton, unpublished.

5 E. J. Baumgärtel, Predynastic Egypt, *Cambridge Ancient History*, 3d ed., vol. 1, pt. 9 (1965), p. 477.

6 See K. W. Butzer, "Contributions to the Pleistocene Geology of the Nile Valley," *Erdkunde* 13

and the distinctiveness of such ware in certain periods of the archaeological record suggest that study of particular clay sources might prove to be profitable. For this reason an examination of the Qena clay source was undertaken during the course of paleo-environmental studies in Nubia and southern Upper Egypt during 1962–63. A brief joint trip to Qena with Virginia Burton was of immeasurable profit.

The major modern pottery kiln of Qena is situated about 1.5 km. northeast of the railroad station along the asphalt road Qena–Safaga. Most of the clay used in this kiln comes from a series of shallow pits and cuttings under the cultivated fields extending into the lower course of Wadi Qena. The present, inactive channel or wadi floor is over 1 km. wide where it coalesces with the Nile alluvium, but rapidly narrows upstream to an average width of 500 m.[7] This surface has been irrigated and cultivated for a distance of 4 km. northeast of the town of Qena and about 3.5 km. beyond the edge of the Nile floodplain. Further up in Wadi Qena the channel ultimately narrows down to a width of about 200 m.

Both the higher-lying spreads of late Pleistocene wadi alluvium and the modern floor of Wadi Qena are studded with shallow pits and excavations, partly intended for the exploitation of natural, dilute fertilizers, partly for the procurement of pottery clay. Some of the pits in the area of the pottery kiln were almost certainly once intended to exploit possible clay resources. But all of the pits shown to us as the present source of raw material were located under the cultivated fields, within the modern wadi channel. The land is rented by the entrepreneurs in small units at a time, stripped of economically useful beds, and the lower surfaces so exposed are subsequently cultivated afresh. Exploitation is irregular and sporadic, and limited to cuttings seldom exceeding 1.5–2 m. in height, 50–100 m. in cumulative length.

A detailed stratigraphic section was examined in the pits currently being dug as the major clay source of the Qena pottery works. These workings are located just northeast of a freshly dug or deepened canal running along the northern edge of the railroad track, some 500 m. northeast of the level-crossing of the Qena–Safaga road. At this place the canal dredging brought up considerable masses of rolled, coarse-grade limestone gravel, embedded in a matrix of very pale brown,[8] homogeneous, silty clay (bed (d), table 1).[9] The thickness of these gravels is unknown, but they appear to underlie the wadi channel at depth and very probably form part of a suballuvial, late Pleistocene fill. According to the workmen, the matrix is acceptable as a source for pottery clay.

The following generalized section can be described from the cuttings in the channel fill of lower Wadi Qena, beginning with the topmost unit.

1. 80–90 cm. thickness. Pale brown,[10] poorly bedded, nonhomogeneous silt loam (bed (a), table 1),[11] with abundant grains of quartz, feldspar, and ferromagnesian sand, and occasional sandstone granules. This material is comparable to modern beds of

[7] K. W. Butzer and C. L. Hansen, *Desert and River in Nubia: Geomorphology and Prehistoric Environments at the Aswan Reservoir* (Madison, 1968), pp. 123, 497.

[8] According to the Munsell Soil Color Charts, Baltimore, 1954. The color code is 10 YR 7/4.

[9] Mechanical separations to obtain sediment texture are described by I. W. Cornwall, *Soils for the Archaeologist* (London, 1958), chap. 11, and related terminology is discussed by K. W. Butzer, *Environment and Archeology: An Ecological Approach to Prehistory* (Chicago, 1971), chap. 10. Textural classes are those used by the U.S. Soil Survey. As used to describe beds (a) to (d) (table 1), these classes refer to the noncarbonate residues only. By conventional definition all of these deposits would be classified as marls.

[10] Color code 10 YR 6–7/3.

[11] See above, note 7.

the eastern desert wadis, namely sands and silts derived from older alluvial beds and deposited by rare flood spates. The density of archaeological debris (potsherds, brick fragments, charcoal) well below the plow zone suggests destruction of man-made structures or reworking of surface debris. Human agency or co-agency may, however, also be responsible for this deposit. Straw-tempered "ridged" ware (late Coptic or Islamic) and very coarse ware (probably not earlier than the fifteenth or sixteenth century A.D.)[12] indicate a very recent age.

TABLE 1

SEDIMENT ANALYSES FROM THE CHANNEL FILL OF WADI QENA

Bed	$CaCO_3$(%)	Noncarbonate Residue			pH
		Sand (%)	Silt (%)	Clay (%)	
(a)	36.2	20.5	57.8	21.7	7.9
(b)	32.3	23.5	76.5†	—	8.1
(c)	41.6	2.2	72.1	25.7	8.2
(d)	36.8	0.8	52.3	46.9	8.3

† Includes silt and clay.

2. 80–150 cm. thickness. Very pale brown,[13] stratified, silt loam (bed (b), table 1) with an appreciable component of quartz sand. This is beyond question a "natural" deposit due to sporadic floods. Rootlet impressions suggest a low herbaceous, succulent or thorny plant growth on the channel floor at time of deposition. Rare potsherds of "incised" ware, probably of Christian age,[14] are of interest.
3. At least 120 cm., base not seen. Light yellowish brown,[15] laminated, homogeneous, silt loam employed as the primary source of pottery clay. Rootlet impressions as in bed (b). The lamination or banding and the homogeneity of bed (c) suggest deposition by uniform-velocity, slow-moving or standing muddy waters with little turbulence. In the wake of heavy rains in the distant Red Sea hills, torrential and turbulent floodwaters upstream give way to a uniform, laminar flow downstream, with deposition of only the finest sediments. However, the floods that devastated Qena during the present century have left a record of fine silt and sandy wash, so that bed (c) suggests an extended period of a different and possibly more moist climate in the hill country. In one section two subcontinuous hearth zones, each up to 4 cm. thick, were found at varying depths of 15 to 30 cm. and 55 to 75 cm. below the top of stratum (c). These bands consist of a loamy marl, baked to a light brown or reddish yellow color, with dark gray to black discolorations or inclusions due to the presence of charred vegetable matter and carbonized wood. Potsherds were absent, but the intensity of clay firing suggests human occupation rather than natural conflagration. A radiocarbon date was obtained from carefully pretreated charcoal out of the lower hearth, at 55 to 60 cm. below the top of bed (c). The

[12] Identifications with probable ages provided by George T. Scanlon.

[13] Color code 10 YR 7/3.

[14] Identified by Scanlon.

[15] Color code 10 YR 6–7/4.

age is A.D. 1090 ± 115 (I-2561).[16] This indicates that the source bed for the Qena clay accumulated in early Islamic times, presumably over a period of a century or two. This phase of sedimentation and accelerated streamflow is obviously contemporary with the post-Byzantine alluviation evident along the margins of the Nile Valley in Middle Egypt.[17]

Unlike the heterogeneous beds (a) and (b), which were at least in part reworked from older Pleistocene alluvia by local sheetwashing, the clay source (c) was sorted by stream action during transport from higher up in the Wadi Qena basin. At the time of deposition these were lime-charged muds. The finely dispersed lime or calcium carbonate is present in the form of calcite, and owes its origin to the limestone rocks exposed through much of the drainage basin. The dissolved calcite was precipitated as the floodwaters evaporated from the wadi bed. The noncalcareous fraction, almost exclusively carried in suspension by flood waters, consists primarily of quartz, soda-lime feldspars, illite and kaolinite.[18] Most of the quartz was probably derived directly or indirectly from the Nubian sandstone exposed in the middle sector of the Wadi Qena basin, while the feldspars came from the crystalline rocks of the Basement Complex that form the Wadi Qena headwater region. Some of the illite and kaolinite may be derived from impurities once embedded in the limestone, but the greater part must ultimately be attributed to primary clay minerals or decomposition of feldspars and ferromagnesian minerals from the Basement Complex. Although the X-ray diffractogram shows no peak of hematite (anhydrous ferric oxide), the illite peak is very poorly defined, suggesting considerable interlayering, probably with montmorillonite or ferric oxides.[19]

In overview, the present source of the Qena pottery clay is complex and owes its origins to a fortuitous combination of clay minerals, inert but very fine-grained minerals, as well as dissolved calcite, accumulated by the flood waters of Wadi Qena ca. A.D. 1000–1200. This material is tempered by the addition of medium to coarse-grained quartz sand (0.06 to 6.0 mm. in diameter) and the ashes used to achieve a porous texture are obtained by sieving the rubbish from the kiln fires.

Although raw pottery clay is or has been obtained from other, older clay marls exposed in wadi beds east of Qus and near Ballas, these have a different origin and vary in composition. Consequently, insofar as the Qena potters restrict their workmanship to the source clays described above, fully identical raw materials were not available in pre-Islamic times. To employ the much "richer" clays of the underlying Pleistocene gravel matrix would presumably require a slight modification of extraction techniques, as well as differences in the amount or type of temper applied. Conceivably, therefore, the introduction of a new and desirable clay source by natural phenomena during early

[16] Bristlecone pine calibration of radiocarbon dating would suggest an age some twenty-five to thirty years younger (see H. E. Suess, "The Three Causes of the Secular C-14 Fluctuations, Their Amplitudes and Time Constants," *Radiocarbon Variations and Absolute Chronology* (New York, 1970), pp. 595–604. Bed (c) was probably laid down between A.D. 1000 and 1200.

[17] K. W. Butzer, *Die Naturlandschaft Ägyptens während der Vorgeschichte und dem dynastischen Zeitalter*, Abhandlungen Akademie der Wissenschaften und der Literatur (Mainz) *Math.-Naturw. Kl.*, no. 2 (1959), pp. 67 ff. Analogous contemporary deposits have been described from other parts of the Mediterranean Basin by C. Vita-Finzi, *The Mediterranean Valleys* (Cambridge, 1969).

[18] As determined by X-ray diffractogram analysis.

[19] It should be mentioned that the high percentages of oxides obtained from global chemical analyses of Qena clay and buff pottery in general (Lucas and Harris, *Ancient Egyptian Materials*, p. 496) refer almost exclusively to constituent molecules of the clay minerals, not to free oxides.

Islamic times may have had specific economic significance to Qena, possibly leading to concentration on a single source of raw material. Other clay pits around Qena or further south, along the margins of the Eastern Desert, may have been abandoned as a result. Similarly, earlier buff pottery manufactured in the Qena area could not have been completely identical to the modern ware.

In order to test how unique the Qena clay is, a number of other natural samples and "mixtures," collected by Virginia Burton at the Fustat kilns of Cairo, were also analyzed (see table 2). A "dark" mixture[20] used for red ware proved to be a lime-poor, silty clay essentially of nilotic origin, tempered with a little organic matter and, possibly, sand. The clay minerals are primarily montmorillonite, with some kaolinite and a trace of illite, much like other nilotic sediments of various ages.[21] By contrast, the "light" mixture[22] used for buff ware is a lime-rich, silty clay loam, obtained primarily from wadi marls with perhaps one-third nilotic mud. The temper component includes organic matter and a little sand. Both wadi marls are highly calcareous, silty clays, although that from the cultivation edge at Tapini has more sand than the "special gebel clay" or "sel." Surprisingly, the Tapini clay was also montmorillonitic.[23] In other words, the "dark" and "light" mixtures used at Fustat vary primarily in lime, not in organic content or clay type; they are processed similarly, but only the finished products differ conspicuously, on account of their color.

TABLE 2

SEDIMENT ANALYSES FROM THE FUSTAT AREA

Source or Type	$CaCO_3$(%)	Noncarbonate Residue		
		Sand (%)	Silt (%)	Clay (%)
Nilotic mud	9.8	2.5	67.5	30.0
Dark mixture	8.8	9.0	47.5	43.5
Light mixture	33.3	8.0	54.5	37.5
Tapini clay	42.7	7.0	43.0	50.0
Sel	49.8	1.5	47.0	51.5

SOURCE: Samples collected by Virginia Burton

The Fustat information has further implications for the Qena ware. The buff pottery produced at Fustat and Qena is almost indistinguishable in terms of material, yet the clay minerals are different and the clay fraction of the primary raw material may vary by a factor of two. Clearly, therefore, the potters readily compensate for major textural differences by mixing raw materials or applying additional tempers. Differences in clay minerals appear to be in part compensated for by the presence of a minor but significant component of kaolinite, which counteracts the excessive shrinkage otherwise probable with a montmorillonitic clay.[24] Similarly, the presence of angular quartz sand may help counteract the same effect.[25] Finally, longer or more intensive firing—assured by the 900–1000° C temperatures necessary to produce a buff color[26]—removes the hydrated water from the expandable montmorillonite, changing the mineral structure. Thus, whereas the red and buff wares are visibly different, buff ware can theoretically be

[20] Munsell color grayish brown (10 YR 5/2).

[21] Determined by X-ray analysis. Butzer and Hansen, *Desert and River in Nubia*, pp. 485 ff.

[22] Munsell color pale brown (10 YR 6/3).

[23] Determined by X-ray analysis.

[24] See A. O. Shepard, *Ceramics for the Archaeologist*, rev. ed., Carnegie Institute of Washington Publication, no. 609 (1968), pp. 20, 377.

[25] F. R. Matson, personal communication.

[26] Ibid.

manufactured from a variable range of marls found at any of a great number of basically suitable outcrops through the limestone province from about Gebelein to Cairo. In view of the fact that the sources for buff-firing clays are not truly unique, ancient buff ware could have been made from a variety of lime muds then found through much or most of Upper and Middle Egypt. In other words, buff ware as such cannot be used as an argument in favor of large-scale trade in Egyptian Predynastic times.

Matson has already made a strong case for the significance of contemporary potters' raw materials, manufacturing techniques, and attitudes in archaeological research.[27] The present study shows that a precise definition of clay resources has several applications. In particular, it cautions against the assumption that the clay landscape of today is necessarily the same as that of antiquity. At the same time it can contribute to a fuller understanding of prehistoric industrial traditions and commodity exchange. It is to be hoped that further and more comprehensive studies of Egyptian clay resources will be attempted by young Egyptian scholars.

[27] "Ceramic Ecology: An Approach to the Study of the Early Cultures of the Near East," *Viking Fund Publ. Anthropol.*, no. 41 (1965), pp. 202–17; "Ceramic Queries," ibid., pp. 277–87; also "The Quantitative Study of Ceramic Materials," ibid., no. 28 (1960), pp. 34–59. For an exemplary study of regional pottery clays and their significance see A. O. Shepard, "Rio Grande Glaze-Paint Pottery: A Test of Petrographic Analysis," *Viking Fund Publ. Anthropol.*, no. 41 (1965), pp. 62–87.