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## Chemical Analyses of Pottery and Clays from the Islamic City of al-Basra and Its Hinterland in Northern Morocco

**Key words:** Islamic pottery, Morocco, Chemical analysis.

**\*Abstract:** This article presents the results of chemical analyses of pottery and clays from the early Islamic city of al-Basra (A.D. 800—1100) in northern Morocco and settlements in its hinterland to reconstruct patterns of regional production and exchange. Our research indicates that wheelmade utilitarian storage jars, pitchers, and bowls with the same chemical composition as those produced at al-Basra were found at smaller settlements up to 40 km away. We suggest that al-Basra's urban potters supplied utilitarian wares to smaller towns and villages in the region through a weekly market system known to have existed during the Islamic period and similar to one that still operates today.

**Palabras clave:** cerámica islámica, Marruecos, análisis químicos.

**\*\*\*Resumen:** Este trabajo presenta los resultados de los análisis químicos efectuados para obtener información sobre los modos de producción y los intercambios regionales, referido a las cerámicas y las arcillas que datan del principio de época islámica (siglos VIII–XII) descubiertas en al-Basra (Marruecos septentrional) y en núcleos urbanos de su área de influencia. Nuestros trabajos muestran que jarras utilitarias, ollas y cuen-

cos de los tipos producidos en Basra, se han encontrado en núcleos urbanos distantes 40 km. Pensamos que los ceramistas de al-Basra produjeron mercancías utilitarias para las aglomeraciones menos importantes de la región merced a un sistema de mercados semanales que existió durante el período islámico y que se asemeja al existente aún hoy.

**Mots clés :** poterie islamique, Maroc, analyse chimique.

**\*\*Resumé :** Cet article présente les résultats d'analyses chimiques effectuées, en vue d'obtenir des renseignements sur les modes de production et d'échanges régionaux, sur des poteries et des argiles datant du début de la période islamique (800 à 1100 après J.C.), découvertes à al-Basra (au nord du Maroc) et dans des noyaux urbains de son arrière-pays. Nos travaux montrent que des jarres utilitaires, des pots et des bols ayant la même composition chimique que ceux produits à al-Basra ont été trouvés dans des noyaux urbains moins importants distants de 40 Km. Nous pensons que les potiers de al-Basra fournissaient des marchandises utilitaires à des agglomérations moins importantes de la région grâce à un système de marchés hebdomadaires qui existait pendant la période islamique et qui ressemble à celui encore en vigueur de nos jours.

### 1. Introduction.

While long-distance movements of luxury Islamic pottery are fairly well-documented in the circum-Mediterranean area, the scale of production and distribution of utilitarian wares has not been investigated as widely. Most archaeological studies of Islamic pottery have focused on the manufacture of high-status pottery, such as lustrewares and polychrome glazed wares. These studies have shown that glazed wares were generally manufactured in large production centers and were widely exported throughout the Mediterranean, the Near East, and Africa (e.g., EL HRAIKI, SCHMITT & PICON, 1995; MASON & TITE, 1994; REDFORD & BLACKMAN, 1997). However, the manufacture

and exchange of utilitarian Islamic pottery used in domestic contexts to prepare and serve food and to store water, oil, and other products is much less known. Until recently, such ordinary pottery was not seriously studied by archaeologists, and it was often discarded without examination at archaeological sites in North Africa.

Our research objective in this project was to reconstruct the nature and extent of the exchange system for utilitarian pottery during the Islamic period in northern Morocco. To do this, we conducted chemical analyses of pottery excavated stratigraphically from the early Islamic city of al-Basra (A.D. 800—1100) as well as pottery collected from the

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surfaces of 15 Islamic-period sites in the vicinity of al-Basra. We also considered the results of chemical analyses of clays collected from the area around al-Basra and pottery and clays collected from four contemporary pottery workshops in northern Morocco. To develop hypotheses of ceramic exchange, we drew on the wealth of ethnographic and ethnohistorical information available on pottery production and distribution in the Maghreb (BALFET, 1965; TROIN, 1974; VANACKER, 1973; VOSSEN, 1984; VOSSEN & EBERT, 1986). Our study addressed two main research questions: (1) was the utilitarian pottery made at al-Basra distributed beyond the urban center to small towns and villages in the region and (2) if it was, what type of regional exchange system facilitated the movement of the pottery.

### 1. Historical and Archaeological Context.

Located in northern Morocco (fig. 1), the city of al-Basra served as a provincial center during its 300-year history. It was founded by the Idrisid dynasty in about A.D. 800 and flourished until the early 10th century under the Idrisids. In the 10th century, al-Basra came under the influence of the

Fatimids of Ifriqqiya (Tunisia). Sometime around A.D. 979, al-Basra was partially destroyed during a conflict between the Fatimids and the Umayyads of southern Spain (Andalusia). The city was rebuilt and continued to exist during the Almoravid period (ca. A.D. 1050-1150), but it was abandoned sometime in the 12th or 13th century. Although the city's economy was based primarily on agricultural products (LOYET, 2004; MAHONEY, 2004), its artisans also produced a variety of craft goods, including large quantities of utilitarian pottery.

#### 1.1. Archaeological Excavations.

Archaeological excavations during the 1980s and 1990s (REDMAN, 1983, 1983-84; BENCO, 1987, 2001, 2002, 2004) at the 30-hectare site revealed four occupation levels dating from the pre-Idrisid period (ca. A.D. 600-800) to the Almohad period (ca. A.D. 1150-1250). The excavations uncovered house compounds in a residential zone and pottery and metallurgical manufacturing facilities in an industrial zone (fig. 2). Clear evidence of a local pottery industry included two rectangular-shaped updraft kilns and numerous kiln wasters, or overfired pottery.

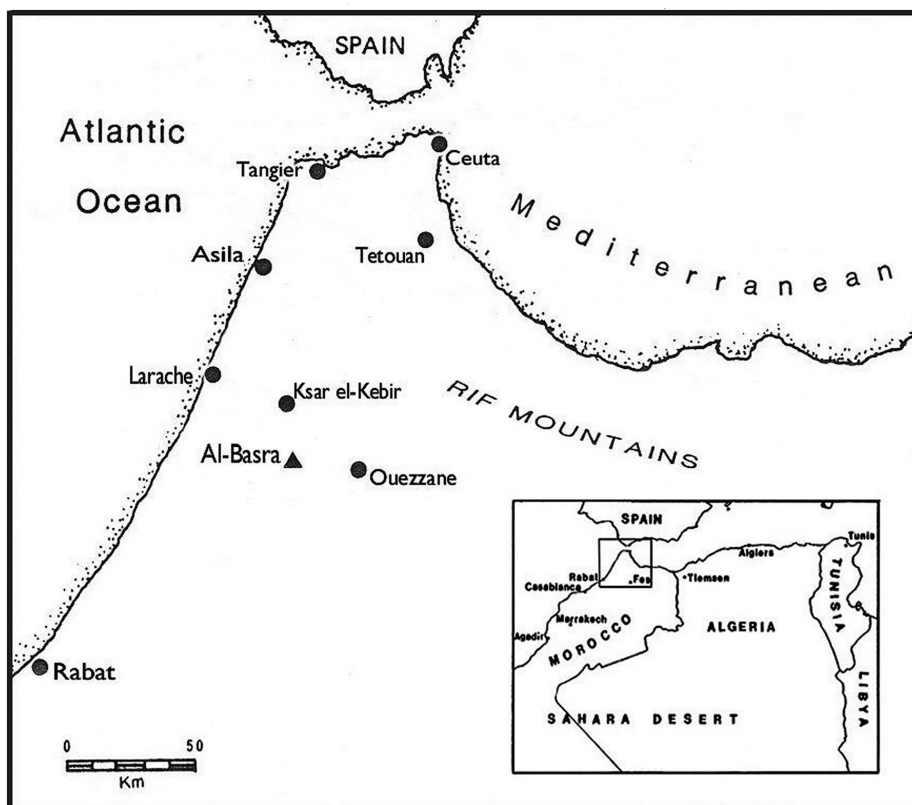


Fig. 1. Map of Northern Morocco.

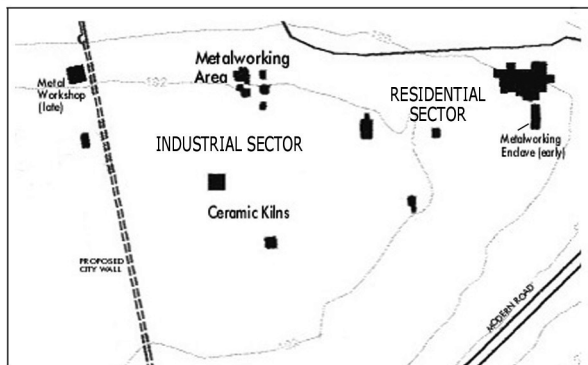
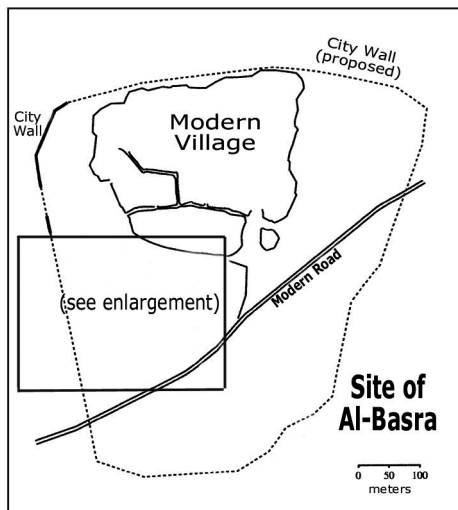


Fig. 2. Map of Al-Basra.

The pottery from al-Basra is remarkably uniform. Some 80 percent of the assemblage consists of wheelmade, buff-colored wares with little or no decoration. The buff wares occur in a limited range of forms, including small and large storage jars, carinated jars, pitchers, bowls, cups, and oil lamps (fig. 3). All of the kiln wasters found at the site belong to the buff ware group. Another 12 percent of the collection consists of cream-colored wares that occur primarily in the form of pitchers, some with simple painted red or brown (iron oxide paint) motifs. About 5 percent of the pottery consists of handmade cooking vessels made of a paste with large inclusions along with coarse wares, mostly in the form of storage jars. Finally, about 2 percent of the assemblage consists of glazed wares, a diverse group that includes monochrome (honey, green, or yellow), manganese-on-honey (melados), and manganese-on-green glazed sherds, as well as glaze painted pottery (cuerda seca).

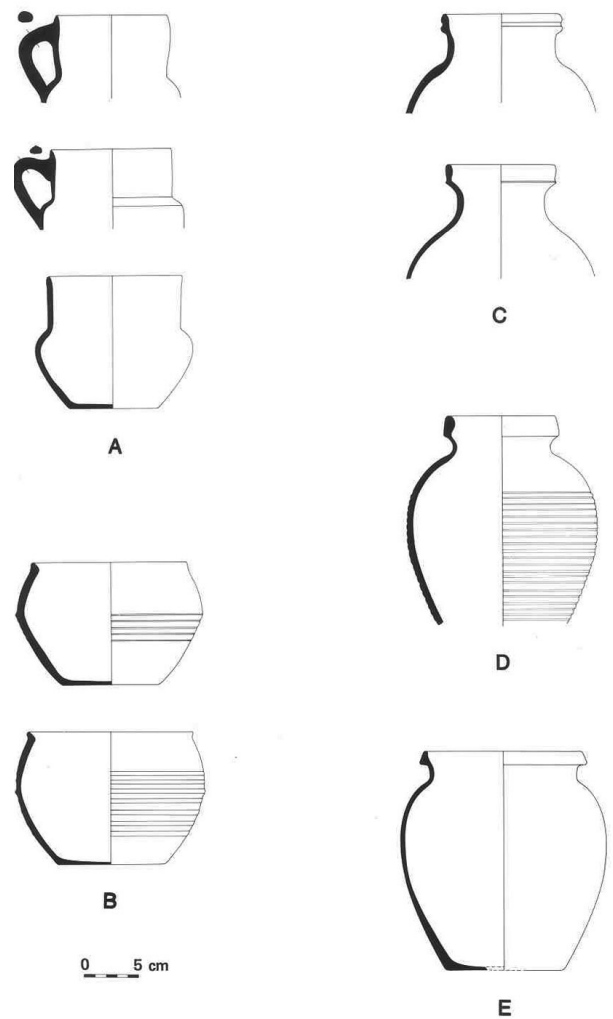


Fig. 3. Al-Basra pottery forms. A = pitchers; B = carinated jars; C, D, E = small storage jars..

### 1.2. Archaeological Survey.

An archaeological survey conducted in 1998 and 1999 in the region around al-Basra identified some 40 hinterland sites, many of which could be dated to the Islamic period on the basis of pottery and other remains visible on the surface (ENNAHID, 2002). The survey area extended about 40 km westward from al-Basra to the Atlantic coast and about 25 km from north to south (fig. 4). Because some of the pottery collected from the surfaces of the sites closely resembled—in both form and paste composition—the buff-colored utilitarian vessels that dominate the al-Basra assemblage, we decided to conduct a chemical study to determine if they could have been produced at the urban center and, thus, have been part of a regional exchange system.

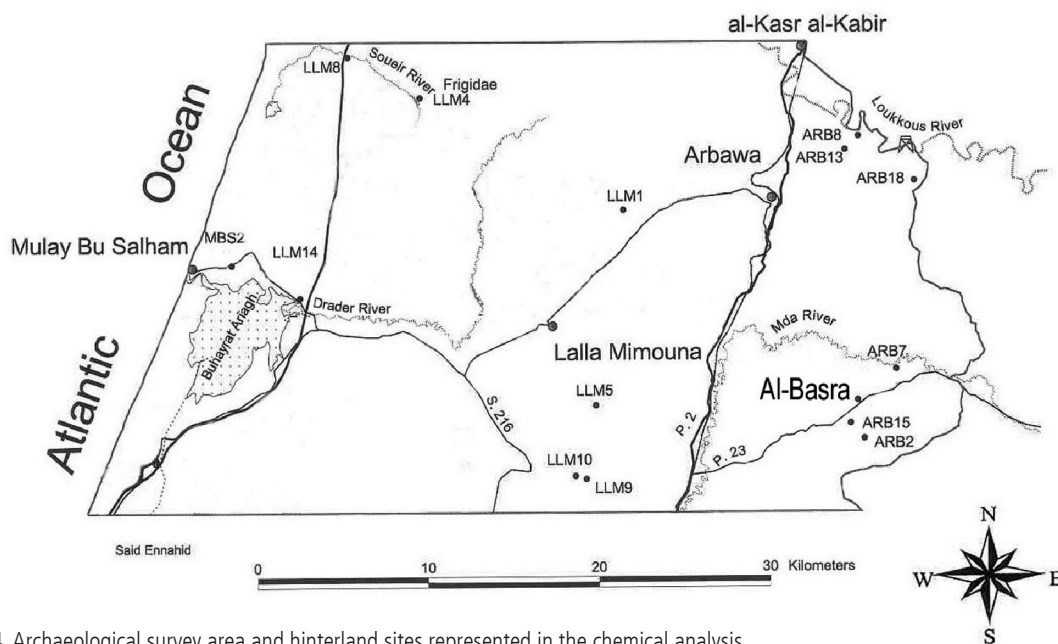


Fig. 4. Archaeological survey area and hinterland sites represented in the chemical analysis.

## 2. The Sample.

The sample included a total of 332 potsherds and clays that came from four groups of material (table 1):

**2.1. Pottery from the al-Basra excavations.** A total of 86 specimens represented the range of pottery types found at al-Basra: buff-colored, cream-colored, handmade, coarse, and glazed sherds from small and large storage jars, carinated jars, bowls, cups, and oil lamps. The specimens came from both the industrial and residential areas of the site and from all stratigraphic levels. Three specimens were kiln wasters.

**2.2. Clays from deposits near al-Basra.** Another 22 specimens consisted of clays collected from deposits located within a 3-km radius of the site as well as two brick samples from the updraft kilns and one sample of building pisé. For the chemical analysis, the clays were treated in different ways in an attempt to simulate the original production process: raw clays; clays fired to 850°C; clays sieved through a 60-mesh screen and fired to 850°C; and clays sieved through a 325-mesh screen and fired to 850°C.

**2.3. Pottery from the archaeological survey.** These 145 specimens were selected from 15 hinterland sites identified during the archaeological survey. The sherds were chosen because they were

similar to the predominant buff-colored pottery types at al-Basra.

**2.4. Pottery and clays from an ethnoarchaeological study.** These 79 samples of pottery, tempering materials, and raw clays were collected in 1987 during an ethnoarchaeological study of contemporary potters in two cities (Tetouan and Ksar al-Kebir) and two villages (Ain Koub and Beni Kissane) in northern Morocco. This material was included in this study to provide a better understanding of the chemical compositional variability of pottery and clays in the region.

## 3. Chemical and Quantitative Analyses.

The pottery, clays, and other materials from al-Basra, the hinterland sites, and contemporary workshops were analyzed by instrumental neutron activation analysis (INAA) to determine their chemical composition.<sup>1</sup> INAA is a highly sensitive analytical technique that allows the quantitative determination of major, minor, and trace elements in archaeological ceramics and other materials. The chemical data are then analyzed quantitatively to identify chemically homogeneous compositional groups within the overall database. Based on the

1. The 15 elements used in the analysis were sodium (Na), potassium (K), scandium (Sc), chromium (Cr), iron (Fe), cesium (Cs), lanthanum (La), cerium (Ce), samarium (Sm), europium (Eu), ytterbium (Yb), lutetium (Lu), hafnium (Hf), tantalum (Ta), thorium (Th). Calcium (Ca) was added later in the data analysis, as it helped in the refinement of the groups identified.

**Table 1. Provenience and General Description of 332 Sherds and Clay Samples**

<b>Pottery from Al-Basra Excavations (Total = 86)</b>	Buff-colored pottery (Total = 45)
	Carinated jar (15), small storage jar (15), pitcher (8), oil lamp (1), cup (1), other (5)
	Cream-colored pottery (Total = 20)
	Small storage jar (4), pitcher (9), oil lamp (3), bowl (1), and other (3)
	Coarse pottery (Total = 3)
	Large storage jar (1), and other (2)
	Handmade cooking pots (Total = 3)
<b>Clay Samples from Deposits near Al-Basra and Brick Samples from Site (Total = 22)</b>	Glazed pottery (Total = 15)
	Honey and manganese-on-honey glaze (10), green and manganese glaze (1), green glaze (1), light green glaze (1), and glaze painted (2)
<b>Clay Samples from Deposits near Al-Basra and Brick Samples from Site (Total = 22)</b>	Kiln brick and building pise (Total = 3)
	Clay samples from Mda River valley and other deposits within 3 km of urban site. (Total = 19)
<b>Surface Collections from 15 Hinterland Sites (Total = 145)</b>	Al-Ghzalal (ARB2): carinated jar (6), small storage jar (4)
	Bhalla (ARB7): carinated jar (6), small storage jar (1), and other (3)
	Jahjouka (ARB8): carinated jar (6), storage jar (2), tall-necked water storage jar (1), and other (1)
	Sidi Bou Douma (ARB13): carinated jar (4), small storage jar (1), and other (5)
	Kudyat Srafah (ARB15): carinated jar (5), small storage jar (5)
	Ketama (ARB18): carinated jar (4); small storage jar (2), and other (4)
	Shkayfa (LLM1): carinated jar (5), small storage jars (5)
	Frigidae (LLM4): carinated jar (1), small storage jar (1), and other (3)
	Sidi an-Niyya (LLM5): carinated jar (6), small storage jar (3), and other (1)
	Sidi Ahmed Bourziguine (LLM8): carinated jar (2), small storage jar (4), other (4)
	El-Arab (LLM9): carinated jar (5), small storage jar (4), tall-necked water storage jar (1)
	Kudyat Sma (LLM10): carinated jar (5), small storage jar (5)
	Sidi Yssef (LLM14): carinated jar (6), small storage jar (5), tall-necked water storage jar (1), and other (3)
	Al-'Asimi (MBK1): carinated jar (3), small storage jar (2)
	Douar Riah (MBS2): small storage jar (1), flask (2), and other (7)
<b>Contemporary Pottery Workshops in Northern Morocco (Total = 79)</b>	Tetouan urban workshops: pottery (8) and clay (12)
	Ksar el-Kebir urban workshops: pottery (8) and clay (12)
	Ain Koub village potters: pottery (14), clay (8), and slip (1)
	Beni Kissane village potters: pottery (10) and clay (6)



“provenience postulate” (WEIGAND, HARBOTTLE & SAYRE, 1977), such compositional groups are assumed to represent geographically restricted sources or source zones for ceramic material. In our case, we were able to use the three overfired sherds (kiln wasters) to assign a compositional group to the pottery workshops at al-Basra.

The ceramic and clay samples were analyzed at two research laboratories using somewhat different sample preparation and irradiation procedures. At the Smithsonian Institution–National Institute of Standards and Technology (NIST), the al-Basra samples were drilled with tungsten carbide drill bits and analyzed in NIST’s 20-megawatt research reactor, using one irradiation with two gamma counts. The procedure provided elemental concentration values for 26 elements (see BLACKMAN, 1984, for details). At the Missouri University Research Center (MURR), samples of ethnographic ceramic material (NEFF & GLASCOCK, 1993) and hinterland pottery (NEFF & GLASCOCK, 2000) and were burred and then crushed; they were analyzed in MURR’s 10-megawatt research reactor, using two irradiations and three gamma counts. The procedure yielded elemental concentration values for 33 elements (see GLASCOCK, 1992, for details).

To determine the presence of chemical compositional groups in the data, we followed standardized procedures established for data analysis (BIEBER *et alii*, 1976; GLASCOCK, 1992:15–25; HARBOTTLE, 1976:42–60; SAYRE, 1975). We converted the data to base-10 logarithms to compensate for differences in magnitude between major and trace elements and provide trace elements with a more normal distribution. To focus initially on just the pottery from al-Basra and the hinterland sites, we reduced the dataset from 332 samples to 231 (86 al-Basra and 145 hinterland pottery specimens), setting aside the al-Basra clay and brick samples and ethnographic materials for consideration later in the analysis.

To generate preliminary compositional groups, we submitted the 231 samples to a hierarchical aggregative clustering algorithm (average linkage based on a mean euclidean distance matrix), using 15 chemical elements<sup>1</sup> as an initial sorting technique. These elements were chosen because they are the most precisely determined of the elements common to the Smithsonian Institution–NIST and the MURR analyses. The resulting dendrogram

showed the presence of one large group, with five possible subgroups; two smaller discrete groups; and some unassigned outliers. To refine the groups, we used several statistical techniques. Mahalanobis distance calculations were obtained for each of the potential groups and subgroups. This procedure calculates the probability of membership for each sherd in each group or subgroup and reassigns the sherds accordingly. As part of this procedure, we also used a cross-validation, or jackknifing, technique to evaluate group membership.

### 3.1. *Al-Basra Core Group.*

The statistical analysis indicated that 150 samples (27 from al-Basra and 123 from hinterland sites) fell into one large, statistically verifiable group at a 99 percent probability based on Mahalanobis calculations (fig. 5 and table 2). The five subgroups initially identified in the cluster analysis could not be validated. Except for varying amounts of calcium, the subgroups were compositionally similar to one another. Bivariate element plots, principal components analysis, and discriminant function scores all showed no discernable subgroups. Moreover, an examination of the sherds in each subgroup indicated no clear differences in terms of ware or form type, phase, or hinterland site location among them. In general, the sherds in each subgroup ranged across nearly all ware and form categories and originated from sites scattered throughout the hinterland as well as from al-Basra. Significantly, the al-Basra core group includes all three kiln wasters that were found at al-Basra, providing additional evidence that the buff wares were produced at the urban center. Surprisingly, the al-Basra core group also includes two glazed fragments that are clearly buff-colored wares and that were found in the later occupation levels.

### 3.2. *Cream Ware Group.*

One of the two small compositional groups identified in the cluster analysis consisted of 20 cream ware sherds from al-Basra (fig. 5 and table 2). These sherds separated out from the rest on the basis of their high calcium content (about 14 percent or more), indicating that the clay used for this pottery was calcareous. This group included red- or brown-painted pottery along with one glaze-painted fragment. The forms consisted primarily of pitchers and oil lamps.

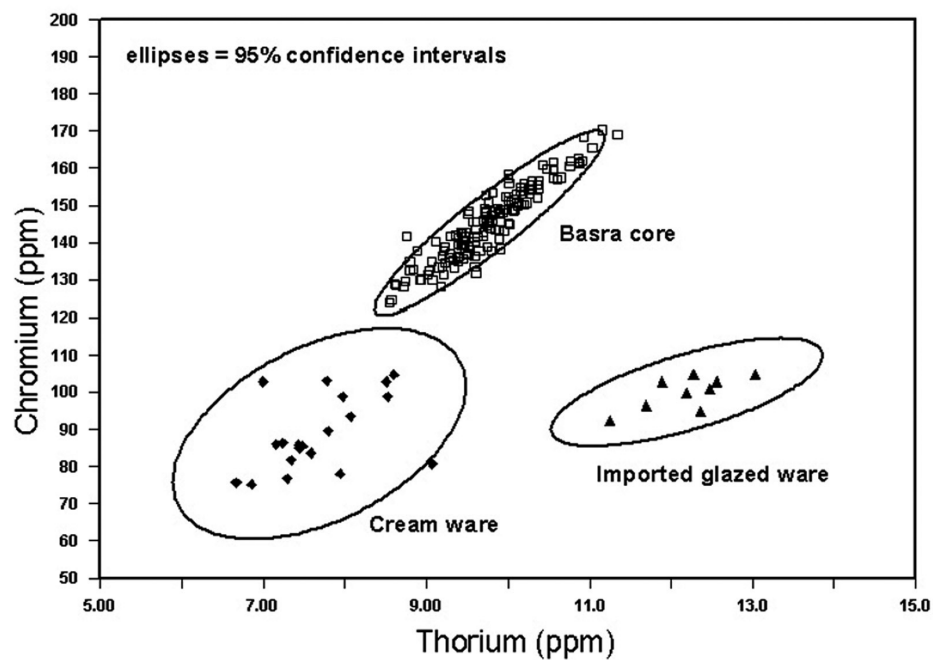


Fig. 5. Bivariate plot of thorium and chromium concentrations showing three chemical compositional groups: Basra core group, cream ware group, and imported glazed ware group.

**Table 2: Assignment of Pottery Samples from Al-Basra and Hinterland Sites to Chemical Compositional Groups**

Site Number	Site Name	Total No. of Samples	Basra Core	Crèam Wares	Glazed Wares	Not assigned
n.a.	al-Basra	86	27	20	9	30
ARB2	al-Ghزالat	10	9			1
ARB7	Bhalla	10	5			5
ARB8	Jahjouka	10	10			0
ARB13	Sidi Bou Douma	10	5			5
ARB15	Kudyat Srafah	10	9			1
ARB18	Ketama	10	10			0
LLM1	Shkayla	10	10			0
LLM4	Frigidae	5	5			0
LLM5	Sidi an-Niyya	10	9			1
LLM8	Sidi Ahmed Bourziguine	10	8			2
LLM9	El-Arab	10	10			0
LLM10	Kudyat Sma	10	9			1
LLM14	Sidi Yssecf	15	13			2
MBK1	Al-'Asimi	5	5			0
MSB2	Douar Riah	10	6			4
<b>Total</b>		<b>231</b>	<b>150</b>	<b>20</b>	<b>9</b>	<b>52</b>

Table 2. Means and Coefficients of Variation for 24 Elements Obtained for 3 Chemical Compositional Groups

### 3.3. Glazed Ware Group.

The second small group included eight of the ten honey and manganese-on-honey glazed sherds and one green glazed sherd. This group could be readily distinguished from the cream ware group and the al-Basra core group (fig. 5 and table 2). The honey glazed and manganese-on-honey glazed specimens occurred primarily in the form of bowls or cups, and their pastes ranged from a yellow to an orange hue. The glazed wares were likely made in one source area and brought to al-Basra through trade or some other mechanism. Manganese-on-honey lead glazed wares have been found at many North African and Iberian sites (e.g., MYERS & BLACKMAN, 1986). The analysis could not definitively assign the remaining three sherds of this glaze type to this group, suggesting that multiple workshops, clay sources, or mixing recipes are represented.

### 3.4. Unassigned.

A total of 52 sherds from al-Basra and a number of hinterland sites could not be assigned to any of the three main compositional groups. Mahalanobis calculations indicated they had less than a 1 percent probability of belonging to any of the main groups and, for most, the probability was less than 0.01 percent. Three of the unassigned specimens

were glazed, three were handmade, and three were coarse wares; the remaining samples were buff-colored wares.

### 3.5. Al-Basra Clays and Ethnographic Samples.

The analysis suggests that the clays used by al-Basra's urban potters are chemically distinct from other clays available in deposits near the site or from those exploited by modern-day potters, such as those working at Ksar-el-Kebir. The Mahalanobis calculations showed that the al-Basra clay and brick specimens and the ethnographic materials from contemporary Moroccan workshops had less than a 1 percent, and most less than a 0.01 percent, probability of belonging to one of the three main chemical compositional groups. When the clays from deposits near al-Basra are projected against the three ceramic compositional groups on a bivariate plot of thorium and chromium concentrations (fig. 6), it is apparent that most of the clays are chemically speaking "poor matches" with the archaeological groups. This is not unusual since clay deposits available hundreds of years ago may no longer exist or may not be accessible today.

Likewise, a bivariate plot of cesium and zinc concentrations (fig. 7) illustrates the distinctiveness of the ceramic material from four contemporary

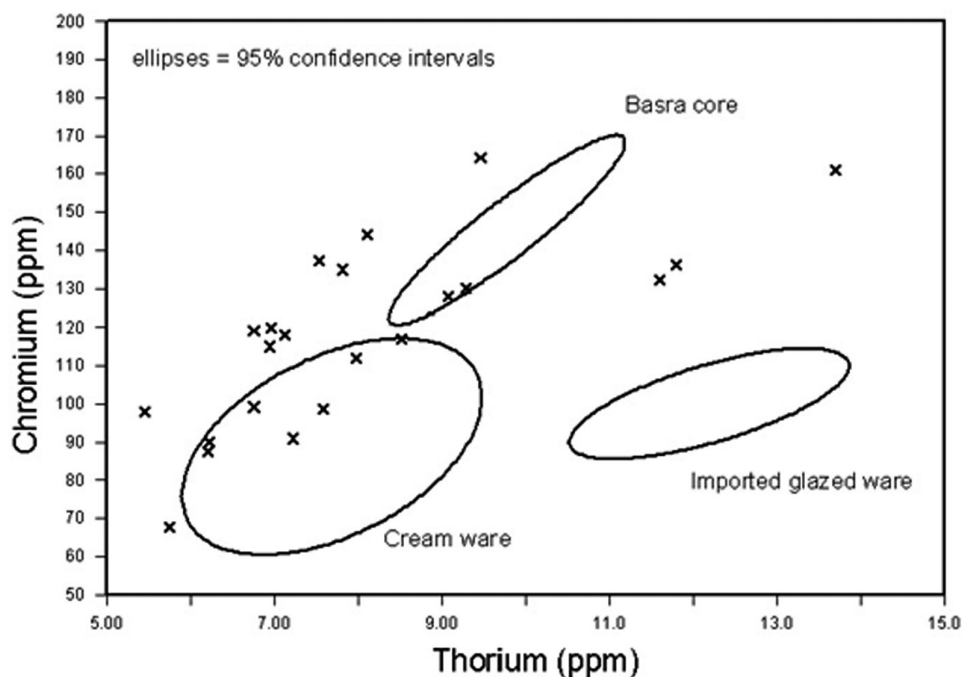


Fig. 6. Bivariate plot of thorium and chromium concentrations, showing clays (x) from deposits near al-Basra and ellipses for three pottery compositional groups.



potteries relative to the Basra core group and suggests the broader patterns of geographic variation in ceramic compositions in northern Morocco. Although the Basra core group overlaps with Ksar el-Kebir and Ain Koub ethnographic materials on cesium and chromium, a rubidium-cobalt plot (ENNAHID, 2002:58) clearly discriminates it from Ksar el-Kebir, and a cobalt-zinc plot (ENNAHID, 2002:59) clearly discriminates it from Ain Koub. Thus, not only does the Basra core group form a chemically homogeneous group, but it is easily discriminated from groups known to represent localized chemical profiles from elsewhere in northern Morocco. Perhaps most telling of all, a majority of the archaeological samples from sites ARB8, ARB13, and ARB18, which are less than 10 km from Ksar el-Kebir (fig. 4), fall into the Basra core group (table 3) rather than the Ksar el-Kebir ethnographic group. These observations are consistent with the hypothesis that the Basra core group consists of pottery made in a restricted zone, presumably in the immediate vicinity of al-Basra (NEFF & GLASCOCK, 2000:6).

#### 4. Conclusions.

The chemical analyses suggest that utilitarian wheelmade vessels recovered from more than

15 hinterland sites, located up to 40 km from al-Basra, were produced at the urban center. Of the 145 sherds from the hinterland sites, a total of 127 showed a high probability of belonging to the al-Basra core group. As table 2 shows, sherds belonging to the al-Basra core group occur at every hinterland site included in the study. These sites were located in the vicinity of al-Basra as well as near the modern-day towns of al-Ksar el-Kebir, Lalla Mimouna, and Mulay Bu Selham on the Atlantic coast (fig. 4).

Other pottery-making locations may have existed in the region during the Islamic period. The relatively large number of specimens that fell outside the Basra core group suggests that potters were producing vessels that were similar in appearance to the wheelmade al-Basra buff wares but were using clays or production processes different from those employed at al-Basra. Where these workshops may have been located is difficult to say. None of the hinterland sites, except possibly one, LLM5, displayed any evidence of pottery manufacturing on their surfaces (ENNAHID, 2002:98). The modern city of Ksar el-Kebir, which is located near al-Basra, has many pottery workshops operating today, but the clays they are using, which are collected primarily from the banks of the Loukkos River, are

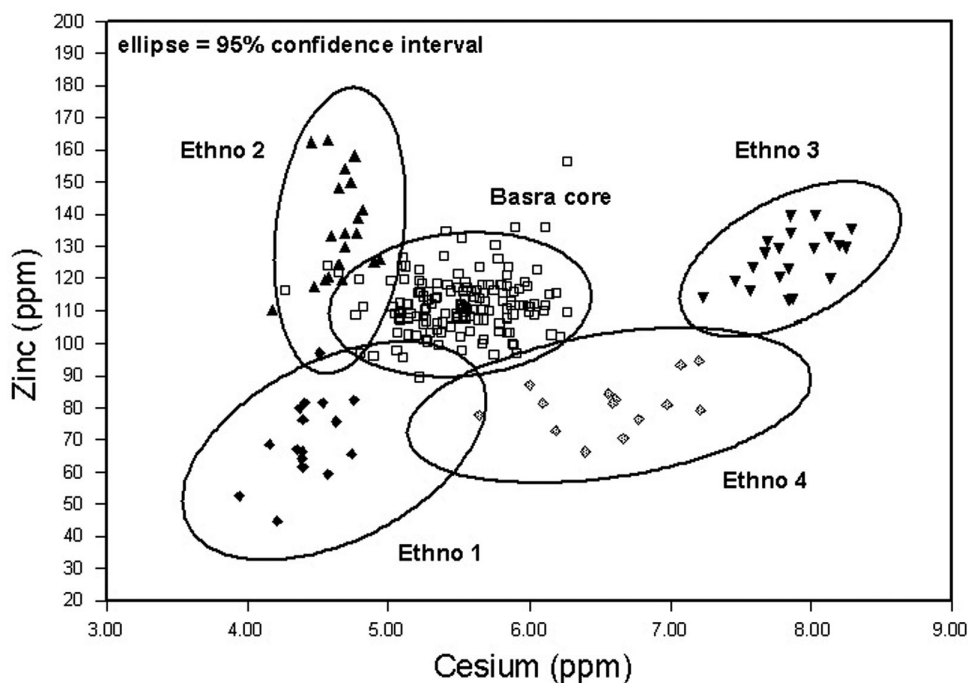


Fig. 7. Bivariate plot of cesium and zinc concentrations, showing ceramic material from four contemporary Moroccan pottery workshops and three pottery compositional groups. Ethno 1 = Ain Koub, Ethno 2 = Ksar el-Kebir, Ethno 3 = Tetouan, Ethno 4 = Beni Kissane.

**Table 3. Means and Coefficients of Variation for 3 Major Chemical Compositional Groups**

Element	Basra Core N = 150		Cream ware N = 20		Imported Glaze ware N = 9	
	Mean	C.V.	Mean	C.V.	Mean	C.V.
Na %	0.526	15.6%	0.404	29.2%	0.540	21.9%
K %	1.75	7.9%	1.85	14.2%	2.82	9.9%
Ca %	6.09	21.5%	16.0	13.2%	6.69	27.6%
Sc ppm	15.9	5.0%	12.9	6.5%	15.4	4.3%
Cr ppm	145.	6.8%	88.8	11.2%	100.	4.5%
Fe %	4.71%	5.1%	3.41	9.3%	4.02	4.5%
Zn ppm	112.	7.9%	111.	19.4%	101.	11.1%
As ppm	7.13	41.2%	6.63	45.0%	14.1	14.8%
Sr ppm	324.	25.4%	836.	26.9%	268.	24.4%
Zr ppm	140.	18.6%	131.	23.4%	242.	22.0%
Sb ppm	0.430	55.8%	0.558	20.7%	3.45	41.7%
Cs ppm	5.51	6.7%	4.57	18.0%	7.20	19.5%
La ppm	36.6	6.3%	30.1	6.3%	42.0	3.3%
Ce ppm	72.9	6.5%	56.2	6.7%	83.9	6.7%
Nd ppm	30.9	11.7%	24.2	15.9%	33.3	11.3%
Sm ppm	6.39	5.7%	5.15	7.0%	7.49	6.6%
Eu ppm	1.37	5.7%	1.10	6.8%	1.46	9.7%
Tb ppm	0.712	17.5%	0.684	16.1%	0.957	15.4%
Yb ppm	2.42	6.5%	2.13	7.7%	3.11	9.6%
Lu ppm	0.347	6.7%	0.303	8.6%	0.396	9.0%
Hf ppm	5.34	12.2%	4.42	12.0%	6.56	13.2%
Ta ppm	1.20	7.8%	0.818	9.1%	1.17	6.2%
Th ppm	9.78	5.7%	7.69	8.2%	12.2	4.3%
U ppm	2.54	15.8%	1.99	41.8%	3.76	13.4%

Table 3. Assignment of Pottery Samples from Al-Basra and Hinterland Sites to 3 Chemical Compositional Groups

chemically distinct from the al-Basra core group (fig. 7).

Although the cream wares from al-Basra may have been made in or near the urban center, this type of pottery was likely produced by potters working within another technological tradition. The cream wares form a separate chemical compositional group, characterized by the use of calcareous clays. They occur in a limited range of forms, mostly pitchers and oil lamps. Many of the pitchers were decorated with simple red or brown-painted motifs, unlike the vast majority of al-Basra buff wares. Some researchers have suggested that this kind of decorated pottery is similar to the ethnically distinct Berber pottery that is still made in parts of northern Morocco today (VOSSSEN & EBERT, 1986).

The glazed wares were also manufactured by potters accustomed to a different pottery-making tradition. The use of glazes requires a specialized

knowledge of mineral properties and firing techniques. The fact that glazed wares represent only 2 percent of the al-Basra assemblage also suggests that they were not produced locally but were imported to al-Basra through trade or some other mechanism. However, in the later periods, there is evidence that some al-Basra potters may have begun to experiment with glazes. Two glazed specimens from the urban site fell into the Basra core group and one of them, in particular, exhibits an attempt at glaze painting.

### 5. Mechanism of Regional Pottery Exchange.

Although it is clear that the urban potters of al-Basra produced large quantities of wheelmade buff-colored wares in their pottery workshops and associated updraft kilns, it is equally evident that some of this pottery made its way to smaller towns and villages located in the hinterland. Some al-Bas-

ra pottery was likely sold at markets (souks) within the city itself, as it was in medieval Fez (LEO AFRICANUS, 1956:193). Additional pottery was likely dispersed to smaller settlements through a weekly market system, which existed in medieval Morocco. According to Arab chronicles, local exchange between urban centers and the rural communities in their hinterlands occurred at weekly rural, or tribal, markets. An 11th-century geographer (AL-BAKRI, 1965:212) cites the names of such market places, often named after a tribe, an important personage, or a day of the week, where people met on a regular basis to exchange a variety of products. Some of these markets were located at major crossroads so that a maximum number of villages and hamlets could have access to the products and services offered there (CRESSIER, 1992). They were also located at the boundaries of tribal or ecological zones to facilitate the exchange of products between, for example, farmers and pastoralists (VANACKER, 1973:673—674).

Such a weekly market system continues to form an integral part of the rural Moroccan economy today. According to Troin (1975:vol. 1, 81—96), the current market system is well-organized, both temporally and spatially. The vast majority of the nearly 400 markets he studied are held on a specific day of the week and a few, called supra-regional markets, are held twice a week (TROIN, 1975:vol.1, 81-86). The marketplaces form part of a regional network, with each region having a central market with a radius of 40 to 50 km, or the equivalent of a 10- to 12-hour walk, and a set of subordinate smaller markets with a radius of 7 to 22 km, or a 2-hour walk (TROIN, 1975:vol.1, 86-96).

Significantly, the boundaries of one of Troin's regional networks correspond closely with the area encompassed by al-Basra and its hinterland sites identified during the archaeological survey (TROIN, 1975:vol.2, plan 5). If al-Basra had served

as the central marketplace more than a millennium ago, it would have produced and distributed a range of agricultural and craft products, including utilitarian pottery, to people living in the smaller settlements within this regional network. Although al-Basra disappeared in the 12th- or 13th-century, the regional network still operates today, but the central marketplace has shifted 16 km westward to the modern town of Souk al-Arba du Gharb, where a market is held on the fourth day (*arba*) of the week.

## 6. Acknowledgments.

Over the years, many individuals and institutions provided support for the field and laboratory work reported in this article. A 1986—1987 Postdoctoral Fellowship in Materials Science supported Nancy Benco's al-Basra pottery work with M. James Blackman at the Smithsonian Institution's Conservation Analytical Laboratory. The al-Basra pottery and clay samples were analyzed through the Smithsonian's collaborative instrumental neutron activation program with NIST in Maryland (BENCO & BLACKMAN, 1998). A grant from the Wenner-Gren Foundation for Anthropological Research funded Nancy Benco's ethnoarchaeological fieldwork in Morocco and subsequent neutron activation analysis of ethnographic pottery and other materials at MURR (NEFF & GLASCOCK, 1993). Said Ennahid's archaeological survey and subsequent chemical analyses were supported by a National Science Foundation Doctoral Dissertation Improvement grant (SBR-9808443), a Wenner-Gren Foundation for Anthropological Research Predoctoral grant, a Sigma Xi grant, and others. The hinterland pottery was analyzed at MURR (NEFF & GLASCOCK, 2000). Madame Joudia Hassar-Benslimane, director of the Institut National des Sciences de l'Archéologie et du Patrimoine in Rabat, and her staff, facilitated the fieldwork and export of ceramic materials for analysis.

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