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Compositional Analysis of Glazed Earthenwares from Eighteenth-Century Sites on the Northern Gulf Coast

ABSTRACT

Compositional classification of colonial-era ceramics using neutron activation analysis has heretofore focused primarily on majolicas from Spain and Mexico. In order to expand the chemical database to include 18th-century French ceramics, 186 sherds from Old Mobile and nearby sites on the north-central Gulf Coast have been analyzed, including *faïence blanche, faïence brune,* Mexican majolicas, and several types of coarse earthenwares. Quantitative analysis of 23 elements provides a basis for distinguishing French and Spanish-colonial earthenwares, as well as suggesting some preliminary chemical groupings of French faience.

Introduction

Excavations at the site of Old Mobile (1MB94), capital of French colonial Louisiana (1702–1711), have yielded a diverse assemblage of ceramics attributable on stylistic grounds to a variety of European and colonial sources. As indicated in the foregoing discussion of French faience (Waselkov and Walthall, this issue), however, well-recognized stylistic types that are distinguishable visually may or may not correspond to distinct production locales, because 18th-century French potters evidently often copied popular decorative motifs that originated elsewhere. Chemical and mineralogical studies of source-specific geological raw materials—clays and glaze constituents—used by 18th-century French potters could be extremely helpful to archaeologists who are attempting to determine the origins of individual earthenware vessels made from those materials. Unfortunately, these kinds of studies have barely begun in France (Rosen 1995:189–192).

Nevertheless, even in the absence of baseline chemical and mineralogical studies of geological raw materials, some progress can be made toward understanding French earthenware production and distribution by applying those same analytical methods to earthenware specimens found at North American archaeological sites. For this study, chemical compositions of sherds from Old Mobile and later nearby archaeological sites were determined using neutron activation analysis. Although discerning the precise manufacturing sources of particular pots remains far beyond our ability at this point, it is possible to document considerable chemical variability present in some common types of 18th-century French ceramics and to identify intriguing patterns in the data that deserve additional study. This should be considered a preliminary phase of a very large, long-term project that will require the combined efforts of many researchers.

Archaeological Ceramic Samples

A collection of 186 sherds (Table 1) was assembled from eight colonial-era archaeological sites in Alabama (Waselkov, this issue, Figure 1). In chronological order, these sites include:

1. Old Mobile, 1MB94 (42 specimens), the earliest site in the sequence dating 1702–1711, during the French-colonial period, and discussed throughout this issue (Waselkov 1991, 1999).
2. Dauphin Island Stockade, 1MB61 (37 specimens), 1711–1722, a wooden palisaded fort that protected the village and anchorage at Port Dauphin, during the French-colonial period (Shorter, this issue; Stowe 1977).
3. Bienville Square, 1MB32 (54 specimens), a block-sized city park in modern downtown Mobile with preserved features and middens of the colonial town, dating from the French, British, and Spanish periods, ca. 1720–1800 (Silvia 1989).
4. Fort Condé/Charlotte/Carlota, 1MB262 (31 specimens), a masonry fortification constructed in 1723 and occupied during successive French, British, Spanish, and American regimes, until

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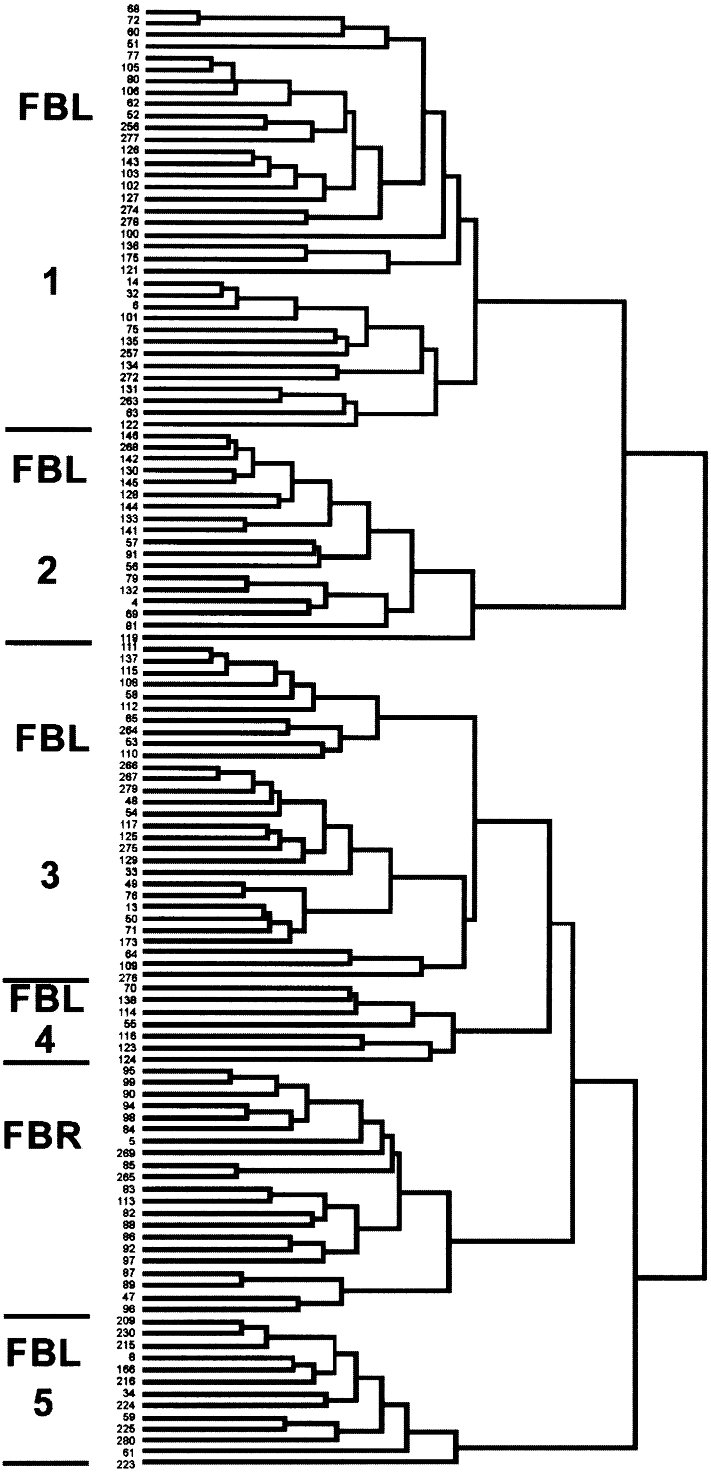

FIGURE 1. Dendrogram for faience samples showing six major chemical groups, five for *faïence blanche* ware and one for *faïence brune.*

TABLE 1

SHERD SAMPLES BY CERAMIC WARE, CHEMICAL COMPOSITION GROUP, STYLISTIC TYPE, AND SITE PROVENIENCE († DENOTES GROUP OUTLIERS).

Sample	Ware	Group	Type	Site
004	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB32
005	faïence brune	FBR	Rouen Plain	1MB32
006	faïence blanche	FBL1	Normandy Blue on White	1MB61
008	faïence blanche	FBL5	Normandy Plain	1MB61
009	lead-glazed coarse earthenware (redware)	G	Saintonge Slip Decorated, circles/dots	1MB61
010	lead-glazed coarse earthenware	G	Saintonge Slip Decorated, combed	1MB61
011	green lead-glazed coarse earthenware	G†	Saintonge Plain	1MB61
012	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
013	faïence blanche	FBL3	Nevers Blue on White	1MB61
014	faïence blanche	FBL1	Nevers Blue on White	1MB61
015	lead-glazed coarse earthenware	G	Saintonge Slip Decorated, circles/dots	1MB61
016	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
017	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
018	lead-glazed coarse earthenware (redware)	G	Saintonge Slip Decorated, circles/dots	1MB61
019	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
021	green lead-glazed coarse earthenware	G	Saintonge Plain	1MB61
022	lead-glazed coarse earthenware (redware)	G	Saintonge Slip Decorated, circles/dots	1MB61
023	lead-glazed coarse earthenware (redware)	G	Saintonge Slip Decorated, circles/dots	1MB61
024	yellow lead-glazed coarse earthenware	G	Charente Plain	1MB61
026	red lead-glazed coarse earthenware	G†	New England slip decorated	1MB61
027	red lead-glazed coarse earthenware	G†	New England slip decorated	1MB61
028	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
029	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
030	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
031	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
032	Dutch Delft	FBL1	blue on white	1MB61
033	faïence blanche	FBL3	Normandy Blue on White	1MB61
034	faïence blanche	FBL5	Normandy Blue on White	1MB61
036	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB132
037	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB32
038	green lead-glazed coarse earthenware	G†	Saintonge Slip Plain	1MB32
039	yellow lead-glazed coarse earthenware	G†	Charente Plain	1MB262
042	red lead-glazed coarse earthenware	G†	New England slip decorated	1MB262
043	yellow lead-glazed coarse earthenware	G†	Charente Plain	1MB49
047	faïence blanche	FBR	Normandy Plain	1MB32
048	faïence blanche	FBL3	Normandy Plain	1MB32
049	faïence blanche	FBL3	Normandy Plain	1MB132
050	faïence blanche	FBL3	Normandy Plain	1MB32
051	faïence blanche	FBL1	Brittany Blue on White, Rim A	1MB262
052	faïence blanche	FBL1	Brittany Blue on White, Rim A	1MB262
053	faïence blanche	FBL3	Brittany Blue on White, Rim A	1MB32
054	faïence blanche	FBL3	Brittany Blue on White, Rim A	1MB262
055	English delft	FBL4	blue on white	1MB262
056	faïence blanche	FBL2	Seine Polychrome	1MB262
057	faïence blanche	FBL2	Normandy Blue on White	1MB262
058	faïence blanche	FBL3	Seine Polychrome, Rim L	1MB262
059	faïence blanche	FBL5	Saint Cloud Polychrome	1MB32
060	faïence blanche	FBL1	Normandy Blue on White	1MB32
061	faïence blanche	FBL5	Normandy Blue on White	1MB32
062	faïence blanche	FBL1	Normandy Blue on White	1MB32
063	faïence blanche	FBL1	Normandy Blue on White	1MB32
064	faïence blanche	FBL3	Saint Cloud Polychrome, Rim L	1MB262
065	faïence blanche	FBL3	Normandy Blue on White	1MB32
068	faïence blanche	FBL1	Seine Polychrome, Rim I	1MB32
069	faïence blanche	FBL2	Seine Polychrome, Rim G	1MB32
070	faïence blanche	FBL4	Seine Polychrome, Rim G	1MB132

071	faïence blanche	FBL3	Seine Polychrome	1MB32
072	faïence blanche	FBL1	Seine Polychrome, Rim I	1MB32
075	faïence blanche	FBL1	Seine Polychrome	1MB32
076	faïence blanche	FBL3	Seine Polychrome	1MB32
077	faïence blanche	FBL1	Seine Polychrome	1MB32
079	English delft	FBL2	blue on white	1MB32
080	faïence blanche	FBL1	Seine Polychrome, Rim F	1MB262
081	faïence blanche	FBL2	Seine Polychrome, Rim C	1MB49
082	faïence brune	FBR	Rouen Polychrome, Rim G	1MB32
083	faïence brune	FBR	Rouen Polychrome, Rim G	1MB32
084	faïence brune	FBR	Rouen Polychrome, Rim G	1MB262
085	faïence brune	FBR	Rouen Polychrome, Rim G	1MB132
086	faïence brune	FBR	Rouen Blue on White	1MB32
087	faïence brune	FBR	Rouen Polychrome	1MB32
088	faïence brune	FBR	Rouen Polychrome	1MB32
089	faïence brune	FBR	Rouen Polychrome	1MB262
090	faïence brune	FBR	Rouen Plain	1MB32
091	faïence blanche	FBL2	Normandy Blue on White, Rim B	1MB262
092	faïence brune	FBR	Rouen Plain	1MB132
094	faïence brune	FBR	Rouen Polychrome, Rim G	1MB262
095	faïence brune	FBR	Rouen Plain	1MB32
096	faïence brune	FBR	Rouen Plain	1MB32
097	faïence brune	FBR	Rouen Plain	1MB32
098	faïence brune	FBR	Rouen Plain	1MB32
099	faïence brune	FBR	Rouen Plain	1MB32
100	faïence blanche	FBL1	Normandy Blue on White, Rim H	1MB32
101	faïence blanche	FBL1	Normandy Blue on White, Rim H	1MB32
102	faïence blanche	FBL1	Normandy Blue on White, Rim H	1MB132
103	faïence blanche	FBL1	Normandy Blue on White, Rim I	1MB262
105	faïence blanche	FBL1	Normandy Blue on White	1MB32
106	Dutch Delft	FBL1	blue on white	1MB32
108	faïence blanche	FBL3	Saint Cloud Polychrome, Rim G	1MB32
109	faïence blanche	FBL3	Saint Cloud Polychrome, Rim G	1MB262
110	faïence blanche	FBL3	Saint Cloud Polychrome, Rim G	1MB132
111	faïence blanche	FBL3	Saint Cloud Polychrome, Rim L/G	1MB32
112	faïence blanche	FBL3	Saint Cloud Polychrome, Rim K/G	1MB262
113	faïence blanche	FBR	Saint Cloud Polychrome	1MB262
114	faïence blanche	FBL4	Saint Cloud Polychrome, Rim G	1MB32
115	faïence blanche	FBL3	Saint Cloud Polychrome, Rim L	1MB32
116	faïence blanche	FBL4	Saint Cloud Polychrome	1MB132
117	faïence blanche	FBL3	Saint Cloud Polychrome, Rim D	1MB262
119	faïence blanche	FBL2	Saint Cloud Polychrome	1MB262
121	faïence blanche	FBL1	Moustiers Polychrome	1MB262
122	faïence blanche	FBL1	Seine Polychrome, Rim G	1MB32
123	faïence blanche	FBL4	Seine Polychrome, Rim G	1MB32
124	faïence blanche	FBL4	Seine Polychrome, Rim G	1MB32
125	faïence blanche	FBL3	Normandy Blue on White, Rim I	1MB262
126	faïence blanche	FBL1	Normandy Blue on White, Rim H	1MB262
127	faïence blanche	FBL1	Normandy Blue on White, Rim H	1MB262
128	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB262
129	faïence blanche	FBL3	Saint Cloud Polychrome, Rim D	1MB262
130	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB32
131	faïence blanche	FBL1	Normandy Blue on White	1MB32
132	faïence blanche	FBL2	Normandy Blue on White, Rim B	1MB32
133	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB132
134	faïence blanche	FBL1	Provence Blue on White, Rim J	1MB49
135	faïence blanche	FBL1	Provence Blue on White, Rim J	1MB32
136	faïence blanche	FBL1	Normandy Blue on White	1MB32
137	faïence blanche	FBL3	Saint Cloud Polychrome	1MB262
138	faïence blanche	FBL4	Saint Cloud Polychrome	1MB132
141	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB262
142	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB32
143	faïence blanche	FBL1	Normandy Blue on White, Rim H	1MB49

144	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB32
145	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB32
146	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB32
147	lead-glazed coarse earthenware (redware)	R†	El Morro	1MB94
148	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
149	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
151	green lead-glazed coarse earthenware	G†	Saintonge Plain	1MB94
155	green lead-glazed coarse earthenware	G†	Saintonge Plain	1MB94
156	green lead-glazed coarse earthenware	G	Saintonge Plain	1MB94
159	green lead-glazed coarse earthenware	G	Saintonge Plain	1MB94
163	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB94
166	faïence blanche	FBL5	Normandy Plain	1MB94
173	faïence blanche	FBL3	Normandy Plain	1MB94
175	faïence blanche	FBL1	Normandy Plain	1MB94
183	majolica	MM	Puebla Polychrome, blue variety	1MB94
184	majolica	MM	Puebla Polychrome, blue variety	1MB94
185	majolica	MM	Puebla Polychrome, blue variety	1MB94
186	majolica	MM	Puebla Polychrome, green variety	1MB94
187	majolica	MM	Puebla Polychrome, green variety	1MB94
188	majolica	MM	Puebla Polychrome, green variety	1MB94
192	majolica	MM	San Luis Polychrome	1MB94
193	majolica	MM	San Luis Polychrome	1MB94
194	majolica	MM	San Luis Polychrome	1MB94
195	majolica	MM	San Luis Polychrome	1MB94
209	faïence blanche	FBL5	Normandy Blue on White	1MB94
215	faïence blanche	FBL5	Normandy Blue on White	1MB94
216	faïence blanche	FBL5	Normandy Blue on White	1MB94
223	faïence blanche	FBL5	Seine Polychrome	1MB94
224	faïence blanche	FBL5	Seine Polychrome	1MB94
225	faïence blanche	FBL5	Seine Polychrome	1MB94
230	faïence blanche	FBL5	Seine Polychrome	1MB94
231	majolica	MM	Puebla Polychrome, blue variety	1MB94
232	majolica	MM	San Luis Polychrome	1MB94
233	majolica	MM	San Luis Polychrome	1MB94
234	majolica	MM	San Luis Polychrome	1MB94
235	majolica	MM	San Luis Polychrome	1MB94
236	majolica	MM	San Luis Polychrome	1MB94
237	yellow lead-glazed coarse earthenware	G†	Charente Plain	1MB94
238	green lead-glazed coarse earthenware	G†	Saintonge Plain	1MB94
239	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
240	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
241	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
242	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
243	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
244	lead-glazed coarse earthenware (redware)	R	El Morro	1MB94
245	green lead-glazed coarse earthenware	G	Saintonge Plain	1MB61
246	green lead-glazed coarse earthenware	G	Saintonge Plain	1MB61
247	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
248	green lead-glazed coarse earthenware	G†	Saintonge Slip Plain	1MB61
249	yellow lead-glazed coarse earthenware	G†	Charente Plain	1MB61
250	yellow lead-glazed coarse earthenware	G	Charente Plain	1MB61
251	yellow lead-glazed coarse earthenware	G	Charente Plain	1MB61
252	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
253	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
254	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
256	Dutch Delft	FBL1	blue on white	1MB262
257	faïence blanche	FBL1	Provence Blue on White, Rim J	1MB32
258	green lead-glazed coarse earthenware	G†	Saintonge Slip Plain	1MB61
259	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB61
260	green lead-glazed coarse earthenware	G	Saintonge Slip Plain	1MB132
263	faïence blanche	FBL1	Brittany Blue on White, Rim A	1MB262
264	faïence blanche	FBL3	Seine Polychrome, Rim I	1MB32
265	faïence brune	FBR	Rouen Polychrome, Rim G	1MB132

266	faïence blanche	FBL3	Normandy Blue on White, Rim I	1MB262
267	faïence blanche	FBL3	Normandy Blue on White, Rim I	1MB262
268	faïence blanche	FBL2	Provence Blue on White, Rim J	1MB32
269	faïence blanche	FBR	Saint Cloud Polychrome, Rim G	1MB161
272	faïence blanche	FBL1	Normandy Blue on White, Rim I	1MB161
274	faïence blanche	FBL1	Brittany Blue on White, Rim A	1MB262
275	faïence blanche	FBL3	Brittany Blue on White, Rim A	1EE8
276	faïence blanche	FBL3	Brittany Blue on White, Rim A	1EE8
277	faïence blanche	FBL1	Brittany Blue on White, Rim A	1EE8
278	faïence blanche	FBL1	Brittany Blue on White, Rim A	1EE8
279	faïence blanche	FBL3	Brittany Blue on White, Rim A	1EE8
280	faïence blanche	FBL5	Moustiers Yellow on White	1MB161

demolished in 1820; analyzed sherds date ca. 1730–1800 (Harris and Nielsen 1972).

5. Riverview Plaza, 1MB49 (4 specimens); during construction on this block in modern downtown Mobile during the 1970s and 1980s, artifact samples were gathered from domestic contexts dating to the French- and British-colonial periods, ca. 1740–1770.

6. Fort Toulouse II, 1EE8 (5 specimens), 1751–1763, a French military post at the confluence of the Coosa and Tallapoosa rivers (in modern-day central Alabama), abandoned at the end of the French-colonial period (Waselkov 1989).

7. Dog River, 1MB161 (3 specimens), a plantation on Mobile Bay occupied by ethnic French colonists throughout most of the 18th century; the analyzed sherds came from late 18th-century contexts, ca. 1750–1790 (Waselkov and Gums 2000).

8. Fort Condé Village, 1MB132 (10 specimens), a neighborhood in modern downtown Mobile with preserved domestic features and middens dating from the French, British, and Spanish periods, ca. 1750–1800 (Silvia and Waselkov 1993).

This sherd sample contains representatives of the most common stylistic types of earthenwares found at French-colonial sites on the north-central Gulf Coast. (Sherd illustrations are posted at website http://www.southalabama.edu/archaeology/old_mobile/faience/NAA.htm). French coarse earthenware types include Charente Plain, Saintonge Plain, Saintonge Slip Plain, and Saintonge Slip Decorated, attributed to potteries in western France (Steponaitis 1979; Barton 1981:10–25; Walthall 1991b:106–109). The French fine earthenwares are all tin-opacified lead-glazed faience. As discussed by Waselkov and Walthall (this issue), the geographical referents in stylistic type names—such as Normandy Plain, Brittany Blue on White, Nevers Blue on White, and Provence Blue on White—reflect the presumed origins of styles, which may not coincide with sources of manufacture (Walthall 1991a; Genêt 1996). In fact, determining whether any correlations exist between faience styles and chemical groups was one of the principal goals of this study.

Some other earthenwares were analyzed for comparative purposes. Spanish-colonial types include the sand-tempered, lead-glazed coarse earthenware known as El Morro (Deagan 1987:50–51), and the refined, tin-opacified lead-glazed majolicas, San Luis Polychrome and Puebla Polychrome (green and blue varieties) (Goggin 1968:166–169, 173–182). El Morro is suspected to have had multiple sources of production, while the two majolicas have been demonstrated, on the basis of chemical composition, to derive from potteries in the vicinity of Puebla, Mexico (Olin and Blackman 1989). A few sherds of Dutch and English delfts, both fine tin-opacified lead-glazed earthenwares, were also included in the study collection, as well as three specimens of New England slip-trailed coarse earthenware.

Methods

Neutron activation analysis, a precise and accurate method of chemical analysis, was used in this study. Our sampling procedure involved using a tungsten carbide drill to extract about 1 g of paste from the interior of each sherd. After drying, a 100-mg subsample was removed for analysis. Paste samples were taken from 186 sherds for chemical analysis. Seven sherds had multiple samples removed from different locations to evaluate intra-sherd paste variation, (these samples are numbered 4 and 257; 12 and 258; 36 and 260; 51 and 263; 85 and 265; 125, 266, and 267; and 145 and 268) bringing the total number of analyzed samples to 194.

Samples were irradiated, along with standards, in the nuclear reactor at the National Institute of Standards and Technology for 4 hours at a flux of 7.7 x 10^{13} n/cm^2/sec, then counted with an intrinsic germanium detector for 1 hour after 6 days and again for 2 hours after 30 days. For additional information on analytical protocols and instrumentation, see Blackman (1984:23–25, 1986) and Blackman et al. (1989:64–65).

In this study, 23 elements were quantified for use in the statistical analysis: sodium (Na), potassium (K), calcium (Ca), scandium (Sc), chromium (Cr), iron (Fe), arsenic (As), rubidium (Rb), strontium (Sr), cesium (Cs), barium (Ba), lanthanum (La), cerium (Ce), neodymium (Nd), samarium (Sm), europium (Eu), terbium (Tb), ytterbium (Yb), lutetium (Lu), hafnium (Hf), tantalum (Ta), thorium (Th), and uranium (U). Elemental data for the 194 samples are presented in Table 2.

Standard statistical analytical procedures were applied to these data. Cluster analysis, applying an average-link clustering algorithm to a mean Euclidean distance matrix of 15 elements, was used for the initial sorting. Clusters were then tested for statistical validity using principal components analysis from variance-covariance matrices and iterative calculation of probabilities of group membership based on Mahalanobis distance. These procedures identified nine chemical compositional groups.

Compositional Analysis Results

Neutron activation analyses of paste composition have been widely employed to distinguish ceramics made from clays originating in different locales (Chrestien and Dufournier 1995; Gaimster and Hook 1995; Steponaitis et al. 1996; Mainfort et al. 1997; Lynott et al. 2000). Such inferences about production are based on two premises, one well established and the other subject to question (Blackman et al. 1989:64–65). First, it is generally accepted that firing does not alter elemental chemical composition in non-calcareous ceramics, although changes do occur in paste mineralogy. For calcareous ceramics, firing above about 800° C results in the loss of CO_2 that effectively increases the concentrations of all elements proportionally. Secondly, traditional potters are presumed to have used clays available near the place of production. This latter premise has been substantiated in many studies of traditional pottery making, but must be subject to test in situations of industrial-scale production.

Mexican Majolica

The discussion begins with Mexican majolica because this ceramic ware has received considerable attention in earlier chemical characterization studies. In fact, most previous compositional analyses of colonial ceramics from sites in North America have focused on Spanish and Mexican majolicas (Olin et al. 1978; Maggetti et al. 1984; Jornet et al. 1985; Olin and Blackman 1989; Myers et al. 1992; Olin and Myers 1992). Olin and Blackman (1989) used neutron activation analysis to differentiate stylistic types produced in Spain from those made in Mexico. They were also able to identify two chemical groups within the Mexican majolicas, one linked to the Valley of Puebla based on analysis of modern Puebla majolica, and the other attributed to the Valley of Mexico. Each stylistic type of majolica was found to be derived exclusively (or at least with very few exceptions) from a single production center.

The 16 samples, characterized stylistically as San Luis Polychrome (n = 9) and Puebla Polychrome (n = 7), all from the Old Mobile site, form a single compositional group (Table 2), which fits well statistically within the Puebla chemical group defined previously by Olin and Blackman (1989:98–101). Olin and Blackman attributed Puebla Polychrome to Puebla production, but their analysis did not include San Luis Polychrome. Typological studies of San Luis Polychrome split in their suggestions of origin between the Valley of Puebla (Goggin 1968:168) and the Valley of Mexico (Deagan 1987:76). Our results indicate a Puebla origin, at least for 18th-century production.

French Faience

Analysis of 124 samples of French faience (Table 2) resulted in the recognition of six chemical groups, five (FBL1-5) consisting entirely of *faïence blanche* and one (FBR) comprised principally of *faïence brune* (Waselkov and Walthall, this issue). Cluster analysis produced the dendrogram in Figure 1.

A glance at the distributions of faience samples across chemical groups by archaeological site (Table 3) and by stylistic type (Table 4) reveals a very complex situation. Unlike the results from chemical compositional analyses of Spanish and Mexican majolicas, which have demonstrated clear correlations between paste composition and stylistic type, few straight-forward correlations seem to exist for French 18th-century faience.

The clearest correspondence exists between chemical group FBR and all of the *faïence brune* ware (although that group includes three *faïence blanche* samples, as well). Group FBR differs from four of the five *faïence blanche* groups (FBL1-4) in its markedly lower percentage of calcium, reflecting its manufacture using less calcareous clays. This is confirmed by historical recipes for producing brown faience that called for 10% "white calcareous marl," in contrast to the 28% required for white faience (Diderot and d'Alembert 1756:454; Blanchette 1981:33).

Leaving aside for the moment their different chemical compositions, *faïence blanche* groups FBL1–4 are remarkably similar in stylistic terms. FBL1 contains a high proportion of Normandy Blue on White samples, St. Cloud Polychrome predominates in FBL3, and Provence Blue on White is most common in FBL2. Each of these types, however, is also represented in other chemical groups, and the other *faïence blanche* types are likewise distributed across chemical groups. What explains such compositional diversity within stylistic types?

As discussed at some length in the preceding article (Waselkov and Walthall, this issue), faience specialists recognized long ago that 18th-century faience manufacturers freely copied each others' decorative patterns and motifs. Although decorative styles tended to be most commonly produced in particular regions of France, and those regional associations are reflected in current type names—Normandy Blue and White or Moustiers Polychrome, for instance—it is known that style production was not confined by regional boundaries. Consequently, it can be infered that the chemical diversity of samples sharing a single decorative style is attributable to this sort of artistic cross-fertilization by potters working in far-flung regions with access to different sources of clay. This may account for some of the patterning seen in the data. Chemical groups FBL1, FBL3, and FBL4 could derive from three clay sources in northern France, while FBL2 samples were made elsewhere, judging from the preponderance of southern decorative styles in that latter group.

There is, however, at least one other important factor to consider. Some clays used to produce faience, a refined earthenware, were transported considerable distances during the 18th century. While the economics of faience manufacture (which operated on a large scale) dictated that substantial quantities of appropriate clays be available close at hand to minimize transport cost, some rare clays, particularly whitish calcareous marls, were evidently shipped from their sources in barrels by boat or pack-animal to faience factories (Taburet 1981:85; Halbout and Vaudour 1987:160–161; Abel 1993:10). Faience was always made from mixtures of clays, and much of the manufacturing process involved thoroughly mixing together different clays to form a homogeneous paste (Diderot and d'Alembert 1756:454; Rosen 1995:18). A sherd of Provence Blue on White (Figure 2) exemplifies that this mixing process was not

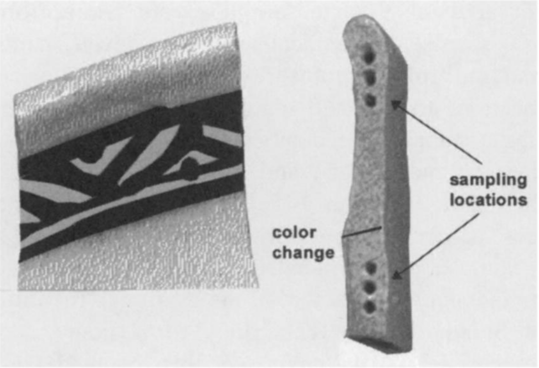

FIGURE 2. A sherd of Provence Blue on White faience from which two samples (4 and 257) were obtained. The samples, taken from different colored pastes, belong to different chemical groups (FBL2 and FBL1, respectively).

TABLE 2

ELEMENTAL COMPOSITIONS OF SHERD SAMPLES IN PARTS PER MILLION (PPM), EXCEPT FOR ELEMENTS WITH ASTERISK (*) IN PERCENTAGES, BY CHEMICAL GROUP.

Mexican Majolica (MM):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
183	0.824	0.574	4.33	14.1	136.	4.49	9.82	57.0	0.00	2.86	544.	25.0	42.1	13.7	5.32	1.39	0.804	2.43	0.297	4.86	0.553	6.25	0.000
184	1.30	0.774	3.19	12.2	113.	3.58	11.0	54.2	299.	2.88	353.	16.9	24.6	18.9	3.86	1.02	0.698	1.71	0.237	4.83	0.692	5.89	0.847
185	0.993	0.000	5.51	14.3	121.	4.22	26.2	0.00	0.00	2.16	931.	20.1	28.3	14.5	4.51	1.19	0.671	2.07	0.291	5.43	0.000	4.61	0.000
186	0.933	0.397	7.14	13.5	130.	3.68	4.40	26.8	0.00	2.27	520.	21.0	24.4	21.9	4.46	1.22	0.446	1.87	0.250	4.69	0.607	5.57	0.832
187	1.52	0.527	5.22	13.3	133.	3.73	3.78	39.5	485.	3.38	311.	12.0	18.3	8.63	3.03	0.867	0.000	1.49	0.173	5.02	0.547	5.41	1.01
188	1.56	0.608	2.58	13.5	130.	4.08	3.52	48.9	427.	2.90	277.	15.8	23.3	16.0	4.21	1.10	0.352	2.00	0.223	4.94	0.617	5.18	0.700
192	1.17	0.436	3.10	13.6	134.	3.24	10.8	37.8	0.00	3.48	512.	21.1	28.7	0.00	4.80	1.27	0.818	2.05	0.330	4.99	0.564	5.90	0.000
193	1.51	0.681	4.93	13.2	132.	3.96	19.0	50.0	282.	2.81	0.00	15.0	22.5	16.1	3.80	1.02	0.436	1.38	0.187	4.97	0.562	5.41	0.000
194	1.02	0.553	1.99	13.4	109.	3.54	9.82	56.2	214.	3.08	379.	17.2	30.6	23.0	4.89	1.21	0.670	1.97	0.309	5.36	0.685	6.82	1.04
195	1.13	0.507	5.31	11.7	104.	3.42	7.80	56.1	401.	3.18	1960.	22.0	37.0	17.2	4.28	1.12	0.598	1.80	0.265	4.83	0.726	6.22	0.000
231	1.41	0.703	3.46	12.7	99.3	3.61	5.74	53.2	371.	3.21	412.	19.5	28.5	20.5	4.42	1.11	0.593	2.01	0.237	5.78	1.02	7.52	0.000
232	1.20	0.000	2.88	14.0	123.	3.48	11.5	48.9	261.	3.17	335.	16.3	25.4	0.00	4.29	1.18	0.555	2.12	0.324	5.30	0.679	5.90	0.780
233	1.35	0.564	5.61	12.9	109.	3.48	8.24	54.3	179.	3.72	406.	23.0	28.9	0.00	4.52	1.20	0.000	1.87	0.311	5.26	0.839	6.68	0.000
234	0.959	0.738	2.65	13.0	115.	3.52	12.0	40.6	0.00	3.07	311.	15.7	27.0	18.9	4.52	1.10	0.469	1.87	0.262	5.21	0.731	6.71	0.869
235	1.45	0.000	3.33	12.9	112.	3.54	6.44	57.5	380.	3.34	459.	21.9	30.8	0.00	4.65	1.244	0.646	2.08	0.296	5.47	1.02	7.06	0.000
236	1.40	0.650	2.27	13.6	119.	3.61	4.50	43.5	399.	2.69	635.	19.4	30.8	24.9	4.53	1.22	0.619	2.10	0.259	5.90	0.809	5.52	0.000
Mean																							
n=16	1.23	0.593	3.95	13.2	120.	3.70	9.66	48.3	336.	3.01	556.	18.8	28.2	17.8	4.38	1.15	0.598	1.93	0.266	5.18	0.710	6.00	0.87
C.V.	19.2	19.2	37.9	5.1	9.8	8.8	61.6	18.5	28.4	13.7	75.8	18.7	20.1	25.2	11.7	10.5	22.8	13.1	17.6	6.7	21.8	12.8	13.9

Faïence Blanche Group 1 (FBL1):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
006	0.400	0.843	6.87	13.490	109.	3.49	16. 6	44.5	445.	5.96	314.	37.6	73.6	34.9	6.32	1.21	0.807	3.24	0.376	5.93	1.25	12.3	2.29
014	0.420	1.00	6.70	13.213	99.5	3.82	18.5	39.9	0.00	4.75	350.	37.8	68.2	27.5	5.89	1.14	0.690	2.92	0.403	6.40	1.11	12.1	2.82
032	0.380	0.953	7.91	13.397	106.	3.78	37.2	45.7	442.	5.06	372.	42.6	72.1	33.9	6.56	1.27	0.847	3.11	0.391	6.50	1.11	12.2	2.49
051	0.369	0.792	16.9	10.304	90.2	2.61	14.3	39.9	414.	2.65	279.	28.9	52.9	34.8	4.61	0.851	0.785	2.12	0.315	3.60	0.729	8.55	1.73
052	0.467	1.29	13.2	11.803	82.2	2.99	17.2	54.2	515.	4.30	445.	33.6	62.1	25.9	5.01	0.979	0.698	2.29	0.320	4.92	0.962	10.2	1.89
060	0.442	0.849	14.4	9.977	83.6	2.58	9.75	89.9	480.	3.09	442.	30.4	51.3	0.00	4.67	0.838	0.787	2.42	0.396	5.72	0.908	7.87	1.28
062	0.758	0.826	12.4	11.912	87.7	3.32	13.0	57.4	512.	2.58	760.	38.4	65.6	42.9	6.08	1.11	0.679	2.65	0.403	6.18	1.18	10.6	1.90
063	0.203	1.09	9.46	14.894	96.6	3.58	16. 6	72.9	0.00	3.96	477.	42.7	79.4	23.9	6.67	1.20	0.661	2.66	0.360	3.69	1.04	11.9	3.60
068	0.261	0.833	20.3	9.705	77.6	2.70	9.42	53.2	548.	3.14	309.	28.8	47.8	21.9	4.20	0.832	0.638	2.36	0.330	6.90	0.820	7.73	1.76
072	0.284	0.918	17.5	9.484	80.9	2.63	10.3	60.5	549.	3.18	196.	29.2	47.2	23.7	4.30	0.807	0.552	2.29	0.318	7.08	0.826	7.85	1.96
075	0.393	0.760	13.9	17.701	95.7	3.96	17.1	49.7	653.	3.39	609.	45.7	93.3	30.9	7.28	1.36	1.12	3.52	0.436	6.28	1.58	13.5	1.98
077	0.750	0.811	14.3	10.990	86.5	3.14	13.9	50.7	642.	3.17	510.	35.7	62.4	34.2	5.61	1.03	0.627	2.47	0.333	5.81	0.962	10.1	1.95
080	0.721	0.782	15.7	9.908	79.1	2.86	16.8	45.3	492.	2.99	328.	32.2	59.2	22.5	4.94	0.955	0.582	2.67	0.340	5.20	0.855	9.66	1.26
100	0.525	0.408	19.5	10.093	91.6	2.86	12.2	39.6	558.	3.06	639.	29.2	51.3	22.6	4.61	0.843	0.682	2.55	0.421	7.60	0.841	7.24	1.46
101	0.346	0.774	11.1	12.912	114.	3.52	20.1	53.6	615.	4.42	452.	38.3	68.2	25.4	5.68	1.10	0.800	2.92	0.465	9.10	1.07	10.3	2.03
102	0.577	0.762	17.1	10.304	88.7	2.87	12.3	69.2	586.	2.89	699.	32.3	52.6	22.9	4.89	0.942	0.713	2.80	0.317	8.22	0.955	8.59	1.69
103	0.570	0.705	16.7	10.789	91.8	2.81	10.9	63.2	474.	4.71	436.	32.5	60.5	28.2	4.90	0.899	0.630	2.70	0.376	7.78	0.940	8.77	1.48
105	0.713	0.759	14.7	10.593	74.1	3.06	14.8	53.8	641.	3.05	612.	34.4	62.9	25. 6	5.31	1.03	0.662	2.29	0.359	5.41	0.923	9.89	1.34
106	0.713	0.804	16.9	10.093	79.2	2.73	13.4	56.5	563.	3.72	496.	33.6	58.5	25.1	5.27	0.991	0.552	2.79	0.336	5.28	0.902	9.66	1.80

121	0.442	0.644	17.7	10.593	73.6	3.31	29.4	33.9	439.	1.83	514.	34.4	65.6	26.4	5.30	0.899	0.893	2.59	0.305	6.35	0.982	12.2	2.06
122	0.305	1.06	15.7	11.194	63.2	3.41	10.9	89.5	0.00	4.76	635.	37.2	64.7	31.6	5.82	1.08	0.828	2.97	0.352	5.10	1.15	11.1	2.82
126	0.544	0.953	15.7	11.194	98.6	2.94	15.1	56.5	432.	3.97	635.	34.3	61.2	24.5	5.25	0.953	0.676	2.54	0.414	8.93	0.98	9.25	1.43
127	0.707	1.04	12.9	12.388	115.1	3.49	11.8	66.5	542.	4.52	490.	38.0	66.1	31.3	5.77	1.09	0.893	3.10	0.385	9.25	1.03	10.1	1.82
131	0.268	1.01	18.8	11.298	77.8	2.48	5.83	66.9	0.00	2.96	659.	35.9	66.1	30.4	5.50	1.03	0.916	2.22	0.290	4.52	0.96	10.1	0.000
134	0.225	1.11	19.5	13.490	86.3	2.67	11.9	65.2	590.	3.56	763.	42.5	69.2	31.4	6.28	1.22	0.989	3.43	0.429	6.21	1.42	12.3	3.90
135	0.505	0.637	17.7	13.614	93.9	4.13	20.5	80.7	0.00	4.43	676.	47.3	86.1	25.4	7.33	1.30	0.966	3.90	0.582	5.94	1.31	14.4	2.11
136	0.506	0.982	7.92	12.388	94.8	3.50	21.9	43.8	490.	2.56	968.	40.6	71.3	30.8	6.34	1.20	0.798	2.84	0.385	6.70	1.15	11.3	2.04
143	0.530	1.07	19.0	10.4	94.8	2.79	11.6	70.3	537.	3.99	417.	32.1	53.7	25.7	4.75	0.89	0.838	2.48	0.372	7.83	0.838	8.34	1.61
175	0.444	0.955	8.05	16.4	103.	4.13	14.9	35.6	341.	1.97	239.	33.9	76.4	33.1	7.16	1.48	1.05	3.33	0.425	6.56	1.10	12.5	2.70
256	0.524	0.962	12.7	11.5	85.9	3.44	19.5	64.7	523.	4.49	474.	37.1	66.4	27.4	5.64	1.07	0.608	2.50	0.337	4.85	1.05	10.3	1.82
257	0.290	0.667	14.5	13.8	79.4	4.34	16.6	61.9	466.	4.96	393.	43.6	72.6	37.2	6.37	1.21	0.612	3.19	0.409	4.49	1.37	13.4	2.67
263	0.292	1.11	10.5	12.2	103.	3.39	24.3	62.9	515.	3.55	609.	35.2	60.8	29.9	5.37	1.02	0.664	2.29	0.346	4.40	0.951	10.2	2.33
272	0.178	0.940	8.61	13.9	123.	3.16	19.1	62.5	0.000	3.63	544.	43.6	76.7	43.8	7.03	1.41	1.07	3.33	0.571	9.38	1.31	11.7	3.16
274	0.586	0.927	34.8	9.59	69.3	2.67	9.80	64.9	609.	4.49	459.	28.9	54.4	25.6	4.48	0.86	0.538	1.79	0.290	3.94	1.11	8.61	3.35
277	0.608	0.922	24.8	11.9	93.3	3.24	10.9	49.1	618.	5.53	918.	35.7	63.1	34.7	5.70	1.09	0.783	2.65	0.486	5.10	1.12	10.5	0.000
278	0.643	0.698	41.3	9.55	75.3	2.82	11.8	60.8	563.	3.84	1109.	28.6	51.2	28.5	4.34	0.86	0.627	2.28	0.416	3.88	0.845	8.57	2.14
Mean n=36	0.469	0.879	15.7	11.9	90.2	3.20	15.6	57.7	527.	3.75	535.	35.9	64.3	29.3	5.59	1.06	0.757	2.73	0.383	6.14	1.05	10.4	2.14
C.V.	35.6	19.4	44.5	16.5	14.1	15.4	38.5	23.6	14.4	25.8	37.8	14.3	16.3	18.7	15.8	16.6	20.3	16.5	17.7	26.6	18.1	17.4	30.9

Faïence Blanche Group 2 (FBL2):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
004	0.432	0.789	13.7	13.6	77.3	4.12	19.5	87.1	316.	7.30	476.	42.9	70.5	34.9	6.27	1.17	0.953	2.94	0.439	4.22	1.22	13.3	2.13
056	0.755	0.000	13.4	11.5	76.2	3.13	12.2	121.	0.000	9.80	399.	39.4	69.7	35.9	6.11	1.06	0.838	2.53	0.385	5.79	1.42	12.9	2.70
057	0.822	0.650	10.7	12.3	82.4	2.79	15.9	134.	0.000	7.50	630.	45.9	80.2	40.9	6.73	1.21	0.931	3.80	0.468	6.86	1.33	13.4	2.74
069	0.598	0.547	19.1	12.5	82.2	3.59	21.8	75.9	568.	8.18	415.	45.1	63.4	37.8	6.34	1.16	0.760	2.708	0.371	5.21	1.22	11.5	2.42
079	0.560	0.853	18.9	11.7	90.2	3.18	15.1	80.9	703.	8.73	712.	35.1	64.7	23.8	5.33	1.01	0.867	2.45	0.301	4.41	1.02	10.0	2.64
081	0.649	1.08	17.7	11.7	71.1	3.24	37.1	154.	0.000	6.78	365.	35.1	61.2	20.1	5.51	0.97	0.577	2.47	0.340	4.01	0.982	10.7	2.31
091	0.679	1.11	12.2	12.2	86.5	2.65	16.6	142.	0.000	8.09	365.	46.6	81.1	33.5	6.84	1.20	1.10	3.21	0.469	7.80	1.65	14.1	2.57
119	0.929	1.19	12.6	15.7	103.	4.38	17.3	187.	0.000	17.6	349.	52.9	84.9	39.1	7.78	1.50	1.17	3.44	0.478	6.21	1.53	14.3	2.00
128	0.635	0.656	15.1	13.2	79.1	3.63	13.9	125.	0.000	7.89	466.	41.61	74.1	0.000	6.04	1.14	0.973	2.89	0.406	4.14	1.31	13.2	0.000
130	0.659	0.728	15.2	12.7	71.4	3.78	26.1	154.	0.000	9.68	660.	44.8	75.7	44.2	6.67	1.23	0.863	2.99	0.371	4.75	1.22	13.4	1.73
132	0.474	0.871	15.6	11.3	73.3	3.08	12.8	89.5	0.000	9.35	431.	37.7	65.6	0.000	5.53	1.01	0.807	2.38	0.330	5.15	1.08	11.9	2.00
133	0.957	0.673	12.3	14.8	79.1	4.48	26.1	243.	0.000	12.4	590.	48.3	77.9	32.3	7.13	1.27	0.818	3.19	0.423	4.55	1.37	14.9	2.02
141	0.832	0.895	10.9	14.3	73.8	4.46	20.4	243.	0.000	12.6	463.	43.4	73.6	38.9	6.32	1.16	0.857	3.12	0.412	4.25	1.32	14.1	2.09
142	0.895	0.000	28.3	14.3	80.5	4.04	14.8	165.	451.	10.8	0.000	47.1	76.2	42.4	7.50	1.24	0.883	3.30	0.450	4.58	1.40	14.5	0.000
144	0.542	0.546	13.1	14.8	83.2	4.38	15.9	119.	339.	8.87	731.	48.3	80.2	37.4	6.99	1.28	1.09	3.51	0.415	4.73	1.26	15.1	2.34
145	0.647	0.731	11.9	14.1	79.2	4.92	16.3	152.	328.	9.82	758.	43.9	72.3	30.5	6.37	1.26	0.843	2.77	0.406	4.44	1.13	13.4	2.58
146	0.857	0.000	14.5	13.5	76.6	4.13	15.9	149.	258.	10.2	514.	42.7	72.3	31.8	6.04	1.17	0.867	3.14	0.406	4.56	1.25	13.2	1.71
268	0.692	0.766	13.0	14.2	78.9	4.24	16.1	161.	344.	10.8	719.	44.4	74.9	33.8	6.53	1.22	1.11	3.58	0.450	4.28	1.26	13.6	2.14
Mean n=18	0.701	0.806	14.9	13.2	80.2	3.79	18.6	144.0	414.	9.80	533.	43.6	73.3	34.8	6.45	1.18	0.906	3.02	0.407	5.00	1.28	13.2	2.26
C.V.	22.0	24.4	27.9	9.9	9.4	17.3	32.8	33.4	36.6	25.9	27.0	10.6	8.9	18.3	10.2	10.4	15.9	13.8	12.3	20.7	13.1	10.5	14.7

Faïence Blanche Group 3 (FBL3):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
013	0.305	0.834	7.31	11.8	99.3	3.05	19.5	77.8	0.000	9.31	0.000	63.9	88.1	48.9	8.22	1.47	1.16	4.16	0.494	8.51	1.61	14.8	2.67
033	0.398	0.550	19.2	10.8	94.6	3.25	15.2	64.3	0.000	8.36	201.	58.7	82.9	43.6	7.30	1.39	1.03	3.33	0.407	7.50	1.34	11.7	1.78
048	0.306	0.818	19.6	9.80	74.8	2.17	10.3	94.6	528.	6.93	389.	49.9	710.	0.000	5.90	1.03	0.946	3.19	0.509	7.73	1.66	13.2	2.62
049	0.258	0.789	19.0	10.0	84.1	2.24	10.6	109.	332.	7.14	324.	55.1	79.8	41.1	7.74	1.25	0.979	3.81	0.598	8.32	1.68	12.7	3.18
050	0.243	0.605	1.00	11.9	89.9	2.74	15.9	78.9	632.	7.10	554.	60.3	82.9	37.5	7.36	1.46	0.920	4.07	0.521	8.83	1.56	13.9	3.18
053	0.132	0.906	16.9	9.14	72.1	2.15	9.59	62.2	381.	4.90	306.	46.7	65.3	34.7	5.65	0.982	0.679	3.30	0.397	8.43	1.43	12.3	2.94

054	0.425	0.586	17.6	10.5	84.3	2.28	10.4	78.7	317.	7.11	243.	52.5	74.8	48.9	6.65	1.15	0.916	3.76	0.497	8.61	1.73	13.6	2.15
058	0.186	0.748	14.9	11.9	116.	2.30	16.8	71.8	391.	7.87	297.	33.4	52.6	0.000	4.91	0.881	0.682	3.75	0.494	9.80	2.95	19.6	3.23
064	0.291	0.596	12.2	9.29	80.7	2.08	15.5	48.4	251.	8.36	271.	33.6	52.4	25.7	4.84	0.859	0.714	2.87	0.343	8.91	1.72	13.9	2.57
065	0.140	0.608	13.8	11.6	97.7	2.61	16.4	58.6	651.	5.12	376.	57.4	80.2	30.2	6.92	1.24	1.16	3.74	0.550	9.10	1.73	14.4	3.12
071	0.241	0.826	8.43	11.2	89.7	2.68	17.4	70.6	575.	8.30	571.	57.5	83.9	0.000	7.05	1.14	1.01	3.58	0.553	10.2	1.85	15.9	2.99
076	0.249	0.733	15.1	10.8	76.2	2.51	11.3	127.	350.	9.98	753.	54.4	81.3	53.9	7.03	1.17	0.796	3.78	0.536	8.95	1.68	13.6	2.56
108	0.123	0.798	15.9	11.7	87.7	2.25	11.8	66.2	584.	7.76	487.	39.4	30.1	29.6	5.88	0.964	0.906	4.50	0.630	11.4	2.68	19.1	3.60
109	0.334	0.413	15.9	10.9	102.	2.23	13.8	35.7	373.	5.53	324.	36.6	55.7	27.5	4.98	0.845	0.603	2.82	0.410	9.16	2.18	17.7	3.48
110	0.153	0.757	18. 8	10.5	59.7	2.01	9.27	67.6	591.	5.77	372.	39.5	61.8	33.1	5.97	0.966	1.04	3.05	0.490	9.57	2.12	16.7	3.94
111	0.147	0.726	16.3	11.6	84.9	2.47	11.2	73.9	368.	7.74	554.	38.4	56.2	30.3	5.51	0.966	0.973	3.44	0.494	10.1	2.74	17.9	2.87
112	0.104	0.758	10.7	9.68	76.4	2.99	12.2	65.0	451.	7.66	680.	38.4	62.2	27.6	5.73	0.975	0.818	3.94	0.519	11.2	2.09	15.5	3.33
115	0.148	0.753	15.8	10.9	87.7	2.36	15.1	60.7	395.	8.89	308.	39.3	64.7	31.9	5.65	0.893	0.673	3.16	0.493	9.62	2.23	18.6	3.34
117	0.292	0.531	19.5	8.83	74.3	2.34	9.59	51.9	321.	6.37	251.	45.2	68.9	35.1	5.92	0.986	0.708	2.99	0.478	7.28	1.39	11.5	2.37
125	0.299	0.590	20.3	9.55	78.9	1.91	8.40	56.6	375.	7.64	287.	44.3	78.5	31.4	5.72	1.05	0.612	2.61	0.367	6.27	1.30	10.9	1.91
129	0.234	0.767	20.3	9.40	73.3	2.17	10.0	57.7	414.	5.20	215.	48.1	74.3	31.7	5.85	1.09	0.897	2.86	0.386	7.69	1.41	11.8	2.40
137	0.149	0.755	30.6	10.9	87.3	2.29	7.66	62.9	460.	7.38	224.	36.4	60.5	32.3	5.25	0.927	0.873	3.31	0.469	10.7	2.49	18.2	2.65
173	0.194	0.714	6.67	13.5	102.	3.35	19.7	59.9	0.000	7.64	251.	49.5	90.6	46.4	8.65	1.57	1.19	3.88	0.640	9.80	1.87	16.4	2.77
264	0.185	0.716	12.4	10.2	83.6	2.18	13.9	72.8	395.	6.11	374.	51.6	77.1	33.0	6.68	1.05	1.17	3.39	0.526	9.38	1.69	14.3	2.98
266	0.356	0.769	15.7	10.9	86.7	2.20	9.77	70.3	467.	8.57	261.	51.4	77.9	37.2	6.38	1.24	0.859	3.54	0.425	7.23	1.65	12.6	2.30
267	0.318	0.665	17.4	10.4	79.8	2.07	9.53	73.1	487.	9.02	317.	49.9	70.1	35.5	6.30	1.14	0.724	3.33	0.433	6.87	1.50	12.6	2.26
275	0.377	0.548	41.0	9.30	71.8	2.30	12.8	75.5	495.	6.68	434.	44.7	66.2	32.4	5.65	0.959	0.853	2.75	0.346	6.73	1.39	11.9	0.000
276	0.368	0.282	38.4	9.98	77.1	2.18	9.77	55.8	489.	6.31	337.	48.9	75.5	36.5	6.37	1.13	0.778	2.79	0.429	7.46	1.52	11.9	0.000
279	0.296	0.594	33.0	9.89	78.3	2.38	12.1	74.8	506.	7.83	444.	47.1	68.5	37.8	5.73	0.986	0.782	3.01	0.466	7.36	1.58	12.2	0.358
Mean																							
n=29	0.250	0.681	18.0	10.6	84.6	2.40	12.6	69.8	446.	7.33	372.	47.3	71.2	35.9	6.27	1.10	0.878	3.40	0.479	8.71	1.82	14.5	2.72
C.V.	36.7	20.0	46.0	10.1	13.8	15.1	26.4	25.5	23.4	17.7	38.1	17.7	15.1	20.2	15.3	17.5	19.4	14.0	16.1	15.5	24.3	17.8	25.7

Faïence Blanche Group 4 (FBL4):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
055	0.141	0.528	11.8	10.3	79.1	1.91	12.6	44.3	363.	5.38	306.	41.3	69.3	32.5	7.06	1.31	1.14	4.91	0.670	14.2	2.79	16.2	4.15
070	0.318	0.624	14.2	12.9	104.	2.60	13.3	39.1	0.000	7.41	295.	39.1	63.2	29.2	5.77	1.05	1.04	4.25	0.569	12.4	3.27	18.5	3.54
114	0.246	0.390	12.3	12.3	99.5	2.11	11.9	0.000	450.	6.24	504.	35.3	58.2	26.2	5.61	0.991	0.838	4.94	0.750	14.1	4.41	20.2	3.39
116	0.239	0.464	20.1	9.27	70.1	1.84	9.68	24.5	0.000	3.55	304.	34.9	57.8	30.3	5.46	0.938	0.757	4.07	0.671	11.8	2.40	14.3	3.91
123	0.218	0.394	18.9	10.1	86.5	2.15	9.40	21.5	338.	6.81	251.	31.7	49.4	27.9	5.09	0.883	0.818	3.57	0.537	10.9	2.44	15.7	3.54
124	0.313	0.479	17.9	12.5	108.	2.62	12.2	28.8	527.	2.67	464.	33.9	52.7	25.9	5.21	0.971	0.955	4.19	0.562	11.2	3.34	19.9	2.97
138	0.267	0.498	12.1	11.5	104.	2.12	15.3	39.2	411.	5.58	406.	47.4	75.2	42.3	6.68	1.01	0.979	5.46	0.804	13.2	2.68	23.4	3.64
Mean																							
n=7	0.249	0.482	15.3	11.3	93.4	2.19	12.1	32.9	418.	5.38	362.	37.7	60.8	30.6	5.84	1.02	0.932	4.48	0.652	12.5	3.05	18.3	3.50
C.V.	24.3	16.7	23.1	12.4	16.0	14.0	17.0	28.0	17.9	31.9	26.7	14.3	14.9	18.4	12.8	13.5	14.5	14.3	15.5	10.6	23.1	17.2	10.4

Faïence Blanche Group 5 (FBL5):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
008	0.196	1.22	7.26	14.9	100.	3.99	13.9	123.	0.000	12.7	348.	71.8	103.	51.5	9.38	1.80	1.30	4.57	0.511	6.92	1.95	15.3	2.50
034	0.237	1.27	5.70	14.5	129.	4.61	25.0	84.1	0.000	8.67	274.	77.4	108.	55.5	10.1	1.87	1.16	4.23	0.684	9.25	1.97	17.1	2.08
059	0.202	0.689	9.33	15.1	119.	3.48	14.9	104.	699.	10.4	325.	63.2	93.9	47.6	8.04	1.53	0.933	3.67	0.507	7.64	1.86	16.2	2.39
061	0.243	1.08	14.9	12.1	88.1	2.13	12.1	123.	136.	13.5	369.	67.4	92.2	54.3	8.83	1.75	1.29	4.17	0.568	7.82	1.76	14.3	3.41
166	0.213	1.48	4.09	16.8	116.	4.08	19.0	142.	0.000	13.8	656.	83.6	129.	58.6	11.1	2.18	1.39	5.33	0.597	8.67	2.05	16.9	2.34
209	0.259	0.802	7.52	15.8	115.	4.21	24.8	110.	0.000	12.6	388.	81.8	110.	60.7	11.1	2.26	1.47	4.78	0.605	7.28	1.84	15.7	2.09
215	0.280	0.674	4.90	15.7	102.	3.80	14.6	110.	0.000	12.1	922.	71.8	111.	57.3	9.82	1.88	1.37	4.90	0.661	9.04	1.94	15.8	2.49
216	0.248	1.07	4.22	17.6	145.	4.23	27.7	115.	0.000	14.7	224.	58.9	107.	54.2	9.91	1.99	1.33	4.14	0.575	7.66	2.30	18.8	2.21
223	0.222	0.386	8.18	16.5	119.	3.99	27.8	83.2	0.000	10.9	332.	83.8	116.	60.8	10.9	2.25	1.58	4.60	0.622	6.38	1.99	16.1	3.01
224	0.137	1.03	2.82	16.6	119.	4.93	26.1	95.7	0.000	9.27	669.	82.0	115.	60.5	11.1	2.26	1.41	4.69	0.684	7.34	1.79	15.9	2.73
225	0.155	0.659	4.66	16.9	132.	4.36	22.4	103.	0.000	12.3	260.	67.1	97.7	56.2	9.91	1.92	1.27	4.20	0.568	7.19	2.00	17.3	2.44

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
230	0.259	0.938	11.9	13.9	108.	4.04	26.6	111.	0.000	11.7	516.	80.5	141.	46.8	10.6	2.02	1.39	4.84	0.690	6.87	1.78	14.8	2.08
280	0.222	0.769	12.8	15.2	92.9	4.03	28.9	76.9	0.000	8.59	606.	52.7	100.	52.5	7.67	1.42	1.29	3.35	0.486	5.83	1.69	15.5	0.000
Mean																							
n=13	0.221	0.928	7.57	15.5	114.	3.99	21.8	107.	n.d.	11.6	454.	72.5	110.	55.1	9.88	1.93	1.32	4.42	0.597	7.53	1.92	16.2	2.48
C.V.	18.6	32.4	49.7	9.4	14.1	16.6	27.9	17.4	----	11.6	45.5	14.0	12.7	8.4	11.5	13.9	11.8	12.1	11.7	13.2	8.3	7.3	16.3

Faïence Brune (FBR):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
005	0.092	0.665	7.28	16.1	133.	4.67	16.4	80.4	0.000	13.2	313.	37.2	62.5	0.000	4.99	0.938	0.925	4.34	0.687	13.1	3.59	27.4	7.71
047	0.195	0.935	1.07	12.8	105.	2.60	13.6	100.	0.000	11.4	503.	39.3	63.7	23.6	5.68	0.942	0.706	3.95	0.703	11.4	3.37	19.3	4.28
082	0.130	0.738	7.45	12.5	103.	3.71	14.8	67.8	0.000	10.2	334.	35.1	54.4	22.3	4.41	0.745	0.845	3.96	0.518	14.1	2.94	20.9	4.75
083	0.126	0.558	9.66	10.8	93.1	2.30	10.4	58.9	291.	9.04	591.	32.9	50.6	22.9	4.80	0.791	1.00	4.71	0.627	4	3.39	21.1	4.72
084	0.122	0.750	4.01	14.2	109.	2.25	12.3	71.4	0.000	13.1	0.000	47.9	71.8	27.8	5.82	0.933	0.893	4.30	0.638	13.7	3.56	23.6	6.14
085	0.106	0.463	3.05	14.8	129.	2.94	16.8	57.9	0.000	9.73	514.	32.7	56.5	0.000	4.27	0.718	0.738	5.26	0.745	17.3	6.24	26.7	6.84
086	0.203	0.496	10.5	12.6	112.	2.47	12.4	39.4	0.000	10.2	0.000	30.5	44.0	18.9	4.14	0.757	0.687	4.59	0.635	16.8	3.85	19.9	5.19
087	0.195	0.991	10.9	12.7	107.	2.81	13.6	91.8	0.000	12.5	567.	50.6	82.8	38.0	7.21	1.15	0.986	3.92	0.516	12.1	2.30	22.2	3.98
088	0.122	0.547	11.1	12.2	100.	2.99	12.6	52.8	258.	12.8	431.	27.4	42.7	17.6	3.73	0.685	0.721	4.08	0.530	14.2	3.48	19.6	4.93
089	0.188	1.040	11.8	13.7	125.	2.77	17.7	92.7	0.000	12.2	1109.	51.5	85.3	42.1	7.60	1.29	1.24	4.44	0.671	13.2	2.62	22.5	0.000
090	0.102	0.560	6.70	13.9	100.	3.39	17.3	54.7	0.000	9.55	352.	33.5	57.3	19.4	5.42	0.908	1.15	5.83	0.813	15.9	4.06	23.9	6.40
092	0.191	0.471	4.42	13.5	123.	2.96	13.5	0.000	0.000	7.74	0.000	27.7	49.3	0.000	3.79	0.684	0.867	3.99	0.555	15.9	4.34	27.4	6.08
094	0.140	0.592	10.6	13.3	92.0	3.18	12.2	56.5	0.000	11.6	0.000	41.2	69.0	22.4	5.38	0.973	1.08	4.69	0.527	17.1	3.27	24.3	7.71
095	0.110	0.590	2.70	13.3	106.	2.77	10.9	75.8	0.000	10.3	441.	38.4	62.5	23.3	5.21	0.847	1.03	5.18	0.748	17.9	3.56	24.2	6.07
096	0.193	0.741	7.41	13.6	109.	3.28	13.7	71.4	0.000	12.9	149.	39.9	65.0	25.7	5.10	0.883	0.759	4.51	0.593	13.8	3.26	22.5	5.04
097	0.151	0.424	12.1	12.2	103.	3.40	15.3	47.9	338.	8.73	395.	31.9	55.5	18.7	4.88	0.920	0.895	4.74	0.570	14.7	3.54	19.7	4.36
098	0.108	0.610	5.57	13.9	95.3	3.24	12.2	61.9	0.000	13.6	334.	43.8	72.6	32.3	5.93	1.02	0.893	4.66	0.604	14.6	3.28	23.8	5.62
099	0.133	0.653	5.73	13.0	95.3	2.79	12.2	62.2	0.000	11.3	387.	39.7	62.9	19.5	5.50	0.893	0.979	4.96	0.769	18.5	3.42	22.8	6.40
113	0.160	0.701	1.86	11.3	98.8	2.23	16.7	70.9	0.000	9.84	462.	29.5	49.8	23.1	4.69	0.865	0.851	4.30	0.597	13.2	4.10	17.5	4.11
265	0.115	0.634	3.90	15.1	123.	3.03	16.5	54.8	0.000	10.5	440.	32.2	54.6	0.000	4.01	0.769	1.08	5.57	0.828	17.4	6.24	26.5	7.69
269	0.145	0.436	1.11	14.3	110.	2.97	18.3	47.6	0.000	8.49	0.000	53.3	86.7	41.2	6.56	1.24	1.22	4.84	0.662	14.5	3.96	22.5	6.15
Mean																							
n=21	0.144	0.647	8.35	13.3	109.	2.99	14.4	65.9	n.d.	10.9	458.	37.9	61.9	25.8	5.20	0.900	0.931	4.61	0.645	14.9	3.73	22.8	5.71
C.V.	25.2	26.8	46.7	9.3	11.1	18.4	16.5	24.7	---	15.9	44.6	20.6	20.5	30.5	20.1	18.5	17.5	11.5	14.9	13.5	25.6	12.2	21.0

Greenware (G):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
009	0.199	1.14	0.00	19.4	130.	1.87	30.9	100.	0.000	10.4	162.	49.9	94.6	26.6	6.03	0.877	0.809	3.67	0.547	11.3	2.28	21.7	4.58
010	0.165	1.35	0.00	19.7	149.	2.58	42.9	116.	0.000	9.53	279.	50.8	84.5	0.000	6.56	1.07	0.679	4.36	0.649	9.18	2.45	22.4	5.01
012	0.151	1.12	0.00	17.9	127.	1.76	36.6	76.4	0.000	8.53	279.	38.1	61.2	22.5	5.05	0.718	0.643	3.68	0.574	12.4	2.96	21.5	5.07
015	0.136	1.34	0.00	17.5	146.	1.78	27.3	105.	0.000	8.77	276.	48.5	76.0	0.000	5.40	0.811	0.467	3.42	0.545	11.7	3.15	21.3	3.93
016	0.131	1.10	0.00	16.9	133.	1.67	31.7	91.2	0.000	8.85	239.	46.3	74.3	32.1	5.60	0.752	0.545	3.40	0.592	11.6	2.44	21.6	4.98
017	0.147	1.28	0.00	19.9	145.	2.03	28.2	103.	0.000	9.14	0.000	47.4	100.	28.8	5.73	0.984	0.929	3.78	0.508	10.9	2.48	21.5	4.85
018	0.139	1.03	0.00	1.84	136.	2.03	32.1	89.7	0.000	9.55	232.	45.2	87.7	33.2	6.27	0.986	0.964	3.30	0.589	9.86	2.41	20.3	3.94
019	0.145	1.16	0.00	15.7	121.	1.56	22.4	87.1	0.000	8.30	243.	63.1	112.	50.2	9.20	1.46	0.771	3.70	0.573	11.9	2.17	19.0	3.78
021	0.132	1.12	0.00	17.6	140.	2.05	40.6	100.	0.000	8.57	231.	41.9	69.3	36.1	5.13	0.767	0.760	3.10	0.530	11.4	2.24	21.3	3.79
022	0.131	1.18	0.00	18.5	132.	2.26	35.7	100.	0.000	8.91	255.	50.5	88.7	32.5	6.07	0.914	0.953	3.48	0.429	11.7	2.60	21.6	5.42
023	0.132	1.17	0.00	17.8	146.	2.68	36.6	89.3	0.000	8.63	306.	42.6	78.7	37.9	6.08	0.944	0.670	3.55	0.486	10.0	2.28	19.9	4.22
024	0.111	0.865	0.00	17.9	151.	1.91	30.4	80.2	0.000	9.25	248.	51.9	83.9	26.9	5.96	0.879	0.752	4.01	0.550	12.4	2.44	22.8	5.00
028	0.120	1.12	0.00	16.9	157.	1.96	29.7	97.0	0.000	9.18	302.	53.3	87.1	32.1	5.82	0.931	0.839	3.88	0.562	11.2	2.39	22.6	4.50
029	0.153	1.12	0.00	19.1	162.	2.34	35.3	106.	0.000	9.77	231.	54.3	84.9	0.000	6.24	0.973	0.883	3.85	0.628	11.5	2.38	23.6	5.14
030	0.151	1.12	0.00	19.5	127.	1.57	28.9	93.9	0.000	8.3.9	207.	52.1	84.9	29.8	6.10	0.897	0.791	3.48	0.457	12.1	2.60	21.9	4.61
031	0.142	1.23	0.00	16.9	162.	2.07	30.9	103.	0.000	9.59	238.	56.4	87.9	32.9	6.47	0.973	0.822	4.23	0.612	12.4	2.37	25.1	5.30
036	0.176	1.33	0.00	19.1	149.	2.42	44.3	102.	0.000	10.2	0.000	46.1	77.6	26.4	5.19	0.871	0.760	3.39	0.453	11.1	2.21	22.6	5.70

037	0.199	1.36	0.00	19.4	134.	2.16	32.4	108.	0.000	10.2	421.	48.2	81.5	28.9	5.79	0.877	0.830	3.49	0.509	10.4	2.32	21.8	4.58
156	0.092	1.18	0.00	20.7	143.	1.00	5.78	102.	0.000	9.23	309.	55.5	82.6	32.7	5.78	0.899	0.469	3.97	0.506	11.1	2.64	21.5	4.28
159	0.104	1.07	0.00	18.6	125.	1.68	31.5	81.1	0.000	8.83	393.	40.6	80.7	28.1	5.65	0.940	0.738	3.43	0.414	10.0	2.09	21.4	4.34
163	0.114	1.13	0.00	15.7	115.	2.16	24.3	86.1	0.000	7.94	410.	45.5	94.4	25.7	6.62	0.946	0.897	3.80	0.582	11.3	2.00	19.3	5.09
245	0.155	1.09	0.00	19.0	133.	1.39	26.1	97.3	0.000	9.62	216.	54.1	104.	0.000	5.61	0.904	0.832	3.30	0.536	10.9	2.29	20.7	4.67
246	0.139	0.982	0.00	16.5	123.	1.70	27.4	80.9	0.000	8.34	0.000	53.3	103.	45.8	7.26	1.11	1.03	4.04	0.575	12.5	2.25	20.1	4.98
247	0.128	1.26	0.00	20.4	162.	2.07	30.3	88.7	0.000	9.27	0.000	46.8	78.5	30.2	5.57	0.916	0.690	3.49	0.505	10.5	2.32	23.2	5.14
250	0.139	1.07	0.00	22.9	164.	1.95	41.0	119.	0.000	9.86	258.	50.9	88.1	0.000	6.08	0.962	0.733	3.53	0.518	10.2	2.79	23.2	4.78
251	0.139	1.19	0.00	18.2	133.	1.99	34.8	93.1	0.000	9.86	348.	47.3	79.9	38.4	5.78	0.826	0.813	3.44	0.469	12.4	2.50	23.6	4.90
252	0.134	1.04	0.00	15.8	116.	1.69	24.7	84.1	0.000	8.71	421.	45.7	81.5	33.9	5.57	0.822	0.698	3.65	0.475	12.3	2.37	19.9	4.75
253	0.124	1.11	0.00	18.6	123.	1.81	26.9	94.2	0.000	8.59	327.	52.1	157.	36.2	6.79	1.02	0.855	3.94	0.476	11.9	2.42	21.4	4.24
254	0.129	1.14	0.00	18.7	153.	1.85	24.2	99.1	0.000	9.79	267.	54.3	87.5	32.2	5.68	0.942	0.820	3.52	0.526	11.8	2.72	22.2	4.69
259	0.136	1.21	0.00	16.7	129.	1.83	24.8	93.5	0.000	9.10		47.8	78.3	32.8	5.52	0.809	0.695	3.60	0.445	11.9	2.48	22.4	4.48
260	0.182	1.35	0.00	18.9	146.	2.37	36.3	103.	0.000	9.42	0.000	49.1	80.5	29.4	5.66	0.881	0.701	3.32	0.474	9.95	2.18	21.9	4.78
Mean n=31	0.141	1.16	n.d.	18.4	139.	1.94	30.8	96.4	n.d.	9.17	281.	49.3	87.6	32.4	6.01	0.92	0.769	3.64	0.526	11.3	2.43	21.7	4.69
C.V.	17.2	9.9	----	8.6	10.3	17.9	23.9	10.6	----	6.8	24.8	10.4	19.0	18.5	12.8	14.3	17.0	7.9	11.4	8.0	10.0	6.1	10.1

Greenware Outliers (G†):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
011	0.130	0.805	0.00	12.4	80.9	1.59	5.72	60.1	0.000	5.12	0.000	62.5	94.8	40.1	7.55	1.31	1.14	3.29	0.423	8.45	1.63	12.4	2.55
026	0.461	1.99	0.00	13.3	115.	3.16	10.5	148.	0.000	10.6	359.	40.6	71.4	0.000	5.51	0.998	0.843	2.73	0.377	6.79	1.45	13.9	2.52
027	0.490	1.91	0.00	13.6	115.	3.58	12.9	127.	0.000	11.9	463.	40.7	72.6	35.6	5.53	0.991	0.615	2.60	0.321	6.52	1.20	14.3	3.08
038	0.172	1.11	0.00	23.8	255.	4.50	110.	93.5	0.000	9.60	0.000	56.2	123.	53.4	14.8	2.78	1.71	5.66	0.743	10.6	2.26	25.8	6.10
039	0.164	0.658	0.00	17.9	116.	2.05	5.90	103.	0.000	7.48	476.	25.1	49.4	22.4	4.86	1.10	0.697	2.77	0.448	5.48	1.09	13.6	2.75
042	0.561	2.02	0.00	14.5	88.1	3.20	5.24	121.	0.000	5.64	490.	52.2	93.8	39.5	7.69	1.44	0.865	3.83	0.500	10.4	3.15	13.4	3.71
043	0.555	2.31	0.00	14.7	86.5	4.38	22.7	172.	0.000	9.77	460.	41.3	72.4	35.9	6.84	1.08	0.689	2.73	0.405	6.86	1.69	14.3	2.35
151	0.129	2.05	0.00	17.8	110.	1.80	18.5	152.	0.000	11.7	474.	48.9	89.7	48.8	8.41	1.58	1.24	3.58	0.601	9.16	2.21	19.7	9.25
155	0.108	1.24	0.00	18.5	157.	2.42	28.8	104.	0.000	8.20	313.	69.9	216.	60.7	10.8	1.84	1.02	4.24	0.533	11.5	2.50	23.2	5.42
237	0.188	2.27	0.00	20.1	132.	2.26	25.7	176.	0.000	12.4	406.	59.4	110.	53.7	10.4	1.83	1.10	4.86	0.675	9.33	2.16	21.9	4.58
238	0.087	1.15	0.00	19.8	172.	2.06	31.7	98.8	0.000	8.93	215.	85.1	162.	123.	14.7	2.37	1.52	5.94	0.832	11.4	2.55	22.5	4.46
248	0.163	1.45	0.00	19.6	125.	1.74	33.3	103.	0.000	10.7	295.	57.9	251.	35.6	9.12	1.40	1.07	4.12	0.659	11.3	2.98	21.6	5.66
249	0.283	3.18	0.00	17.3	83.9	5.08	10.6	214.	0.000	11.5	651.	63.1	109.	55.1	9.04	1.63	1.34	4.43	0.508	6.17	1.46	19.2	2.53
258	0.119	0.871	0.00	16.4	138.	3.11	62.2	83.4	0.000	7.14	0.000	35.7	57.5	22.3	4.34	0.664	0.638	3.37	0.411	12.1	2.14	22.6	4.28

Redware (R):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
148	1.40	1.49	0.00	12.7	99.13	3.40	3.72	71.6	0.000	4.42	302.	30.2	53.2	0.000	4.08	0.893	0.679	1.95	0.344	6.18	1.67	14.9	2.92
149	1.33	0.901	0.00	9.68	149.	3.30	5.82	36.9	0.000	2.00	0.000	21.5	37.5	18.1	3.26	0.771	0.472	1.64	0.244	8.99	1.43	12.9	4.88
239	0.968	0.689	0.00	13.0	87.1	2.78	6.14	47.1	0.000	2.94	0.000	23.3	53.6	0.000	3.38	0.815	0.532	1.56	0.214	5.72	1.16	12.1	2.00
240	1.09	0.780	0.00	10.6	118.	3.20	11.2	40.8	0.000	2.26	330.	23.9	41.2	21.5	3.72	0.944	0.569	1.88	0.323	8.59	1.35	11.9	2.99
241	1.10	0.893	0.00	13.2	90.6	3.26	5.08	49.5	0.000	2.52	458.	23.9	47.6	0.000	3.70	0.789	0.509	1.80	0.272	5.73	1.22	12.6	2.51
242	1.12	0.622	0.00	10.8	138.	2.50	1.71	38.3	0.000	2.82	0.000	23.9	48.9	0.000	3.31	1.12	0.598	1.71	0.272	8.91	1.30	10.9	1.60
243	1.38	1.56	0.00	11.1	74.1	2.86	4.13	67.4	0.000	4.58	341.	30.9	71.9	28.8	4.55	0.877	0.612	2.18	0.323	5.89	1.33	12.4	2.49
244	1.25	0.000	0.00	11.1	146.	3.35	3.93	0.000	287.	2.59	308.	28.3	57.1	0.000	4.83	1.29	0.614	2.42	0.422	9.33	1.45	11.2	3.21
Mean n=8	1.21	0.991	n.d.	11.5	113.	3.08	5.22	50.2	n.d.	3.01	348.	25.8	51.4	n.d.	3.85	0.940	0.573	1.89	0.302	7.42	1.36	12.4	2.82
C.V.	13.1	38.2	----	11.2	26.0	10.6	53.4	27.8	----	31.9	18.2	13.7	20.6	----	15.2	19.3	11.6	15.2	21.7	22.4	11.6	10.0	34.2

Redware Outlier (R†):

No.	Na*	K*	Ca*	Sc	Cr	Fe*	As	Rb	Sr	Cs	Ba	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu	Hf	Ta	Th	U
147	0.524	0.492	0.00	15.2	136.	5.25	2.70	0.000	0.000	2.598	206.	35.2	58.9	23.9	5.41	1.38	0.767	3.11	0.324	11.2	1.93	15.6	3.81

always entirely successful. Two paste colors are visible in the sherd break, a salmon-colored paste in the lip area (Sample 4), which falls into chemical group FBL2, and a gray paste portion of the sherd (Sample 257), which belongs to chemical group FBL1. The sort of mixing of clays that occurred routinely during faience production obviously complicates chemical analysis of archaeological sherds (Rosen 1995:191).

Mixing clays was practiced elsewhere in Europe at factories producing other tin-opacified lead-glazed ceramics, such as English and Dutch delfts and Italian maiolica. In their recent neutron activation analysis of those wares, Hughes and Gaimster suggest that

> the chemical effect of mixing a red and white clay is to raise the calcium content, but it has relatively little effect on the concentrations of the rest of the elements in the red clay, apart from slightly lowering their concentrations systematically. So maiolica ceramics made with mixed clays reflect the composition of the red clay, which is often local, but is much less influenced by the white, which documentary evidence indicates was often imported (Hughes and Gaimster 1999:58).

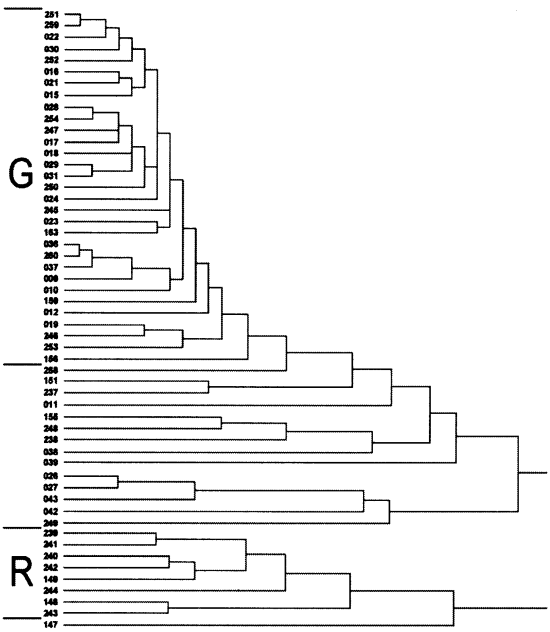

FIGURE 3. Dendrogram for coarse earthenwares showing two major chemical groups, one for French green lead-glazed earthenwares and one for Mexican red lead-glazed earthenwares, with some New England slip-trailed lead-glazed earthenware outliers (Samples 26, 27, and 42).

We are less sanguine about the presumably limited effects of mixing on overall chemical composition; note that the whitish clay in our Provence Blue on White sherd is only slightly more calcareous than the salmon clay, and concentrations of other elements do not vary systematically. The combined effects of clay mixing and stylistic diffusion pose some serious difficulties for chemical analyses of faience production and distribution. Clearly, future studies should include identification of types of clays used and, subsequently, analysis of both clay sources and production waste from 18th-century faience factory sites across France. Rosen (1995:189–193) has initiated an ambitious X-ray fluorescence analysis (a method that, unfortunately, does not yield results directly

TABLE 3

SITES BY FAIENCE COMPOSITIONAL GROUPS

Site	Sample n	FBL1	FBL2	FBL3	FBL4	FBL5	FBR
				Group			
1EE8	5	2	0	3	0	0	0
1MB32	54	16	10	10	3	2	13
1MB49	3	2	1	0	0	0	0
1MB61	7	3	0	2	0	2	0
1MB94	10	1	0	1	0	8	0
1MB132	10	1	1	2	3	0	3
1MB161	3	1	0	0	0	1	1
1MB262	32	10	6	11	1	0	4
Total	124	36	18	29	7	13	21

TABLE 4

FAIENCE WARES AND STYLISTIC TYPES BY COMPOSITIONAL GROUPS

Ware	Stylistic Type	Sample n	Group FBL1	FBL2	FBL3	FBL4	FBL5	FBR
faïence blanche	Normandy Plain	8	1	0	4	0	2	1
	Normandy Blue on White	28	15	3	5	0	5	0
	St. Cloud Polychrome	17	0	1	10	3	1	2
	Seine Polychrome	20	6	3	4	3	4	0
	Brittany Blue on White	11	6	0	5	0	0	0
	Nevers Blue on White	2	1	0	1	0	0	0
	Provence Blue on White	13	3	10	0	0	0	0
	Moustiers Polychrome	2	1	0	0	0	1	0
	[Dutch & English Delft]	5	3	1	0	1	0	0
faïence brune	Rouen Plain	8	0	0	0	0	0	8
	Rouen Blue on White	1	0	0	0	0	0	1
	Rouen Polychrome	9	0	0	0	0	0	9
Total		124	36	18	29	7	13	21

comparable to neutron activation data due to the quantification of a different suite of elements) of sherds and clays from Meillonnas, Dijon, and Nevers, and other French scientists are pursuing similar research programs.

Before moving on to the analysis of coarse earthenwares, faience chemical group FBL5, which stands out from the other *faïence blanche* groups for its low calcium values, should be considered more closely. This group consists mainly of sherds from the sites of Old Mobile and Port Dauphin (Table 3), including the oldest faience included in our study. The early date of this group is reflected in the absence of Guillibaud-style rim motifs that became so popular after 1720. Most of the French ships to arrive in the Louisiana colony during that era set sail from the ports of La Rochelle and Rochefort, in western France, far from the major faience production centers of Rouen, Nevers, and Moustiers. This chemical group may represent pottery produced at minor factories in central or western France.

Coarse Earthenwares

Neutron activation analysis of French coarse earthenwares reveals considerable chemical diversity (aside from their uniformly non-calcareous nature), even though all of the types—Charente Plain, Saintonge Plain, Saintonge Slip Plain, and Saintonge Slip Decorated—are attributed by specialists in French ceramics to potteries in southwest France, specifically to the Saintonge region near Rochefort (Chapelot 1975; Steponaitis 1979; Barton 1981:10–25; Moussette 1982; David and Gabet 1988; Walthall 1991b:106–109).

All of the French coarse earthenwares are lead glazed. Depending on paste color and glaze colorant, these specimens appear green, yellow, or red. Appearance, however, seems to vary independently from paste composition. Thirty-one samples form a statistically significant chemical group (G for Greenware, Figure 3), with fourteen outliers. One of the outliers (Sample 258), however, was derived from the same sherd as a sample (12) in compositional group G. Within group G are sherds that appear red or yellow, apart from the more common green lead-glazed specimens. The red coarse earthenwares include some with a distinctive Saintonge motif of slip-trailed circles and dots under the glaze (Chapelot 1975:86; Steponaitis 1979:64). Among the five chemically most diverse outliers are three specimens of slip-trail decorated redware that apparently originate from New England (Moussette 1982:33, 139).

Finally, analysis of nine sherds of coarse lead-glazed earthenware, sometimes characterized as El Morro ware, yielded a single compositional group (R for Redware, Figure 3), with one outlier. This ware has served as something of a typological catchall, subsuming many visually distinguishable varieties. All of the specimens analyzed here were excavated at Old Mobile and they are generally similar in appearance, with a very sandy, red paste and thinly applied lead glaze. Analysis of additional sherds will probably lead to a subdivision of this chemical group, as research currently underway on similar ceramics of a slightly later date from California Mission sites is yielding multiple compositional groups (Skowronek et al. 2001).

Conclusions

In comparison to the orderly relationship between chemical composition and decorative style seen in Mexican and Spanish majolicas, French faience poses many analytical difficulties. This initial neutron activation analysis of faience paste has identified several chemical groups that may prove to have geographical validity, but clay mixing and copying of decorative styles by faience potters have created formidable obstacles to achieving results similar to those in majolica studies. A next step in the chemical analysis of faience should focus on clay samples from the pottery making regions of France, as well as on waster sherds from factory sites. The same approach may prove most successful with the types of French coarse earthenwares that were exported to North American colonies, since they seem to have been produced almost exclusively in a single region of western France. Future neutron activation analysis of Spanish-colonial coarse earthenwares promises to identify some chemically distinctive types among these poorly known wares.

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