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# MYCENAEAN AND CYPRIOT LATE BRONZE AGE CERAMIC IMPORTS TO KOMMOS

## An Investigation by Neutron Activation Analysis


## ABSTRACT

**The results of a small-scale program of neutron activation analysis of 69 ceramic fragments from the Minoan harbor town of Kommos are presented and critically evaluated. Prior to analysis, the vessels represented in the sample were thought to be imports from outside of Crete, manufactured either on Cyprus or in the Mycenaean cultural sphere. The chemical analyses support the identifications of the vessels as imports from the regions in question in roughly 80% of the cases. They further suggest that the vast majority of these ceramic imports were produced in a comparatively small number of production centers.**


## INTRODUCTION

The Minoan harbor town known by the modern name of Kommos is located on Crete's south-central coast, just to the north of the Hellenistic and Roman harbor of Matala.[1] The site was excavated for a total of 15 seasons, from 1976 to 1985 and again from 1991 to 1995, by an international team directed by J. W. Shaw of the University of Toronto under the auspices of the American School of Classical Studies at Athens. The results of these excavations have been published over the past two decades in a series of five volumes (one in two parts, for a total of six separate books), and a final

1. The authors would like to thank the editor of *Hesperia* as well as Priscilla Keswani and the two anonymous *Hesperia* reviewers for numerous helpful suggestions, including the recommendation to add illustrative material. For active encouragement throughout the extended publication process, especially for the latest versions of the site plans (Figs. 1, 2) and the financial support to publish the second of these in color, we gratefully acknowledge our debt to Joseph and Maria Shaw, codirectors of the Kommos Excavations and coeditors of the associated publications. For suggesting the collaboration that has resulted in this article, we owe a special note of thanks to Elizabeth French. For successfully locating and making available the relevant Kommos analytical data in Manchester long after the analyses were run, we are very grateful to John Prag. The drawings were initially prepared by Julia Pfaff and have been reformatted for this publication by Tina Ross. The photographs were taken by Taylor Dabney.

The contributions of the authors are as follows: the opening sections, discussion, and conclusions were written by Jeremy Rutter, the section on chemical analysis by Sandra Hoffmann, and the sections on statistical analysis and results by Jonathan Tomlinson.

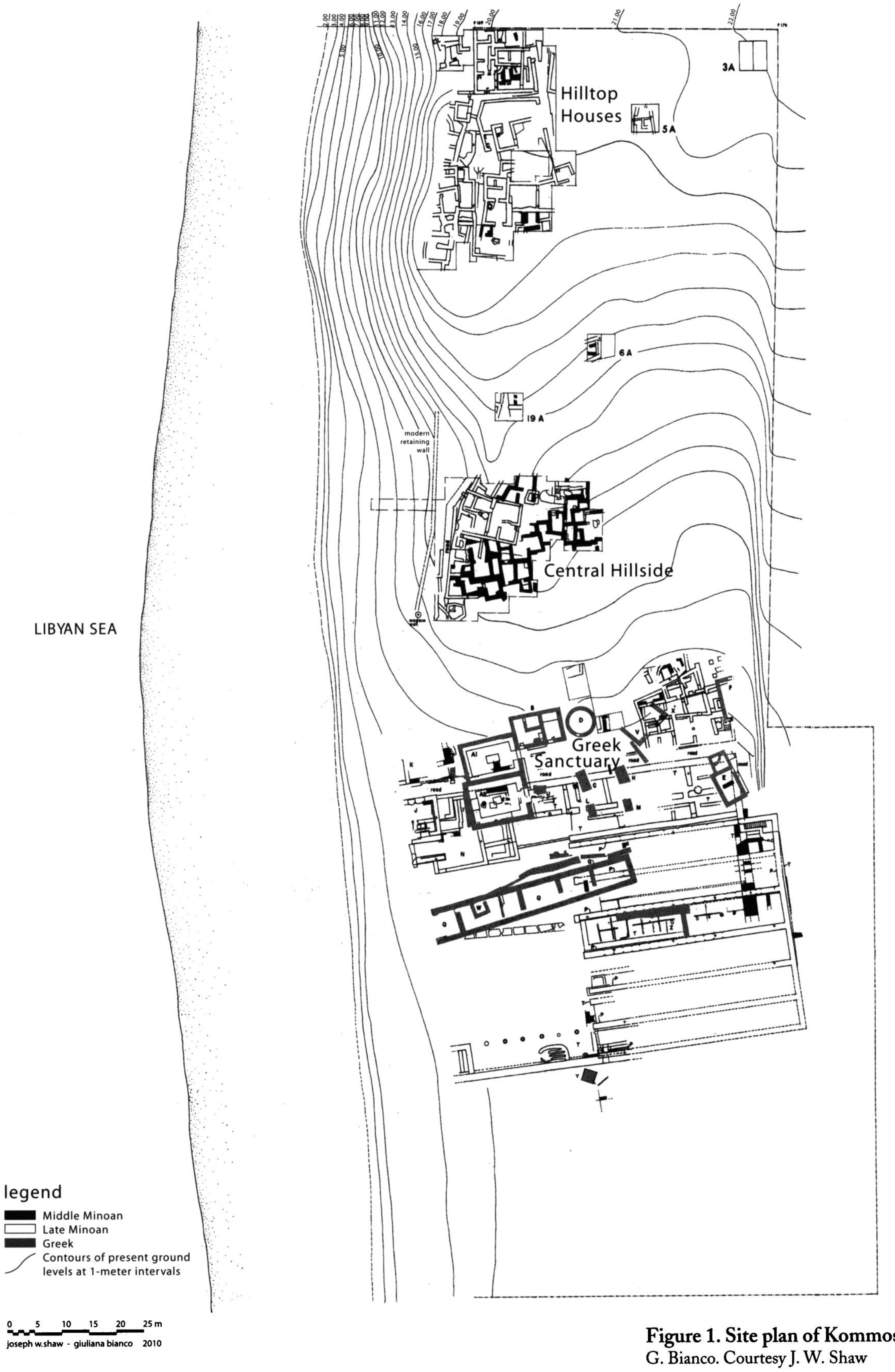



**Figure 1. Site plan of Kommos.**
G. Bianco. Courtesy J. W. Shaw

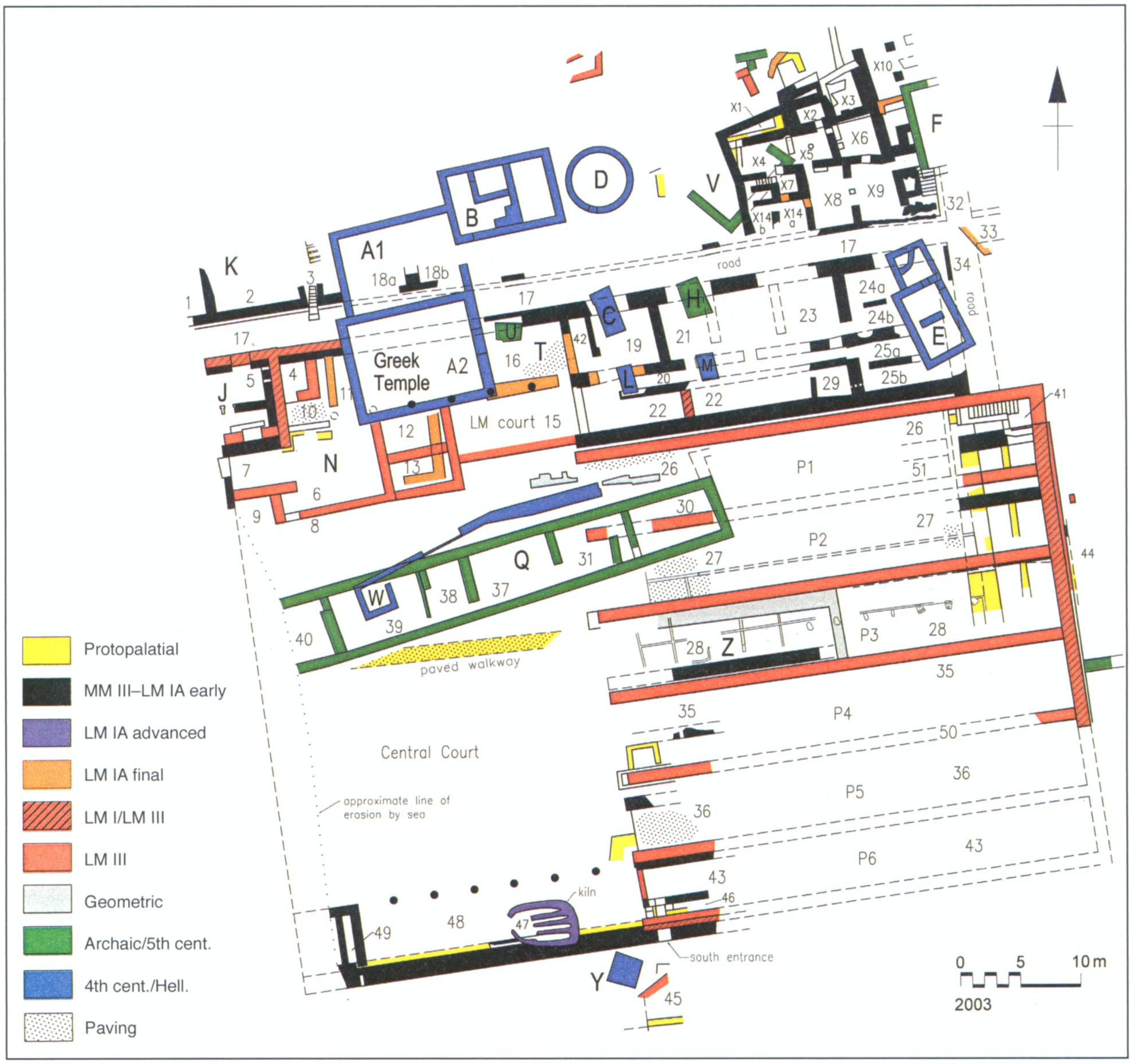



**Figure 2. Period plan of the Southern Area at Kommos, identified in Figure 1 as the Greek Sanctuary.** G. Bianco. Courtesy J. W. Shaw

volume in two parts is currently in preparation.[2] The purpose of the present article is to report on the results of a provenience study of Late Bronze Age ceramics thought to represent imports to the site. Neutron activation analysis (NAA) was undertaken in order to assess this possibility.

Excavations at the site were concentrated in three distinct sectors, from north to south, the Hilltop, Central Hillside, and Southern Area (Fig. 1, in which the Southern Area is labeled "Greek Sanctuary"). In the first two sectors the remains dated exclusively from the Final Neolithic and Bronze Age eras, between approximately 3500 and 1200 B.C. In the Southern Area (Fig. 2) the prehistoric remains were overlaid, after an apparent occupational hiatus of roughly a century, by an extra-urban sanctuary that was in continuous use from the very end of the Bronze Age (ca. 1100 B.C.) until Roman Imperial times. The period most abundantly represented at the site is the Late Bronze Age (LBA), or Late Minoan (LM) era, to which

2. *Kommos* I–V. In preparation are Shaw and Shaw, forthcoming, and Rutter, forthcoming.

a substantial number of residential buildings in the Hilltop and Central Hillside sectors belong. In the Southern Area a series of LM monumental structures (Building T below Buildings N and P) lie to the south of a major east–west road, on the north side of which is a particularly well-appointed domestic building (House X) that incorporated a shrine during its later phases of use.

## IMPORTED POTTERY AT LATE BRONZE AGE KOMMOS

During the four-century span of the Late Bronze Age, Kommos enjoyed an exceptional range of contacts, as attested by the presence of imported ceramics, with regions both within and beyond the Aegean.[3] At the time of writing, vessels originating from the Greek mainland, at least two western Aegean islands (Kythera and Melos, possibly also Naxos and Thera), southwestern Anatolia, Sardinia, Egypt, various locales along the Syro-Palestinian coast, Cyprus, and possibly portions of central Anatolia have been recognized. This extraordinary body of evidence for maritime contacts with regions of the Mediterranean outside of Crete shows that Kommos was a uniquely well-connected trading emporium.[4] It was one of a small number of sites throughout the eastern Mediterranean that functioned as major nodes of intercultural exchange during an era of increasingly intense cultural interaction, especially between ca. 1450 and 1200 B.C. These sites include Enkomi, Kition, and Hala Sultan Tekke on the south coast of Cyprus, Ras Shamra and its port at Minet el-Beida in coastal Syria, Tell Abu Hawam at the north end of the Carmel Ridge in Israel, and perhaps also Troy and Tiryns within the Aegean.

Although the external contacts of Kommos were already impressive prior to the end of the Neopalatial era, ca. 1450 B.C., when it probably served as the principal port of entry for goods entering the polity controlled from either Phaistos (in Protopalatial times) or Ayia Triada (from the developed LM IA phase until near the end of LM IB),[5] the site reached its acme as an entrepôt in LM II–LM IIIA2 Early, ca. 1450–1375 B.C. During this relatively brief interval of two to three generations, when the site of Knossos was home to the only known functioning palace center on Crete, Kommos served as the principal southern port of the Knossian administration. This role no doubt accounts for the fact that the only Egyptian New Kingdom ceramic containers known from the Aegean come from Kommos and were recovered from strata datable between 1500/1475 and 1375/1350 B.C.

3. The principal publications of ceramic imports to Late Minoan Kommos have been Watrous 1985; *Kommos* III, pp. 149–183; Cline 1994, esp. p. 106; Knapp and Cherry 1994, pp. 138–141; Rutter 1999, 2006b. The last of these offers the most up-to-date and wide-ranging overview of the evidence. Other Aegean sites with comparably widespread external contacts during the LBA are extremely rare, arguably being limited to Troy in the northeast and Tiryns in the southwest, but in the case of the latter, they are evident only from the LH IIIA through early LH IIIC phases, ca. 1400 through 1150 B.C.

4. The northern harbor of Knossos at Poros-Katsamba was almost certainly as well connected as Kommos, but most of this site has unfortunately been lost to archaeological exploration due to the modern development of the harbor at Herakleion.

5. For a convenient chart laying out developments at the site of Kommos within the broader context of events throughout the Mesara plain of southern Crete during the Bronze Age, see Shaw 2006, pp. 866–871, table 5:1.

Despite the wealth of imported ceramics from Kommos identified already by Watrous in his 1992 publication of the site's LBA pottery, only a small selection of these imports had been specifically targeted for petrological and trace-element analyses prior to 1995.[6] Up to that time, most of the analytical work on ceramics from Kommos was concentrated on the characterization of products of the local ceramic industry. The discovery of a LM IA kiln and its associated dump in the Southern Area during the 1993 and 1994 seasons provided a copious quantity of material for the study of this local industry for several more years.[7] Two additional programs of ceramic provenience analysis were instituted in the mid-1990s. The first of these was aimed at the imports identified as originating from either the Mycenaean cultural sphere to the north or from Cyprus to the east. Because these two groups of material were comprised largely of fine wares, the method chosen to investigate them was instrumental neutron activation analysis. A second program that focused on bulk transport vessels produced in a variety of medium coarse fabrics (identified as Egyptian, Syro-Palestinian, and Minoan) made use of both petrological as well as chemical methods of analysis and will be published separately.[8]

In August 1996 a series of 21 suspected Mycenaean ceramic imports to Kommos and a further 48 suspected Cypriot imports were sampled at the excavation's apothiki (storage facility) in Pitsidia (Figs. 3–5; Tables 1, 2).[9] The samples were transported shortly thereafter to the University of Manchester for neutron activation analysis by Hoffmann in order to determine the provenience of the 69 vessels represented. Although the samples had already been analyzed by early 1997, a series of unforeseen events including the closing of the archaeometry program at Manchester prevented any further assessment of the significance of these analyses for a number of years.[10] Unfortunate as the delay in publication has been, one positive consequence has been the full presentation of the overwhelming majority of the sampled pieces in prior publications, along with a broad overview of the full range of ceramic imports to LBA Kommos.[11]

Both the Mycenaean and the Cypriot selections represented two-thirds or less of the imports identified from each of these two cultural

6. *Kommos* III; Watrous, Day, and Jones 1998.

7. For the full publication of the kiln and an overview of its production range, see Shaw et al. 2001. See also Buxeda i Garrigos, Kilikoglou, and Day 2001. Some aspects of the output of the kiln at Kommos may now usefully be compared with those from a somewhat later but larger kiln at nearby Ayia Triada published initially by Levi and Laviosa (1979), but more recently in Belfiore et al. 2007.

8. Day et al., forthcoming.

9. The sampling was conducted on August 1, 1996, by Hoffmann and Rutter in the presence of E. Politaki as a representative of the Greek Archaeological Service, as prescribed under the permit ΥΠΠΟ/ΣΥΝΤ/Φ44/526/17317, dated April 1, 1996.

10. Hoffmann subsequently relocated to a new place of employment, and the data became inaccessible for a number of years, in part because of extensive renovations at the University of Manchester Museum, which now houses the Manchester archaeometry archive. Thanks to the efforts of Hoffmann and Manchester Museum's then Keeper of Archaeology, A. John N. W. Prag, the data were finally located in December 2003, and Tomlinson was able to carry out a statistical evaluation and provide an initial draft of the findings to Rutter by April 2004. By this time, however, it had become too late to include the results in the most recent volume of the Kommos publication series to go to press (*Kommos* V), so that further progress on the publication of the NAA data was again stalled for a while.

11. See Tables 1 and 2 and Appendix Table A; also Rutter 2006b. Only 10 of the 69 pieces reported on here have yet to be published (C9126 [Figs. 3, 6] in Table 1; C7237 [Fig. 12], C7238 [Fig. 12], C7239 [Fig. 12], C9013 [Figs. 5, 11], C9382 [Figs. 5, 10], C9567 [Figs. 4, 8], C9612 [Figs. 4, 8], C10209 [Fig. 4], and C10366 [Fig. 4] in Table 2), and all but the three Protopalatial pieces (C7237, C7238, C7239) will be included in the relevant section of the final volume of the Kommos series (Rutter, forthcoming).

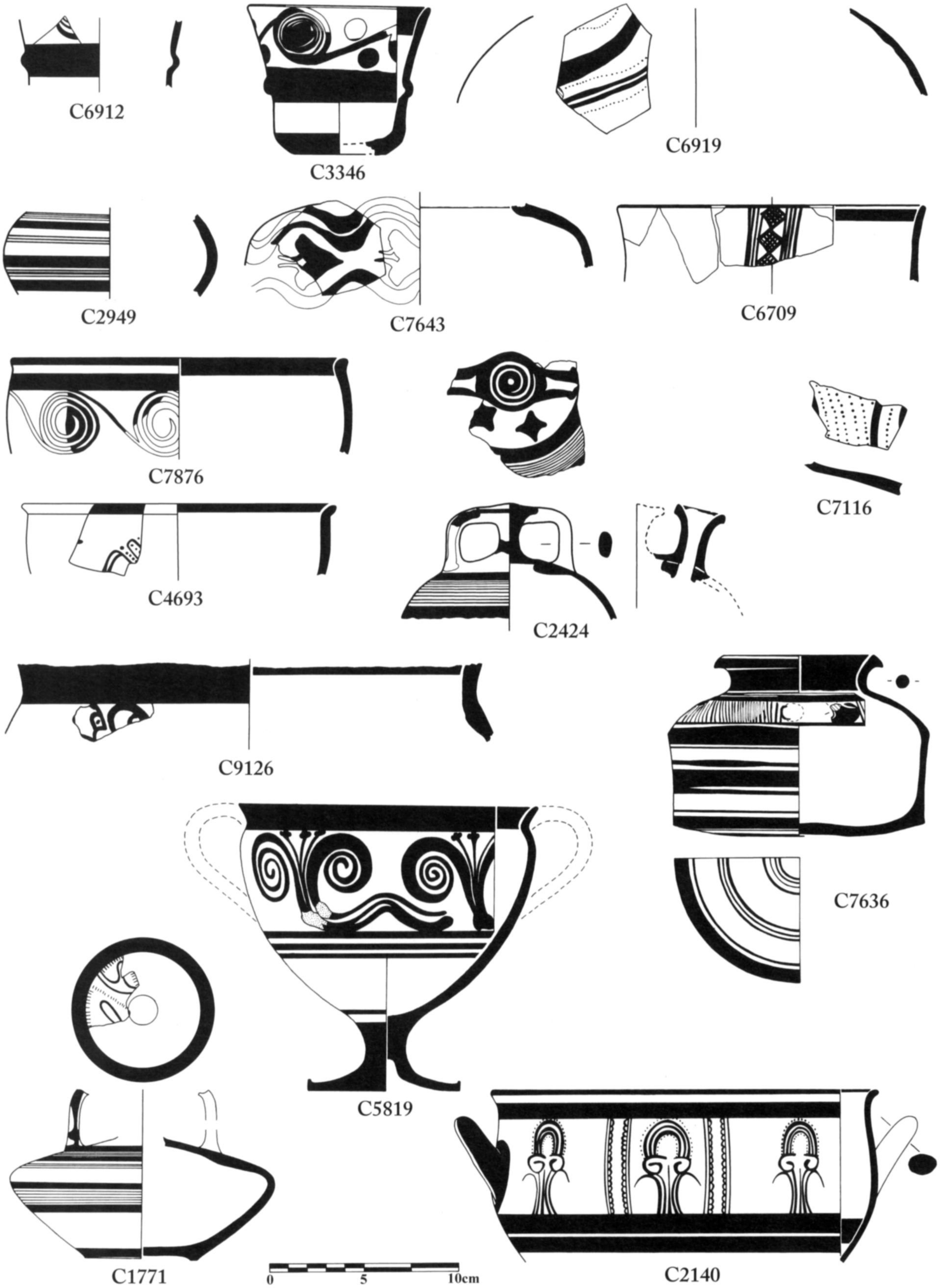



**Figure 3. Fifteen of the 21 suspected Mycenaean imports sampled for chemical analysis by NAA.** Scale 1:3. J. Pfaff

## TABLE 1. SUSPECTED MYCENAEAN IMPORTS SAMPLED BY NAA IN 1996

| *Kommos Inv. No.* | *Shape [Date]* | *Publications* | *Suggested Provenience* | *Comments* |
|---|---|---|---|---|
| C1473 | Stirrup jar (FS 182) [LH IIIB] | *Kommos* III, p. 74, no. 1264, fig. 46, pl. 29 | Central Crete(?) | Possibly from an as yet unidentified mainland Greek center |
| C1771 | Stirrup jar (FS 183) [LH IIIB] | *Kommos* III, p. 155, no. 1017, fig. 69, pls. 24, 50 | Argolid | |
| C2058 | Goblet (FS 255) [LH IIIA1] | *Kommos* III, p. 45, no. 789, pl. 18 | Argolid | Closest association is with group from northwest Peloponnese |
| C2140 | Stemmed bowl (FS 305) [LH IIIB] | *Kommos* III, p. 155, no. 1117, fig. 69, pl. 51 | Argolid | |
| C2424 | Stirrup jar (FS 174) [LH IIIC Early] | *Kommos* III, p. 107, no. 1881, pl. 47; Rutter 2006a, p. 576, no. 79/1, pl. 3:86 | Unprovenienced | |
| C2949 | Stirrup jar (FS 171) [LH IIIA2] | *Kommos* III, p. 155, no. 1927, pl. 51; Rutter 2006a, p. 495, no. 48/4, pl. 3:53 | Argolid | |
| C3346 | Vapheio cup (FS 224) [LH I] | *Kommos* III, p. 155, no. 338, pls. 46, 50; Rutter 2006a, p. 456, no. 37e/16, pl. 3:43 | Argolid | Associated only |
| C3896 | Stirrup jar (FS 167/171/173/180/182) [LH IIIB] | *Kommos* III, p. 93, no. 1621, pl. 41 | Central Crete(?) | Possibly from an as yet unidentified mainland Greek center |
| C3897 | Stirrup jar (FS 167/171/173/180/182) [LH IIIB] | *Kommos* III, p. 156, no. 1628, pl. 41 | Argolid | |
| C4271 | Bowl (FS 284 or 305) [LH IIIA2/B] | *Kommos* III, p. 155, no. 1671, pl. 51 | Argolid | |
| C4693 | Kylix (FS 256–257) [LH IIIA2] | *Kommos* III, p. 155, no. 1928, pl. 51; Rutter 2006a, p. 580, no. MI/MG/3, pl. 3:90 | Argolid | |
| C5425 | Piriform jar (FS 37/45) [LH IIIA2/B] | *Kommos* III, p. 155, no. 1133, pl. 51 | Argolid | Associated only, and also with some central Cretan groups |
| C5819 | Goblet (FS 254) [LH IIB] | *Kommos* III, p. 155, no. 1926, fig. 69, pl. 51 | Argolid | Associated only |
| C6709 | Deep bowl (FS 284) [LH IIIB] | *Kommos* III, p. 101, no. 1739, pl. 44; Rutter 2006a, p. 574, no. 78/23, pl. 3:86 | Argolid | |
| C6912 | Vapheio cup (FS 224) [LH I] | Rutter 2006a, pp. 424–425, no. 24/30, pl. 3:37 | Argolid | Associated only |
| C6919 | Bridge-spouted jug (FS 103) [LH IIA] | Rutter 2006a, p. 467, no. 44b/19, pl. 3:48 | Unprovenienced | Single association noted with diffuse group of transport stirrup jars from Mycenae, themselves probably of central Cretan origin |
| C7116 | Piriform jar (FS 20)(?) [LH IIA] | Rutter 2006a, p. 579, no. MI/MG/1, pl. 3:90 | Argolid | Associated only |
| C7636 | Angular alabastron (FS 94) [LH IIIA2] | Rutter, forthcoming, no. X5:5/52 | Argolid | Associated only |
| C7643 | Pyxis [LM II] | Rutter 2006a, p. 501, no. 52b/5, pl. 3:55 | Crete | Single association noted with group of eight fine ware samples from Pseira, probably all imported at that site |
| C7876 | Stemmed bowl (FS 305) [LH IIIB] | *Kommos* III, p. 101, no. 1737, pl. 44; Rutter 2006a, p. 574, no. 78/24, pl. 3:86 | Argolid | |
| C9126 | Amphoroid krater (FS 54) [LH IIIA2/B] | Rutter 1999, p. 144, n. 45; forthcoming, nonjoining fragment of same vase as no. X5:6/12 | Unprovenienced | |

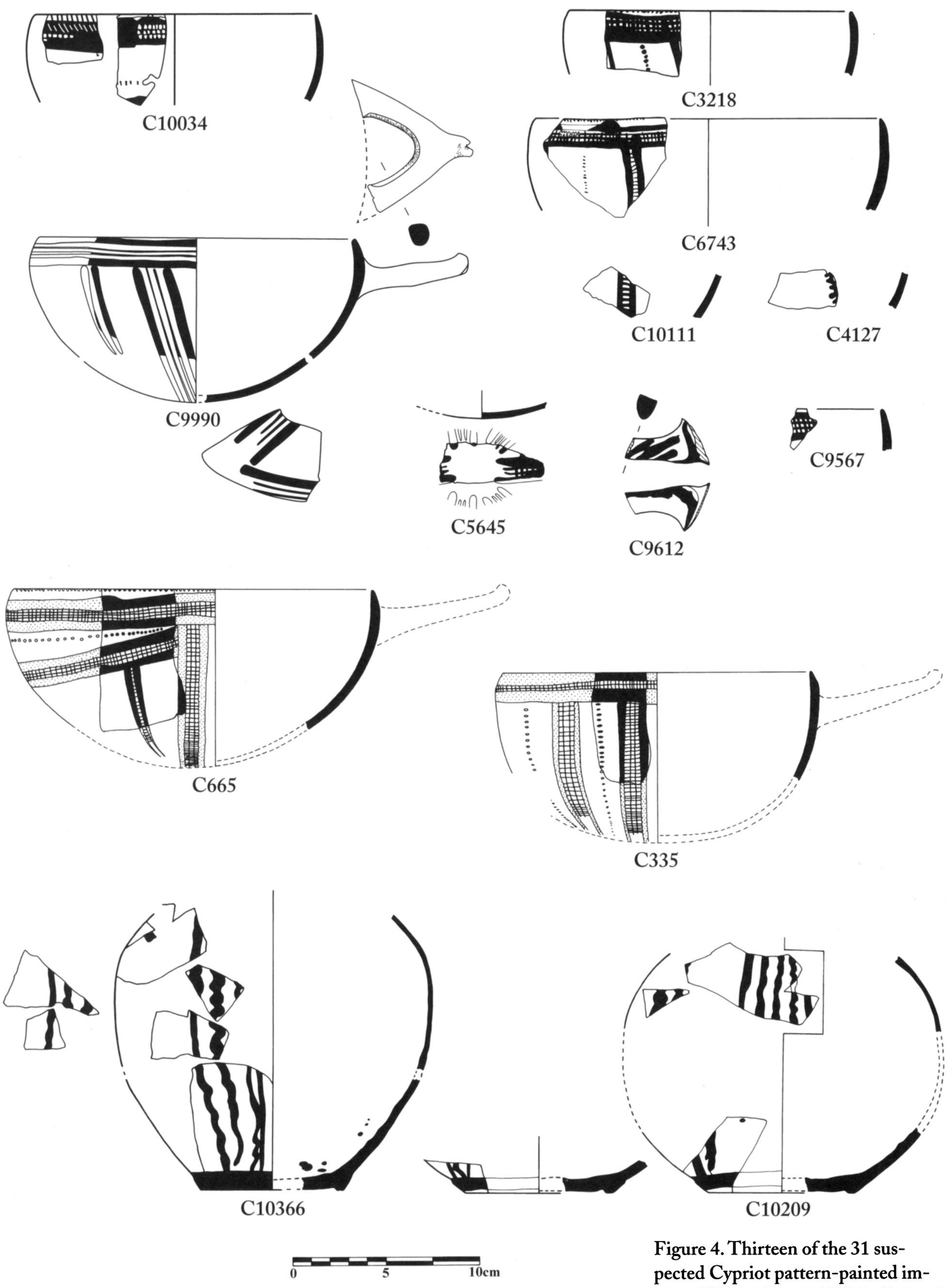



**Figure 4. Thirteen of the 31 suspected Cypriot pattern-painted imports (White Slip and White Painted Wheelmade) sampled for chemical analysis by NAA.** Scale 1:3. J. Pfaff

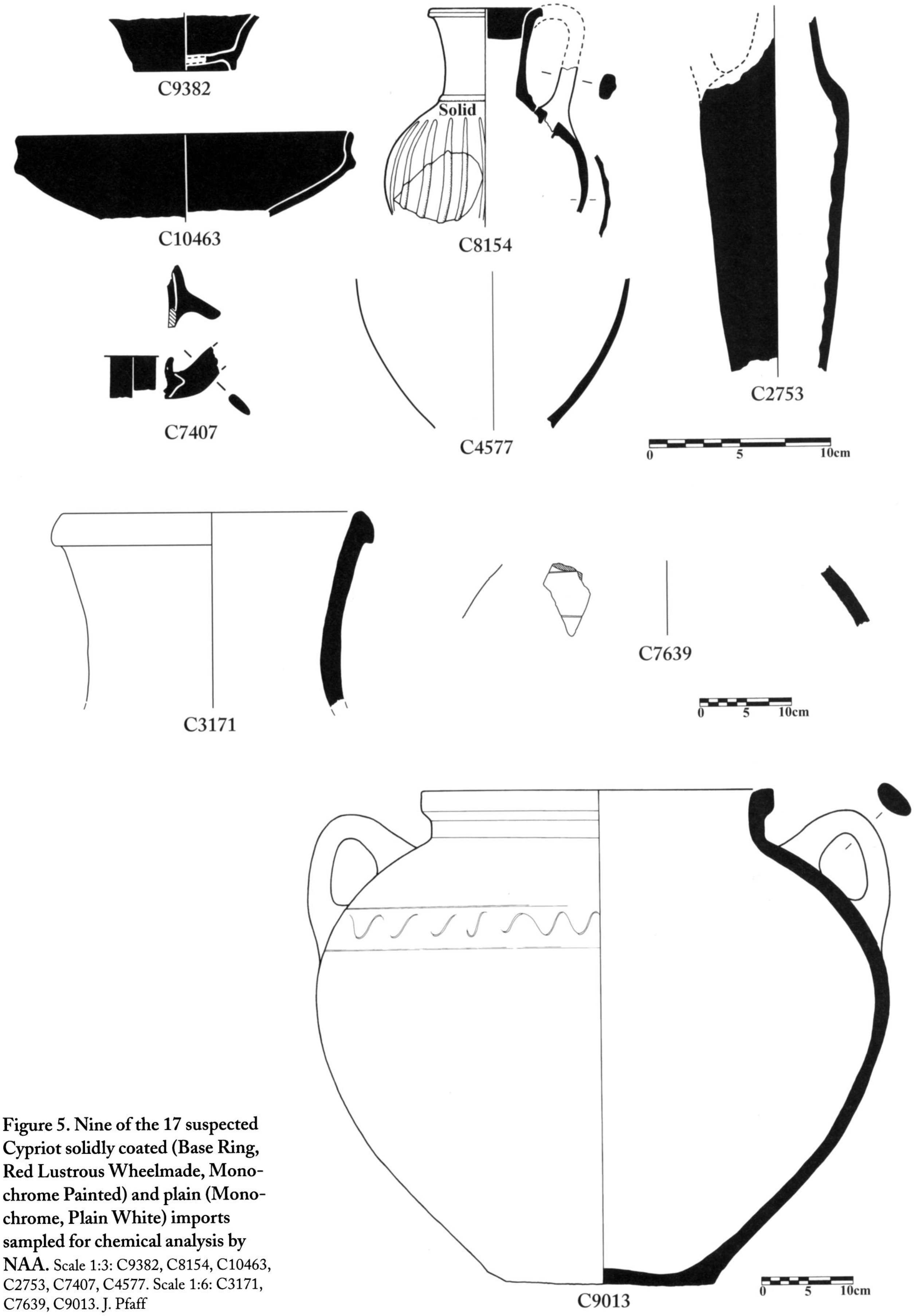



**Figure 5. Nine of the 17 suspected Cypriot solidly coated (Base Ring, Red Lustrous Wheelmade, Monochrome Painted) and plain (Monochrome, Plain White) imports sampled for chemical analysis by NAA.** Scale 1:3: C9382, C8154, C10463, C2753, C7407, C4577. Scale 1:6: C3171, C7639, C9013. J. Pfaff

## TABLE 2. SUSPECTED CYPRIOT IMPORTS SAMPLED BY NAA IN 1996

| *Kommos Inv. No.* | *Shape, Ware [Date]** | *Publications* | *Suggested Provenience* | *Comments* |
|---|---|---|---|---|
| C335 | Milk bowl, White Slip II [LM III] | *Kommos* III, p. 159, no. 1946, fig. 70, pl. 51 | Limassol area | |
| C340 | Milk bowl, White Slip II [LM IIIA1] | *Kommos* III, p. 157, no. 570 | Limassol area | |
| C344 | Milk bowl, White Slip IIA [LM III] | *Kommos* III, p. 159, no. 1947, pl. 54 | Episkopi area | Associated only; one of just two examples of White Slip IIA at Kommos [also C4127] |
| C665 | Milk bowl, White Slip II [LM IIIA] | *Kommos* III, p. 158, no. 1938, fig. 70, pl. 52 [mislabeled "1954"] | Limassol area | |
| C993 | Milk bowl, White Slip II [LM IIIA2] | *Kommos* III, p. 158, no. 1936, pls. 51, 52 | Limassol area | |
| C1052 | Shallow bowl, Base Ring I(?) [LM IIIA2] | *Kommos* III, p. 158, no. 1937, pl. 52 | Episkopi area | |
| C1262 | Milk bowl, White Slip II [LM IIIB] | *Kommos* III, p. 159, no. 985, pl. 52 | Limassol area | |
| C1981 | Milk bowl, White Slip II [LM IIIA] | *Kommos* III, p. 158, no. 1939, pl. 52 | Limassol area | Associated only |
| C1982 | Milk bowl, White Slip II [LM IIIA] | *Kommos* III, p. 158, no. 1940, pl. 52 | Limassol area | Associated only |
| C2046 | Milk bowl, White Slip II [LM IIIA1] | *Kommos* III, p. 157, no. 1935, pls. 52, 53 | Limassol area | |
| C2141 | Milk bowl, White Slip II [LM IIIB] | *Kommos* III, p. 159, no. 1698, pls. 52, 54 | Limassol area | |
| C2753 | Spindle bottle, Red Lustrous Wheelmade | *Kommos* III, p. 156, no. 278, fig. 70, pl. 51; Rutter 2006a, pp. 460–461, no. 40/35, pl. 3:45 | Unprovenienced | |
| C3156 | Milk bowl, White Slip II [LM IIIA2] | *Kommos* III, pp. 157–158, no. 873, pl. 52 | Limassol area | |
| C3171 | Pithos, Plain White [LM IIIA2] | *Kommos* III, p. 158, no. 846, fig. 70, pl. 52 | Limassol area | |
| C3218 | Milk bowl, White Slip II [LM IIIA2 Early] | *Kommos* III, p. 157, no. 1931, pl. 51; Rutter 2006a, p. 495, no. 48/3, pl. 3:53 | Limassol area | Associated only |
| C3249 | Milk bowl, White Slip II [LM IIIA] | *Kommos* III, p. 158, no. 1941, pl. 52 | Limassol area | Associated only |
| C3681 | Milk bowl, White Slip II [LM IIIA2–B] | *Kommos* III, p. 159, no. 1944, pl. 51 | Limassol area | |
| C3729 | Milk bowl, White Slip II [LM IIIA] | *Kommos* III, p. 157, no. 808, pl. 51 | Limassol area | |
| C3947 | Milk bowl, White Slip II [LM IIIA2–B] | *Kommos* III, p. 158, no. 935, pl. 51 | Limassol area | |
| C4127 | Milk bowl, White Slip IIA [LM IIIB] | *Kommos* III, p. 159, no. 1340, pl. 52; Rutter 2006a, p. 547, no. 60/32, pl. 3:73 | Limassol area | Associated only; one of just two examples of White Slip IIA at Kommos [also C344] |
| C4143 | Pithos, Plain White [LM IIIB] | *Kommos* III, p. 168, no. 1099, pl. 50 | Kition area | Associated only |
| C4249 | Milk bowl, White Slip II [LM IIIA1] | *Kommos* III, p. 157, no. 1932, pl. 51 | Limassol area | Associated only |
| C4432 | Milk bowl, White Slip II [LM IIIA1] | *Kommos* III, p. 157, no. 1933, pl. 52 | Limassol area | |
| C4577 | Bowl, Monochrome [LM IIIA2 Early] | *Kommos* III, pp. 156–157, no. 1930, pl. 51; Rutter 2006a, p. 578, no. MI/Cy/9, pl. 3:89 | Chania/western Crete | |
| C4734 | Juglet, Cretan Fine Gray Wheelmade | *Kommos* III, p. 157, no. 803, fig. 76, pl. 53; Rutter 2006b, p. 678 | Central Crete | Recognized at the time of sampling as a Gray ware rather than Base Ring juglet, hence probably Minoan rather than Cypriot |

TABLE 2—*Continued*

| *Kommos Inv. No.* | *Shape, Ware [Date]** | *Publications* | *Suggested Provenience* | *Comments* |
|---|---|---|---|---|
| C4773 | Milk bowl, White Slip II [LM IIIA1] | *Kommos* III, p. 157, no. 1934, pl. 53 | Limassol area | Associated only |
| C5122 | Milk bowl, White Slip II [LM IIIA2] | *Kommos* III, p. 157, no. 847, pl. 52 | Limassol area | |
| C5596 | Milk bowl, White Slip II [LM IIIA] | *Kommos* III, p. 158, no. 1942, pl. 52 | Limassol area | |
| C5645 | Milk bowl, White Slip II [LM IIIA2] | *Kommos* III, p. 158, no. 1943, pl. 51; Rutter, forthcoming, no. X10:2/1 | Limassol area | |
| C5731 | Jug, western Anatolian Reddish-Brown Burnished [LM IIIA1] | *Kommos* III, p. 164, no. 814, pls. 53, 56; Rutter 2006b, p. 659 | Unprovenienced | Recognized some time after the sampling of 1996 as a misfired example of a relatively common class of jugs imported from western Anatolia (Rutter 2006b) |
| C5770 | Pithos, Plain White [LM IIIA] | *Kommos* III, p. 157, no. 807 | Kition area | Associated only |
| C6743 | Milk bowl, White Slip II [LM IIIB] | *Kommos* III, p. 159, no. 1945; Rutter 2006a, p. 547, no. 60/31, pl. 3:73 | Limassol area | |
| C7237 | Jug, Monochrome Painted [MM IIB] | For the context, Van de Moortel 2006, pp. 282–284, group Ba. | Unprovenienced | Identified as a possible off-island import from a Protopalatial context predating Building AA (Watrous 1985, p. 7) |
| C7238 | Jug, Coarse Monochrome Painted [MM IIB] | For the context, Van de Moortel 2006, pp. 282–284, group Ba. | Chania/west Crete | Identified as a possible off-island import from a Protopalatial context predating Building AA (Watrous 1985, p. 7) |
| C7239 | Closed shape, Coarse Monochrome Painted [MM IIB] | For the context, Van de Moortel 2006, pp. 282–284, group Ba. | Chania/west Crete | Associated only; identified as a possible off-island import from a Protopalatial context predating Building AA |
| C7407 | Carinated cup, Base Ring II [LM IIIA2 Early] | Rutter 2006a, p. 578, no. MI/Cy/2, pl. 3:89 | Episkopi area | Associated only |
| C7639 | Canaanite jar, medium coarse unpainted [LM IIIA2 Early] | Rutter 2006a, p. 504, no. 52g/2, pl. 3:57 | Unprovenienced | Recognized following sampling in 1996 as an example of a standard Canaanite jar fabric quite common at Kommos |
| C8154 | Juglet, Base Ring II [LM IIIA2] | Rutter 2006a, p. 528, no. 56e/10, pl. 3:61 | Episkopi area | Together with C10463, part of possible pair of jug plus drinking cup, both found in Building P |
| C9013 | Pithos, Plain White [LM IIIA2] | Rutter 2006b, p. 657; forthcoming, no. X4:2/17 | Enkomi | |
| C9382 | Carinated cup, Base Ring II [LM IIIA2] | Rutter 2006b, p. 657; forthcoming, no. X6:6/4 | Episkopi area | Associated only; together with C12031 (not sampled), part of possible pair of jug plus drinking cup both found in House X |
| C9567 | Milk bowl, White Slip II [LM IIIA] | Rutter, forthcoming, no. X16:Misc./1 | Limassol area | |
| C9612 | Milk bowl, White Slip II [LM IIIA] | Rutter, forthcoming, no. X15:Misc./1 | Limassol area | |
| C9990 | Milk bowl, White Slip II Late [Historic] | Rutter 2006a, p. 578, no. MI/Cy/6, pl. 3:89 | Limassol area | Unique example of White Slip II Late at Kommos |
| C10034 | Milk bowl, White Slip II [LM IIIA2] | Rutter 2006a, p. 578, no. MI/Cy/7, pl. 3:89 | Limassol area | |
| C10111 | Milk bowl, White Slip II [LM IIIA] | Rutter 2006a, p. 578, no. MI/Cy/8, pl. 3:89 | Limassol area | |
| C10209 | Tankard, White Painted Wheelmade I [LM IIIB] | Rutter 2006b, p. 655; forthcoming, no. X3:7/9 | Enkomi | Association is with a very diffuse group and is not at all close, so the connection with Enkomi is unlikely to be significant |
| C10366 | Tankard, White Painted Wheelmade I [LM IB Late] | Rutter 2006b, p. 655; forthcoming, no. X3:4/6 | Enkomi | Association is with a very diffuse group and is not at all close, so the connection with Enkomi is unlikely to be significant |
| C10463 | Carinated cup, Base Ring II [LM IIIA2] | Rutter 2006a, p. 524, no. 56b/5, pl. 3:59 | Episkopi area | Together with C8154, part of possible pair of jug plus drinking cup, both found in Building P |

* The date is assigned according to the Minoan context of discovery.

spheres, but at the time of sampling, the pieces selected were considered broadly representative, both typologically and chronologically, of the vessels imported to Kommos from their respective regions of production. The principal purpose of the provenience analyses was to determine whether any noteworthy spatial or temporal patterns in the importation of either tablewares or transport vessels from these two distinct cultural spheres could be detected.

During the eight years that elapsed between the sampling in 1996 and the completion of analyses in 2004, the numbers of imports identified on stylistic grounds, especially from Cyprus, increased substantially, thanks to the visits paid to the Pitsidia apothiki by scholars having greater familiarity with the wares in question.[12] One unfortunate consequence of this rise in the number of recognized imports has been that two categories of what are now considered Cypriot imports were inadequately sampled, if sampled at all, in 1996. The first is a series of Red Slip or Proto Base Ring jugs from LM IA Final to LM IB Early contexts,[13] and the second includes Plain White shapes other than pithoi from LM IB through LM IIIB contexts.[14]

A comparatively recent and more favorable development has been the proliferation of programs of provenience analysis directed specifically at Mycenaean ceramic imports from an increasingly wide range of sites in the eastern Aegean, Cyprus, Syria, Israel, and Egypt.[15] It is now possible, therefore, to compare the types of ceramics that were sent to southern Crete from various regions of the Mycenaean cultural sphere with those that were sent to other regions of the eastern Mediterranean in a way that would not have been possible when the samples were initially selected and analyzed.

A further aim of this NAA project may be characterized as a check on the reliability of the identification of imports and their assignment to specific regions of production outside of Crete. The suspected Mycenaean imports that were sampled are listed in Table 1 and the suspected Cypriot imports in Table 2, along with their assignments after the NAA analysis. A small number of the pieces sampled in 1996 were already considered on stylistic or technological grounds to be uncertainly identified as imports from the production zones to which they had been attributed, notably juglet C4734 and Protopalatial fragments C7237, C7238, and C7239 (Table 2; see Fig. 12, below). A few additional pieces were subsequently recognized for similar reasons to have been erroneously identified as either Mycenaean (Table 1: C7643; Figs. 3, 6) or Cypriot (Table 2: C5731, C7639 [Fig. 5]) products. The results of the present analysis are rather sobering, in that the accuracy of the Mycenaean identifications in 1996 is shown to have been in the 70%–85% range and that of the Cypriot identifications in the 83%–88% range. The overall accuracy of roughly 80% (55 of 69) is discussed at greater length in the concluding section of this paper.

12. Rutter 2006b, p. 712, n. 215. Of particular assistance with respect to the Cypriot material were Celia Bergoffen, Linda Hulin, Vassos Karageorghis, and Sturt Manning.

13. Rutter 2006b, p. 654, table 3:104, p. 656.

14. Rutter 2006b, p. 655, table 3:105, p. 656.

15. Mommsen, Hertel, and Mountjoy 2001; Mountjoy and Mommsen 2006 (Troy); Niemeier 2002a, 2002b, 2002c (Miletos and Ephesos); Karantzali and Ponting 2000; Marketou et al. 2006 (Rhodes); Mommsen and Sjöberg 2007 (Cyprus); Badre et al. 2005 (Tell Kazel); Gunneweg et al. 1992; Yellin and Maeir 1992 (Tell Dan); Mommsen et al. 1992 (Tell el-Amarna); Mountjoy and Mommsen 2001 (Qantir-Piramesse). A more comprehensive examination of imported Mycenaean pottery from numerous sites in Israel is currently under way as a collaborative effort by Sharon Zuckerman, David Ben-Shlomo, Penelope Mountjoy, and Hans Mommsen; see Zuckerman et al. 2009.

## CHEMICAL ANALYSIS

Appendix Table A lists the results of neutron activation analysis of 69 pottery samples found at Kommos, including multiple analyses of five sherds. All but one of the 69 samples were clipped from sherds at the site. The exception was C3947, which was drilled with a diamond-tipped drill on site. The other 68 sherds had their surface removed using a diamond-tipped drill head, and then the core of the sample was crushed using an agate pestle and mortar. The powder was dried for 24 hours at 150°C. An accurately weighed amount (approximately 200 mg) of the powder was put into a plastic tube that was then heat-sealed. The samples were irradiated twice in the Imperial College reactor at Ascot at a neutron flux of $\sim 1 \times 10^{12}$ n $cm^{-2}$ $s^{-1}$. Podmore red standard clay was used to determine the precise concentrations.

The duration of the first irradiation was 90 seconds per sample, and 20 minutes later the samples were counted on gamma ray spectrometers for 5 minutes. The element concentrations determined from the short irradiation were aluminum (Al), potassium (K), calcium (Ca), titanium (Ti), vanadium (V), manganese (Mn), and dysprosium (Dy). The second irradiation lasted approximately seven hours, and five to seven days later the samples were counted for 30 minutes. Two to three weeks after irradiation, they were counted for two hours. Comparing the gamma peak areas of the Podmore standards with the ceramic sample peak areas, concentrations were obtained for the following elements: sodium (Na), scandium (Sc), chromium (Cr), iron (Fe), cobalt (Co), rubidium (Rb), cesium (Cs), lanthanum (La), cerium (Ce), samarium (Sm), europium (Eu), ytterbium (Yb), lutetium (Lu), tantalum (Ta), hafnium (Hf), and thorium (Th). Since the Ascot reactor's flux is only a third of that of the Universities Research Reactor at Risley, Warrington, which had been used for the analysis of the comparative material presented in Appendix Table B, it was not possible to measure uranium because the peak area was too small.

Altogether 23 elements were measured. After comparing data analyzed on both the Risley and Ascot reactors, however, it was found that concentration data for Yb, Lu, and Ta obtained at Ascot were unreliable. These elemental concentrations have been omitted, therefore, from the presentation of the analytical results in Appendix Table A and should be used with great caution in statistical analyses.[16]

## STATISTICAL EVALUATION

Since all of the sherds analyzed are presumed to be imports to Kommos, no statistical analyses were carried out to look for chemical groups within the dataset. Rather, the Mahalanobis procedures in the MANHATTAN (MAHALA) program were used to compare the chemical profiles of the 69 sherds with the 123 chemical reference groups in the Manchester-Berkeley

16. The raw data are included in an archive of all NAA data generated by the University of Manchester on the website of the Archaeometry Laboratory, Missouri University Research Reactor. The archive is freely available for download from http://archaeometry.missouri.edu/datasets/uman/index.html.

TABLE 3. CHEMICAL REFERENCE GROUPS

| *Region* | *Sites/Areas Represented* | *Groups* |
|---|---|---|
| Attica | Perati | 1 |
| Boiotia | Eutresis, Gla, Kallithea, Tanagra, Thebes | 3 |
| Argolid-Corinthia | Asine, Berbati, Korakou, Mycenae, Tiryns, Tsoungiza, Zygouries | 36 |
| Peloponnese (other) | Achaia, Ayios Stephanos, Chora Ano Englianos, Menelaion, Nichoria, Olympia-Kolosakos, Palaiokastro, Peristeria, Platanos-Renia | 21 |
| Crete | Chania, Knossos, Kommos, Palaikastro, Phaistos, Pseira | 31 |
| Cyprus | Akhera, Arpera, Enkomi, Episkopi Phaneromeni, Hala Sultan Tekke, Kalavasos Ayios Dimitrios, Kition, Maa Palaiokastro, Maroni Tsarroukas, Pyla Verghi | 20 |
| Levant | Lachish, Tell Abu Hawam | 11 |

database, listed in Table 3.[17] Data for all elements common to both sample and group were used in each statistical evaluation.[18]

For the MANHATTAN program, groups are predefined (by cluster analysis in this case) in terms of the mean and standard deviation of each element. For each sample compared against a particular reference group, the Manhattan distance to the center of that group is defined in units of standard deviation ($\sigma$) of each of the elements concerned.

The procedure that was used for establishing the chemical groups in the present study was as follows. First, a chemical grouping was identified by cluster analysis. Its group membership was then refined by considering the standard deviations of the group's elements as each sample in turn was removed from the group. If the removal of a particular sample from a group led to an overall increase in the standard deviations of that group (i.e., the group became more diffuse when the sample was removed), then the sample was in fact considered a member of that group and was returned to it. If, in contrast, the removal of the sample resulted in an overall decrease in standard deviations (i.e., the group became tighter upon removal of the sample), then the sample was indeed excluded from the group in question.

Since experience has shown that the sample members of a chemical reference group have a total distance to the group center less than the number of elements used in the comparison (i.e., an average of up to 1 $\sigma$ per element), then it follows that when comparing samples of unknown provenience against a group, a sample is deemed to "fit" with the group if

17. Attica: Tomlinson 1995b; Boiotia: Tomlinson 1998, 2000; Argolid-Corinthia: Tomlinson 1995a, 1996; French and Tomlinson 1999; Hoffmann et al., forthcoming; Tomlinson, forthcoming; Peloponnese (other): Hoffmann, Robinson, and French 1992; Tomlinson 1997; French et al. 2008; Jones and Tomlinson 2009; Crete: Tomlinson 1991; Tomlinson and Robinson, in prep.; Cyprus: Bryan et al. 1997; Levant: Hoffmann and Robinson 1993; Tomlinson 2004.

18. The number of elements in common varies from 21 to 23, depending on the dataset.

its average distance (d) from the group center in question is less than 1 σ. A sample is deemed to "associate" with a group if its d is greater than 1 σ but less than 1.5 σ.[19]

While the average d values are a very useful indicator, one must also consider the individual values for each element. A sample that seems to associate (rather than fit) with a group may do so because, for example, two of the elemental values lie a long way from the group mean, whereas all other values are very close to their respective mean. In this case, it may be that these two values are spurious for some reason, and that the sample should actually be considered a group member.

Thus, it is important to look not only at the average d values, but also at the individual d values. Mathematically, in a normal distribution, 68% of the data points lie within one standard deviation of the mean value, and only 5% lie beyond two standard deviations. Therefore, for a group comprising 24 samples, for which 24 elements have been measured, the concentrations for each element in 16 of the 24 samples (68%) would fall within 1 σ of the group mean value, while the concentrations of one or two (5%) samples would fall outside 2 σ for that element. From another perspective, we would also expect each of the 24 samples to have concentrations falling within 1 σ of the group mean for 16 of its elements, and for only one or two of its elemental values to be more than 2 σ from the mean.

The results of a comparison of a sample with a group are displayed by the MANHATTAN program not only as the individual d values for each element, but also as the average d value alongside an indication of the distribution of the individual elemental values. The latter is given in the form *x/y*, indicating that *x* elemental values are within 1 σ of the group mean and *y* lie beyond 2 σ of the mean. Thus, an average group member might have an *x/y* value of 16/2, while a group member close to the center of the group might have a value of 24/0, and another close to the edge of the group might have a value such as 13/2.

Some of the reference groups are notably more diffuse than the majority, that is, their standard deviations are generally somewhat larger than normal. Since any individual sample will associate much more readily with a diffuse group (because the standard deviations are larger, the group extends over a larger volume of hyperspace), associations with such groups are likely to be less meaningful than with "normal" (less diffuse) groups. Thus, the size of the standard deviation as a percentage of the mean (sometimes referred to as the coefficient of variation) must also be considered when evaluating the fits and associations indicated by the d values. Appendix Table B lists the chemical profiles of the 19 groups with which at least one Kommos sample fits. For the normal groups listed in the first section of the table, the average percentage standard deviation falls between 7.8% and 13.9%. For the diffuse groups listed in the second section, the values range from 18.1% to 29.9%.

19. This term is used to indicate a sample occupying an area of hyperspace close to the group in question, i.e., a sample whose chemistry is quite similar to the group's chemistry. Of course, a particular sample may thus associate with several different chemical groups which, while separable, have similar chemistry.

## RESULTS OF THE ANALYSIS

Tables 4 and 5 list for each Kommos sample the chemical groups for which its average distance (d) from the group center in question is less than 1.5 σ. The chemical groups are broken down into the categories of normal and diffuse on the basis of how tightly the samples forming the group in question are clustered within that group (see Appendix Table B). The degree to which each sample is related to a particular group is described according to two different thresholds of correspondence, fitting (with a d value of less than 1.0 σ) and associating (with a d value of between 1.0 and 1.5 σ).

### TABLE 4. RELATIONSHIPS BETWEEN SUSPECTED MYCENAEAN SAMPLES AND CHEMICAL REFERENCE GROUPS: MANHATTAN DISTANCES

| *Sample* | *Normal Groups* | | *Diffuse Groups* | |
|---|---|---|---|---|
| | *Fits (d<1.0 σ)* | *Associates (d<1.5 σ)* | *Fits (d<1.0 σ)* | *Associates (d<1.5 σ)* |
| C1473 | Chania 4 (0.72) | Kommos 1 (1.29)<br>Pseira 1 (1.39)<br>Tsoungiza 5 (1.43)<br>Lachish (1.48) | MycSJ B (0.65)<br>Cyprus 15 (0.86) | |
| C1771 | Cyprus 2 (0.58)<br>Hawam G (0.83)<br>Asine 1 (0.94)<br>MycLF 1 (0.95) | Lachish (1.01)<br>MycWH 2 (1.04)<br>Thebes B (1.07)<br>Mycenae 2 (1.16)<br>Zygouries 2 (1.20)<br>Menelaion 4 (1.32)<br>Chania M4 (1.49) | | Cyprus 15 (1.29) |
| C2058a | | Peloponnese 3 (1.25)<br>MycLF 1 (1.28)<br>MycWH 1 (1.36)<br>Mycenae 1 (1.40)<br>Cyprus 2 (1.43)<br>Menelaion 7 (1.45) | | |
| C2058b | | | | |
| C2140 | Cyprus 2 (0.67)<br>MycLF 1 (0.98) | MycWH 2 (1.10)<br>Menelaion 4 (1.17)<br>Hawam G (1.18)<br>Asine 1 (1.22)<br>Peloponnese 2 (1.25)<br>Lachish (1.26)<br>Tiryns 1 (1.45) | | Cyprus 15 (1.46) |
| C2424 | | Lachish (1.20)<br>Gla (1.23)<br>Pseira 1 (1.23) | | Cyprus 15 (1.01)<br>MycSJ B (1.09) |
| C2949 | Lachish (0.54)<br>Cyprus 2 (0.79)<br>Hawam I (0.96)<br>MycLF 3 (1.00) | Chania M4 (1.16)<br>Zygouries 3 (1.19)<br>Peloponnese 5 (1.21)<br>Berbati 2 (1.26)<br>Asine 1 (1.34)<br>Menelaion 4 (1.38)<br>Kommos 1 (1.48) | MycSJ B (0.86) | Cyprus 15 (1.21) |
| C3346 | | MycLF 1 (1.13)<br>Peloponnese 2 (1.24) | | |
| C3896 | Chania 4 (0.75) | Knossos M3 (1.20)<br>Lachish (1.24)<br>Kommos 2 (1.27) | MycSJ B (0.83) | Cyprus 18 (1.25) |

TABLE 4—*Continued*

| | *Normal Groups* | | *Diffuse Groups* | |
|---|---|---|---|---|
| *Sample* | *Fits (d<1.0 σ)* | *Associates (d<1.5 σ)* | *Fits (d<1.0 σ)* | *Associates (d<1.5 σ)* |
| C3897 | Lachish (0.72)<br>Cyprus 2 (0.78) | MycLF 2 (1.13)<br>Peloponnese 4 (1.32)<br>Menelaion 4 (1.39)<br>Pseira 1 (1.39)<br>Chania M4 (1.40) | | MycSJ B (1.16)<br>Cyprus 15 (1.33) |
| C4271 | Cyprus 2 (0.73) | MycLF 1 (1.02)<br>Lachish (1.02)<br>MycWH 2 (1.17)<br>Menelaion 4 (1.21)<br>Peloponnese 2 (1.32)<br>Hawam G (1.41)<br>Zygouries 2 (1.46) | | |
| C4693 | MycLF 1 (0.87) | Cyprus 2 (1.07)<br>Peloponnese 2 (1.14)<br>Hawam (1.26)<br>Menelaion 4 (1.27)<br>Berbati 1 (1.28)<br>Lachish (1.28)<br>Zygouries 1 (1.41)<br>MycWH 4 (1.44) | | |
| C5425 | | Lachish (1.05)<br>Chania M4 (1.13)<br>Cyprus 2 (1.19)<br>Kommos 1 (1.43)<br>Pseira 1 (1.45) | | MycSJ B (1.09)<br>Cyprus 15 (1.19) |
| C5819 | | Cyprus 2 (1.16)<br>MycLF 1 (1.18)<br>MycWH 1 (1.46) | | |
| C6709 | Lachish (0.97) | Cyprus 2 (1.00)<br>Gla (1.14)<br>Menelaion 4 (1.41) | | MycSJ B (1.29)<br>Cyprus 15 (1.38) |
| C6912 | | MycLF 1 (1.02)<br>Peloponnese 2 (1.16)<br>Cyprus 2 (1.24)<br>Menelaion 7 (1.30) | | |
| C6919 | | | | MycSJ A2 (1.33) |
| C7116 | | MycLF 1 (1.18)<br>Cyprus 2 (1.39)<br>Peloponnese 2 (1.46)<br>Menelaion 4 (1.48) | | |
| C7636 | | Cyprus 2 (1.15)<br>MycLF 1 (1.25)<br>Peloponnese 2 (1.29)<br>Menelaion 4 (1.34)<br>Lachish (1.38) | | |
| C7643 | | Pseira 2 (1.40) | | MycSJ B (1.43) |
| C7876 | Cyprus 2 (0.85) | Peloponnese 3 (1.10)<br>Menelaion 4 (1.21)<br>Lachish (1.24)<br>MycLF 1 (1.33)<br>Gla (1.36)<br>Pseira 1 (1.49) | | MycSJ B (1.32) |
| C9126 | | | | |

Abbreviations: MycLF = Mycenae fabric samples; MycSJ = Mycenae stirrup jars; MycWH = Mycenae West House.

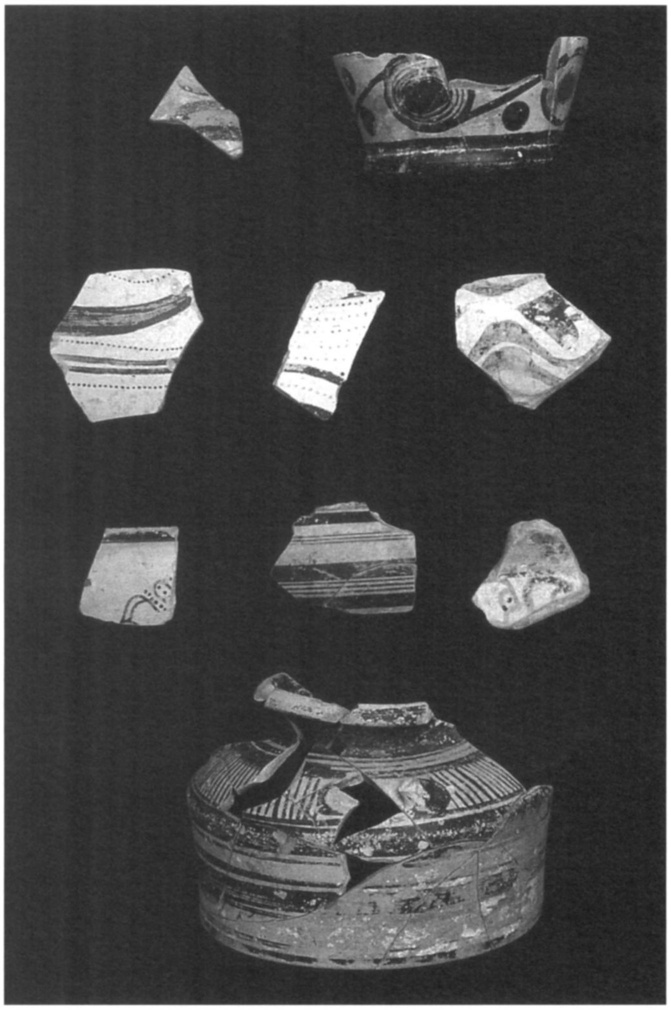


**Figure 6. Suspected Mycenaean imports C6912, C3346, C6919, C7116, C7643, C4693, C2949, C9126, C7636.** For scale, see Figure 3. Photo T. Dabney

## Mycenaean Samples

Of the 21 pieces analyzed that were thought to be Mycenaean, 15 are related to Argolid groups and three to Crete, while the other three pieces are unprovenienced (Tables 1, 4).

*Argolid.* Related to groups displaying chemistry typical of the Argolid, whether from findspots in the Argolid or elsewhere, are LH I Vapheio cups C3346 and C6912 and LH IIA piriform jar C7116 (Figs. 3, 6); LH IIB goblet C5819 (Fig. 3); LH IIIA1 goblet C2058; LH IIIA2 angular alabastron C7636, kylix C4693, and stirrup jar C2949 (Figs. 3, 6); LH IIIA2/B bowl C4271 and* piriform jar C5425; and LH IIIB deep bowl C6709 (Fig. 3), stemmed bowls C2140 and C7876 (Fig. 3), and stirrup jars C1771 (Fig. 3) and C3897.[20]

20. Eight samples actually fit with groups of Argolid provenience (C4693, C2949, C4271, C6709, C2140, C7876, C1771, C3897; with closest d from 0.54 to 0.97). The other seven samples merely associate with Argolid groups (C3346, C6912, C7116, C2058, C7636, C5819, C5425; with closest d from 1.02 to 1.28). Piriform jar C5425 also shows associations with some central Cretan groups, but its associations with Argolid groups are closer. Goblet C2058 has its closest association with a group of sherds from the northwest Peloponnese. As this group's chemistry is quite similar to that of the Argolid (see Tomlinson 1997), however, and as this sample also shows associations with Argolid groups, its provenience is most likely Argolid.

*Central Crete.* Related to central Crete are the LH IIIB stirrup jars C1473 and C3896. The LM II pyxis C7643 (Figs. 3, 6) is identified as being of possible Cretan origin.[21]

*Unprovenienced.* The three unprovenienced samples are LH IIA bridge-spouted jug C6919 and LH IIIA2/B amphoroid (chariot) krater C9126 (Figs. 3, 6), and the LH IIIC Early stirrup jar C2424 (Fig. 3).[22]

## Cypriot Samples

Of the 48 pieces analyzed that were thought to be Cypriot, 40 are related to Cypriot groups, four to Crete, and four are unprovenienced (Tables 2, 5).

*Cyprus.* Related to the groups from the Limassol area are all 26 White Slip II milk bowls, 11 of which are illustrated here (see Figs. 4, 7, 8). The

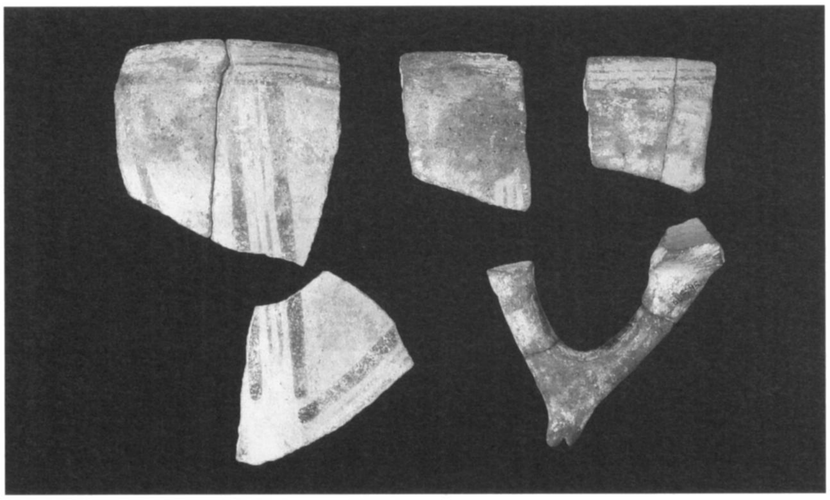


**Figure 7. Cypriot White Slip II Late milk bowl C9990.** For scale, see Figure 4. Photo T. Dabney

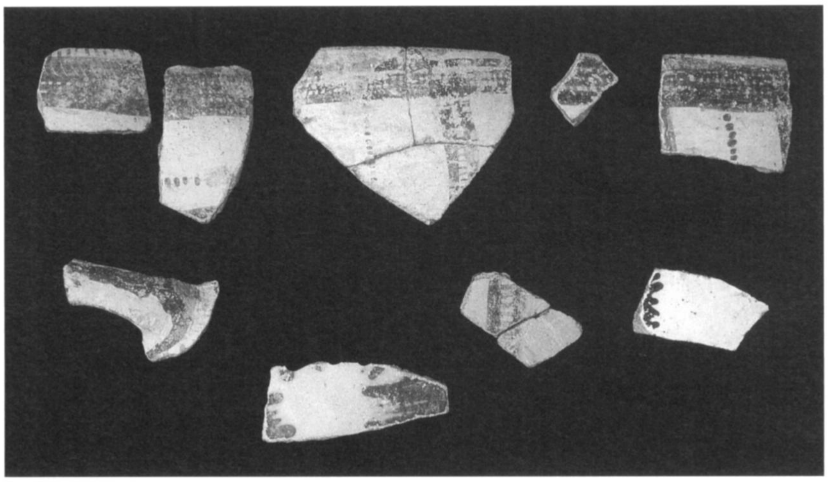


**Figure 8. Cypriot White Slip II and White Slip IIA (C4127) milk bowls C10034 (2 fragments), C6743, C9567, C3218, C9612, C5645, C10111, C4127.** For scale, see Figure 4. Photo T. Dabney

21. Both stirrup jars fit with a group of transport stirrup jars found at Chania but of central Cretan provenience. The pyxis associates (d = 1.40) only with a group of eight fine ware vessels from Pseira.

22. Amphoroid krater C9126 shows no associations whatsoever. The bridge-spouted jug C6919 displays only a single association (d = 1.33) with a diffuse group of transport stirrup jars found at Mycenae but of (most likely central) Cretan origin (see Tomlinson 1995a). Stirrup jar C2424 shows associations with groups from the Argolid (d = 1.20), Boiotia (d = 1.23), and central Crete (d = 1.23), indicating ambiguity at the very least.

## TABLE 5. RELATIONSHIPS BETWEEN SUSPECTED CYPRIOT SAMPLES AND CHEMICAL REFERENCE GROUPS: MANHATTAN DISTANCES

| | *Normal Groups* | | *Diffuse Groups* | |
|---|---|---|---|---|
| *Sample* | *Fits (d<1.0 σ)* | *Associates (d<1.5 σ)* | *Fits (d<1.0 σ)* | *Associates (d<1.5 σ)* |
| C335 | | | Cyprus 11b (0.66)<br>Hawam B (0.80) | CypHMB (1.36) |
| C340 | | | Cyprus 11b (0.74)<br>Hawam B (0.76) | CypHMB (1.23) |
| C344 | | Cyprus 3 (1.28)<br>Chania M3 (1.39) | | MycSJ A2 (1.23) |
| C665a | | | Hawam B (0.84)<br>Cyprus 11b (0.85) | CypHMB (1.17) |
| C665b | | | | Hawam B (1.05)<br>Cyprus 11b (1.10)<br>CypHMB (1.29) |
| C993 | | | Cyprus 11b (0.84) | Hawam B (1.03)<br>CypHMB (1.44) |
| C1052 | Cyprus 3 (0.76) | | | MycSJ A2 (1.46) |
| C1262 | | | Cyprus 11b (0.86)<br>Hawam B (0.89) | CypHMB (1.19) |
| C1981 | | | | CypHMB (1.02)<br>Hawam B (1.14)<br>Cyprus 11b (1.21) |
| C1982 | | | | Hawam B (1.23)<br>CypHMB (1.36)<br>Cyprus 11b (1.37) |
| C2046 | | | Cyprus 11b (0.72)<br>Hawam B (0.77) | CypHMB (1.50) |
| C2141 | | | Cyprus 9 (0.86)<br>CypHMB (0.98) | Hawam B (1.14) |
| C2753 | | | | MycSJ A2 (1.50) |
| C3156 | | | Cyprus 11b (0.75)<br>Hawam B (0.89) | CypHMB (1.26) |
| C3171a | | | Cyprus 10 (0.72) | |
| C3171b | | | | Cyprus 10 (1.01) |
| C3171c | | | Cyprus 10 (0.56) | |
| C3171d | | | Cyprus 10 (0.83) | Cyprus 7 (1.49) |
| C3171e | | | Cyprus 10 (0.61) | |
| C3218 | | | | Cyprus 10 (1.09)<br>Cyprus 7 (1.47)<br>Hawam B (1.12) |
| C3249 | | | | Cyprus 9 (1.07)<br>CypHMB (1.13)<br>Hawam B (1.23) |
| C3681 | | | Hawam B (0.80)<br>Cyprus 11b (0.86) | CypHMB (1.19) |
| C3729 | | | Cyprus 11a (0.70) | CypHMB (1.25)<br>Hawam B (1.39) |
| C3947 | | | Cyprus 11b (0.84)<br>Hawam B (0.87) | CypHMB (1.25) |
| C4127 | | | | Hawam B (1.39)<br>Cyprus 11c (1.48) |
| C4143 | | | Cyprus 5 (0.98) | Cyprus 14 (1.37) |
| C4249 | | | | CypHMB (1.24)<br>Cyprus 11b (1.25)<br>Hawam B (1.32) |
| C4432 | | | Hawam B (0.67)<br>Cyprus 11b (0.87) | CypHMB (1.21) |

TABLE 5—*Continued*

| Sample | *Normal Groups* | | *Diffuse Groups* | |
|---|---|---|---|---|
| | *Fits (1.32)* | *Associates (d<1.5 σ)* | *Fits (d<1.0 σ)* | *Associates (d<1.5 σ)* |
| C4577 | | Chania M1 (1.10)<br>Chania B1 (1.39) | MycSJ A2 (0.80) | |
| C4734 | Chania 4 (0.75) | Phaistos (1.09)<br>Kommos 1 (1.15)<br>Lachish (1.19)<br>Knossos M2 (1.33)<br>Pseira 1 (1.35)<br>Hawam J (1.36)<br>Peloponnese 5 (1.43)<br>Cyprus 2 (1.49) | MycSJ B (0.70) | Cyprus 15 (1.06) |
| C4773 | | | | Cyprus 11b (1.05)<br>Hawam B (1.12) |
| C5122 | | | Cyprus 11b (0.97)<br>Hawam B (0.97) | CypHMB (1.26) |
| C5596 | | | Hawam B (0.61)<br>Cyprus 11b (0.88)<br>CypHMB (0.99) | |
| C5645 | | | Hawam B (0.91) | Cyprus 11b (1.14) |
| C5731 | | | | MycSJ A2 (1.21) |
| C5770a | | Kommos 3 (1.40) | Cyprus 5 (0.90) | Cyprus 13 (1.31)<br>MycSJ B (1.32) |
| C5770b | | Kommos 3 (1.20)<br>Tsoungiza 5 (1.39) | | Cyprus 5 (1.13)<br>Cyprus 15 (1.16)<br>MycSJ B (1.18) |
| C5770c | | | | Cyprus 5 (1.04)<br>MycSJ B (1.47) |
| C6743 | | | Hawam B (0.75) | Cyprus 11b (1.17) |
| C7237 | | | | |
| C7238 | | Chania B1 (1.23)<br>Chania M1 (1.23) | MycSJ A2 (0.87) | |
| C7239 | | Chania M2 (1.18) | | MycSJ B (1.06)<br>Cyprus 15 (1.26) |
| C7407 | | Chania M2 (1.12)<br>Menelaion 1 (1.13)<br>Cyprus 3 (1.18)<br>Peloponnese 10 (1.32)<br>Pseira 5 (1.41) | MycSJ A2 (0.85) | |
| C7639 | | | | |
| C8154 | Cyprus 3 (0.68) | Menelaion 1 (1.44) | MycSJ A2 (0.98) | |
| C9013a | | Chania M4 (1.13)<br>Kommos 2 (1.31) | MycSJ B (0.92)<br>Cyprus 15 (0.99) | Cyprus 4 (1.43) |
| C9013b | | Chania M4 (1.02)<br>Kommos 2 (1.18)<br>Pseira 1 (1.30)<br>Thebes A (1.45)<br>Knossos M1 (1.49) | Cyprus 15 (0.75)<br>MycSJ B (0.82) | Cyprus 4 (1.26) |
| C9013c | | Chania M4 (1.18)<br>Kommos 2 (1.38) | Cyprus 15 (0.82)<br>MycSJ B (0.94) | Cyprus 4 (1.39) |
| C9013d | | Kommos 2 (1.00)<br>Chania M4 (1.05)<br>Pseira 1 (1.12)<br>Knossos M1 (1.17)<br>Phaistos (1.42) | MycSJ B (0.74)<br>Cyprus 15 (0.75) | |
| C9382 | | Cyprus 3 (1.17) | | MycSJ A2 (1.18) |

*Continued on next page*

TABLE 5—*Continued*

| Sample | Normal Groups: Fits (d<1.0 σ) | Normal Groups: Associates (d<1.5 σ) | Diffuse Groups: Fits (d<1.0 σ) | Diffuse Groups: Associates (d<1.5 σ) |
|---|---|---|---|---|
| C9567 | | | Hawam B (0.84) | Cyprus 11b (1.20) |
| C9612 | | | Cyprus 11a (0.88)<br>Hawam B (0.94) | CypHMB (1.35) |
| C9990 | | | Cyprus 11b (0.67)<br>Hawam B (0.85)<br>CypHMB (0.97) | |
| C10034 | | | Hawam B (0.85) | Cyprus 11b (1.02)<br>CypHMB (1.26) |
| C10111 | | | Cyprus 11b (0.90)<br>Hawam B (0.98) | CypHMB (1.15) |
| C10209 | | Chania M4 (1.47) | | MycSJ B (1.41)<br>Cyprus 15 (1.43) |
| C10366 | | Chania M4 (1.48) | | MycSJ B (1.27)<br>Cyprus 15 (1.44) |
| C10463 | Cyprus 3 (0.68) | Menelaion 1 (1.44) | | MycSJ A2 (1.13) |

Abbreviations: CypHMB = Cypriot Handmade Burnished; MycSJ = Mycenae stirrup jars.

particular samples are C335 (Fig. 4), C340, C665 (Fig. 4), C993, C1262, C1981, C1982, C2046, C2141, C3156, C3218 (Figs. 4, 8), C3249, C3681, C3729, C3947, C4249, C4432, C4773, C5122, C5596, C5645, C6743, C9567, C9612, C10034, and C10111 (for the last six, see Figs. 4, 8), White Slip II Late milk bowl C9990 (Figs. 4, 7), and the Plain White pithos C3171 (Fig. 5).[23]

Related to a group from the Episkopi area are Base Ring I shallow bowl C1052, Base Ring II Bucchero juglet C8154 (Figs. 5, 9), three Base Ring II carinated cups (C7407, C9382, and C10463 [Figs. 5, 10]), and White Slip IIA milk bowl C344.[24] Related to a group from Kition are two Plain White pithoi (C4143, C5770).[25]

Related to a group from Enkomi is another Plain White pithos, C9013 (Figs. 5, 11).[26] Unknown, but apparently of Cypriot provenience, are White Slip IIA milk bowl C4127 (Figs. 4, 8) and the two White Painted Wheel-made I tankards C10209 and C10366 (Fig. 4).[27]

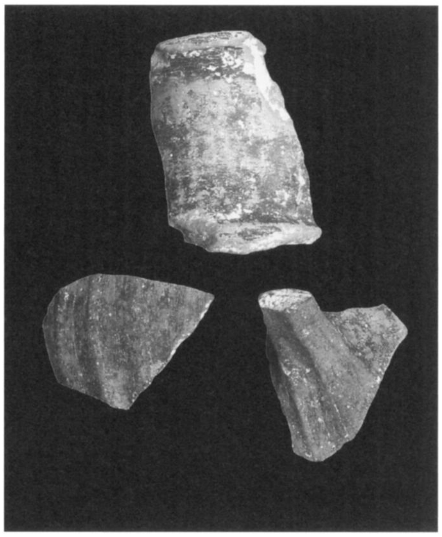
23. Four of the samples, White Slip II milk bowls C2141, C3218, and C3249 and the Plain White pithos C3171, are related to mixed ware groups from find sites in the Limassol region. The remaining 24 samples are related to groups of White Slip pottery from various Cypriot find sites but display chemical profiles most closely mirrored in the aforementioned Limassol groups (see Bryan et al. 1997). All of these groups are diffuse, but many of the samples fit closely with them.

24. All six samples are related to a group of Base Ring pottery found at various find sites but thought to originate in the Episkopi area (Bryan et al. 1997). The White Slip IIA milk bowl and two of the three carinated cups, C7407 and C9382, merely associate with the group, while the other three samples fit well with it.

25. The group is diffuse, and the fits are not especially close (d = 0.98, 0.90), so the samples should be regarded as merely associated.

26. The group is diffuse, but the sample fits well with it (d = 0.75). Note that the two White Painted Wheelmade I tankards (C10209 and C10366), which come from the same destruction horizon as the Plain White pithos, also show associations with this group. These samples, however, have d = 1.43 and 1.44 which, with a diffuse group, is not deemed significant. Their provenience thus remains unknown, though apparently Cypriot.

27. C4127 associates with one of the aforementioned White Slip groups. C10209 and C10366 associate with a group from Enkomi. As both groups are diffuse, however, the associations are not close (d = 1.48; d = 1.43, 1.44) and are not deemed significant.



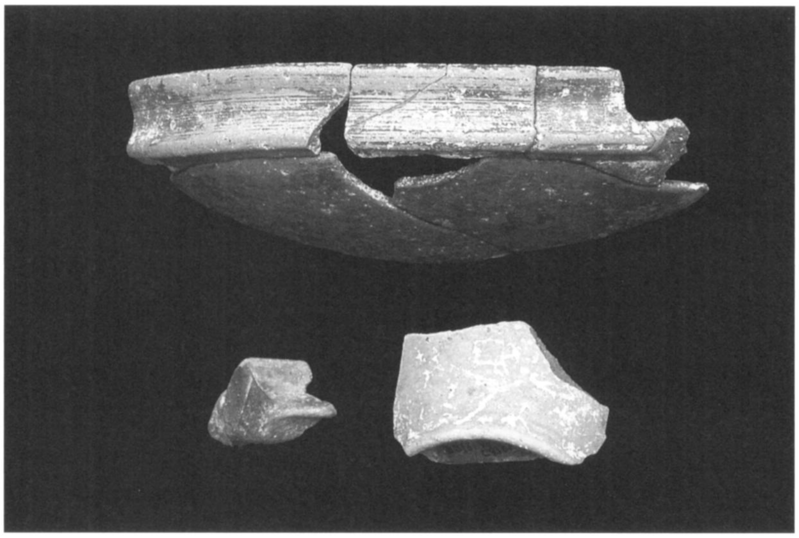


**Figure 9** ***(above, left)*****. Cypriot vertically ribbed Base Ring II juglet C8154.** For scale, see Figure 5. Photo T. Dabney

**Figure 10** ***(above, right)*****. Cypriot Base Ring II carinated cups C10463, C7407, C9382.** For scale, see Figure 5. Photo T. Dabney

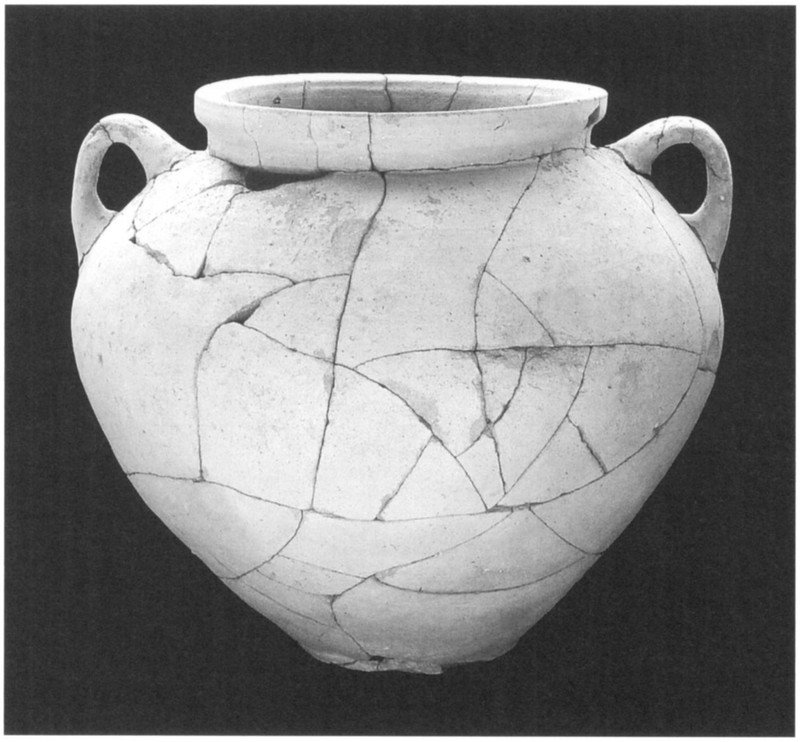


**Figure 11. Cypriot Plain White krater C9013.** For scale, see Figure 5. Photo T. Dabney

*Crete.* Related to western Crete are Monochrome bowl C4577 and two peculiar Protopalatial specimens, C7238 and C7239 (Fig. 12). Related to central Crete is the Fine Gray Wheelmade juglet C4734.[28]

28. The first three examples are associated with groups from Chania (nearest d from 1.10 to 1.23). The last, C4734, fits (d = 0.75) with a group of transport stirrup jars found at Chania but of central Cretan provenience (Tomlinson 1991; Tomlinson and Robinson, in prep.). It also shows associations (d from 1.09 to 1.33) with other central Cretan groups.

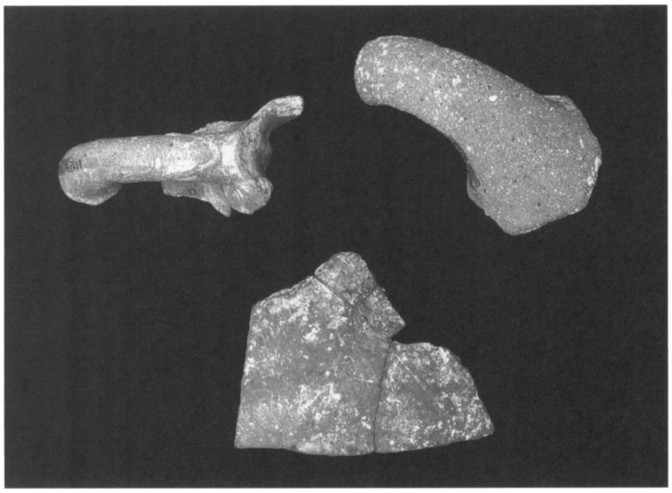


**Figure 12. Medium coarse to coarse Protopalatial (MM IIB) fragments originally identified as Cypriot imports: C7238, C7239, C7237.** Scale 1:3. Photo T. Dabney

*Unprovenienced.* The four unprovenienced samples are Red Lustrous Wheelmade spindle bottle C2753 (Fig. 5), western Anatolian jug C5731, Canaanite jar C7639 (Fig. 5), and another unusual Protopalatial piece, C7237 (Fig. 12).[29]

## DISCUSSION

The determination on the basis of the NAA results that seven very questionably identified imports, one supposedly Mycenaean (C7643 [Figs. 3, 6]) and six Cypriot (C4734, C5731, C7237 [Fig. 12], C7238 [Fig. 12], C7239 [Fig. 12], C7639 [Fig. 5]), were, in fact, unlikely to be Mycenaean or Cypriot imports was unremarkable. The failure of a smaller number of other pieces to qualify unambiguously as non-Cretan imports—stirrup jars C1473 and C3896, shown by NAA to be related to a central Cretan rather than any known Mycenaean production center (Tables 1, 4), and bowl C4577, likewise related to a western Cretan rather than any known Cypriot compositional pattern (Tables 2, 5)—came as a surprise, however. Of course, a certain percentage of virtually all Mycenaean ceramic groups sampled for NAA testing have proven to have composition patterns that do not correspond with any previously identified compositional group. It is thus quite possible that the three fragments just cited indeed come from Mycenaean and Cypriot production centers that have simply not yet been identified by NAA work and thus do not constitute part of the Manchester-Berkeley database.[30]

29. The first two vessels (C2753 and C5731) show associations (d = 1.50 and 1.21) with a group of transport stirrup jars found at Mycenae but of western Cretan origin (see Tomlinson 1995a). This is a diffuse group, however, and the association is certainly not significant for the former vessel and probably not significant for the latter. Therefore, they remain unprovenienced. The last two samples (C7639 and C7237) show no associations whatsoever.

30. In publishing their results from Troy, Mountjoy and Mommsen (2006) recently listed no fewer than 22 singles, or pieces unattributed to specific production locales, from a sample population of 151 Mycenaean sherds, or roughly 15% of the sherds tested. They consider this figure to be more or less normal for analytical programs of this kind; it is closely paralleled at Tell Kazel (Badre et al. 2005), with the equivalent figure being closer to 10% at Qantir (Mountjoy and Mommsen 2001). Among the 20 sherds from Kommos considered to be stylistically Mycenaean (that is, not counting the probably Minoan fragment C7643), three pieces (15%) are here considered unprovenienced singles (C2424, C6919, C9126), while two small and fine stirrup jars with similar compositions

To put the NAA findings concerning Mycenaean ceramic imports to Kommos in a somewhat broader context, one should begin by noting that comparatively little attention has been paid to periods earlier than LM/LH IIIA1 or to individual Minoan sites other than Chania, Knossos, and Kommos.[31] Birgitta Hallager's detailed 2005 presentation of the more than 200 LH III Mycenaean ceramic imports to Chania has shown that far more Mycenaean pots have been recognized there than at any other Minoan site. She notes a LM IIIB1 temporal spike in these imports to Chania and comments on several other mainland Greek features that make their initial appearance at this western Cretan coastal center contemporaneously: fixed central hearths, figurines of Mycenaean types, and both stirrup jars and tablets bearing Linear B texts. In turn, she makes a compelling case for the actual presence of Mycenaeans at Chania in the earlier 13th century B.C., although where they may have come from within the Mycenaean world—Boiotia, the Argolid, Messenia, and now even Laconia all seem distinct possibilities—is unclear.[32]

The imported Mycenaean pottery from Knossos may conceivably have been comparable in quantity, but no systematic study of it has ever been undertaken. A substantial amount of what may actually have been found there, especially if in sherd form, is likely to have been discarded long ago and is thus no longer available for study.[33] The contribution of the imported Mycenaean pottery identified at Kommos lies not in its quantity, which constitutes a mere 10%–15% of what has been recovered at Chania and perhaps an equally small proportion of what might be identified at Knossos, but rather in the temporal range represented, the percentage of the material subjected to chemical analysis, and the seeming changes in the patterns of ceramic importation to this south-central Cretan harbor town through time.

Only at Kommos have Mycenaean pots ranging in date from LH I through to the very beginning of LH IIIC been found. With the exception of the LH IIIC Early stirrup jar C2424 (Fig. 3), the LH IIIA2/B amphoroid chariot krater C9126 (Figs. 3, 6), and the LH IIA bridge-spouted jug C6919 (Figs. 3, 6), all of the Mycenaean vessels sampled for NAA are likely to be Argive products.[34] Mycenaean imports of the LH I

(C1473, C3896; another 10% of the total corpus of Mycenaean pieces being tested) have been identified as fitting a composition pattern otherwise represented exclusively by large, medium coarse transport stirrup jars. Rather than considering these last two pieces as necessarily Minoan products on the basis of this evidence, one might suggest that these two fine stirrup jars in fact represent a mainland Greek production center not previously isolated in the Manchester-Berkeley data bank of 61 reference groups derived from that region (Table 3).

31. Hallager 1993, 2005; Rutter 2006b, pp. 666–672.

32. Mountjoy 2005; see also the discussion following Hallager 2005 and Mountjoy 2005 in D'Agata, Moody, and Williams 2005, pp. 299–302.

33. For an overview of LH IIIA1–IIIB imports, see Hallager 1993; for some LH IIA imports, see Mountjoy 2003, pp. 105–107.

34. Four pieces that were considered Mycenaean when sampled in 1996 have been shown by NAA to be unlikely non-Minoan imports (C1473, C3896) or only possibly Mycenaean inasmuch as they are categorized as unprovenienced (C2424, C6919). None of these were identified as Mycenaean by Watrous (*Kommos* III), whose record for correctly identifying mainland imports is consequently unblemished by the NAA results, even if he also overlooked a few pieces that were, in fact, of Mycenaean manufacture (e.g., C2058, C6709, C6912, C7116, C7876; see Table 1). Unfortunately, the single attested example of a Palace Style pithoid jar of Mycenaean manufacture from Kommos had not been identified as such by 1996 and so was not sampled for analysis (Rutter 2006a, pp. 494–495, no. 47/21, pls. 3:53, 3:91:f), and the same is true for the single identified example of a Mycenaean semiglobular cup (Rutter 2006a, p. 467, no. 44b/20, pl. 3:48); both are of LH IIA date.

and IIA periods identified in LM I contexts at Kommos come exclusively from the monumental Building T (Fig. 2). This structure appears to have served as the town's civic center, and at least one of its functions may have been to accommodate periodic large social gatherings at which drinking and perhaps also feasting played a prominent role. The fact that all the Mycenaean ceramic imports from Neopalatial contexts in Building T took the form of either jugs or one-handled cups, that is, of drinking vessels that were in all likelihood used on these occasions (see, e.g., Figs. 3, 6: C6912, C3346, C6919), is unlikely to be coincidental. During the subsequent Monopalatial era, comprising the LM II and IIIA1 periods, Mycenaean ceramic imports to Kommos were for the first time found in houses outside of the civic center, and their form changed to two-handled goblets (see, e.g., Fig. 3: C5819).

Finally, during the LM IIIA2 and LM IIIB periods, Mycenaean imports belonged to much the same functional range as that attested at Chania, with kylikes (Figs. 3, 6: C4693), stemmed bowls (Fig. 3: C7876, C2140), and deep bowls (Fig. 3: C6709) being the most common open shapes and small stirrup jars by far the most common closed form (Figs. 3, 6: C2949, C2424, C1771). At Kommos, however, the quantities of such imported vessels were minuscule compared to the numbers recovered at Chania. Moreover, open shapes, virtually all of them pattern-decorated rather than either monochrome painted or plain (and thus plausibly all utilized as tablewares), were less common than the small, attractively decorated stirrup jars imported for the perfumed oil they contained. Thus, there is no reason to imagine, at least on the basis of the ceramic imports, that any Mycenaeans were ever resident at Kommos.

Analytical programs employing NAA to determine the provenience of Mycenaean pottery from other sites in the eastern Aegean and eastern Mediterranean, whether such sites were Mycenaean in terms of their material culture (e.g., Pylona and Ialysos on Rhodes, Miletos on the southwest Anatolian coast), Aegean but not Mycenaean (e.g., Troy), or altogether non-Aegean (e.g., Qantir in Egypt, Tell Dan in Israel, or Tell Kazel in Syria), have provided some extremely interesting comparative data. For example, these analyses have shown that decorated Mycenaean pottery of high quality was produced at some eastern Aegean centers already as early as LH II.[35] Ordinarily, by far the largest body of Mycenaean ceramic imports exhibits the Mycenae-Berbati (MYBE) compositional pattern characteristic of the Argolid-Corinthia.[36] At several sites, however, locally

35. It occurred at Troy as early as LH IIA (Mountjoy and Mommsen 2006) and at Miletos at least as early as LH IIB (Niemeier 2002a, 2002b, 2002c).

36. Karantzali and Ponting 2000 (Pylona, Rhodes: LH IIIA–C); Marketou et al. 2006 (Ialysos, Rhodes: LH I–IIIB); Mommsen et al. 1992 (Tell el-Amarna: LH IIIA2); Mountjoy and Mommsen 2001 (Qantir, Egypt: LH IIIA2–B); Gunneweg et al. 1992 (Tell Dan, Israel: LH IIIA2 Late); Niemeier 2002a, 2002b, 2002c (Miletos, Turkey: LH IIB–IIIC); Badre et al. 2005 (Tell Kazel, Syria: LH IIIA2 Late–IIIB Final). Because of severe difficulties in distinguishing chemically between Argive products of the MYBE group and Trojan products of the A-TROY group, it is as yet not possible to identify with certainty the geographic source of the largest chemical grouping of Mycenaean pieces tested thus far from Troy (Mommsen, Hertel, and Mountjoy 2001; Mountjoy and Mommsen 2006). For an overview of NAA programs directed at corpora of Mycenaean pottery from Syro-Palestinian and Egyptian sites, see Jung 2006, p. 153, nn. 24, 25; for the significance of the MYBE group specifically and its connection with the potters' quarter at Berbati, see pp. 173–174.

produced Mycenaean pottery constitutes a substantial percentage of the pieces tested (e.g., Troy, Pylona, Ialysos, Miletos, Tell Kazel), and the only site where the Mycenaean pottery analyzed has been attributed exclusively to the MYBE group is Tell Dan. From 19th Dynasty levels (latest 14th-century and all of the 13th-century B.C. strata) at Qantir in Egypt, although 46% of the 138 pieces sampled came from Argive production centers,[37] roughly 25% have been attributed to Cypriot workshops, 9% to producers probably located in Egypt, and 9% to Canaanite workshops.[38]

Against this backdrop, the identification of 75%–85% of the Mycenaean imports from Kommos as Argive, with just three (Fig. 3: C2424, C6919, C9126) to five (including the two small stirrup jars C1473 and C3896) pieces potentially representing other production locales, presumably located on the Greek mainland, reveals an unusually concentrated source of supply for the Mycenaean imports recovered at the site. Furthermore, of the few Mycenaean imports falling outside of the MYBE compositional group, C9126 (Figs. 3, 6) is highly unusual as it is the only chariot krater fragment identified at Kommos and one of just two known from all of Crete, while a second—the LH IIIC Early stirrup jar C2424 (Fig. 3)—is the latest known Mycenaean import not only from the site of Kommos but possibly from all of Crete. In other words, with a very few and rather special exceptions, most of the impressively long-lived and typologically varied repertoire of Mycenaean imports found at Kommos come from a single region of production located in the northeastern Peloponnese. In this respect, the situation at Kommos is similar to, although not quite as extreme as, the picture of the much more narrowly dated importation of LH IIIA2 Late vessels found in tomb 387 at Tell Dan.

With regard to the imports from Cyprus, of the 40 pieces effectively confirmed by NAA as Cypriot products, no less than three-quarters (30 samples) are White Slip (WS) II milk bowl fragments, two of these (C344, C4127) being attributable to the WS IIA subgroup, and one (C9990) to the WS II Late subgroup (Figs. 4, 7, 8). With the exception of the two WS IIA fragments (one of which, C344, is related to products from the neighborhood of Episkopi), all of these are associated with groups from the Limassol area, although whether they may also be connected with the large production center identified at Sanidha, west-northwest of Kalavasos in the eastern Troodos foothills, is uncertain.[39] What is clear is that virtually all of the WS II milk bowls imported to Kommos were produced from clays found several kilometers inland from the south-central coast of

37. Of 138 samples, 53 are assigned to the MYBEQ group (that is, MYBE group constituents recovered from contexts at Qantir), eight to the closely related MYKRQ group (made up of samples with MYBE-like compositions except for divergent potassium and rubidium concentrations evidently caused by unusual taphonomic circumstances), and three to the TIRQ group (attributed to workshops at or in the vicinities of Tiryns and Asine, closer to the Argive coast than the workshops constituting the MYBE group).

38. Of the 138 samples cited in the preceding note, 21 are attributed to the HCYP group (now suggested by Mommsen and Sjöberg [2007] to represent potters working at the site of Sinda), six to the ICYP group, and another eight to the KQAN group; the last two groups are also considered to be Cypriot. Nine samples in the LQAN group and four in the MQAN group are considered likely to represent Egyptian production centers, while 12 samples make up the JPAL group identified as representing Canaanite production.

39. For earlier NAA work on Cypriot Bronze Age wares by the Manchester Archaeometry Laboratory, see Bryan et al. 1997; for the Sanidha production site, see Todd and Pilides 2001.

Cyprus. However numerous the production centers that were supplying this Cypriot ware and its subvarieties to Kommos may have been, they seem to have been clustered within a fairly small area of the island, in much the same way as the Mycenaean imports to Kommos derived largely from the Argolid. All of the WS imports to Kommos were milk bowls, all of them are classifiable as WS II of one kind or another (i.e., there are no examples of either Proto WS or WS I), and all came from contexts dating between LM IIIA1 and LM IIIB.[40]

The much smaller number of Cypriot Base Ring vessels sampled for analysis (C1052, C7407, C8154, C9382, C10463 [Figs. 5, 9, 10]) may be assigned to ceramic groups from sites further west along the south coast in the Episkopi area.[41] Base Ring ware occurs at Kommos in the form of carinated cups, jugs and juglets, and a possible tankard, thus representing a wider shape repertoire than the WS II imports, but it makes its initial appearance in LM IIIA2 Early contexts, more or less contemporaneously with the WS II milk bowls.[42] To judge from the comparatively scanty contextual data available for this class of Cypriot imports, it is possible that the carinated cups and jugs were regularly used together at Kommos in paired sets.

In marked contrast to the two preceding categories of Cypriot imports, the four Plain White pithoi sampled from Kommos seem to have been produced at several different locations along the south coast, one in the Limassol area (Fig. 5: C3171), two further east at Kition (C4143, C5770), and one yet further northeast in the neighborhood of Enkomi (Figs. 5, 11: C9013).[43] Appearing at Kommos at the same time as the first WS II milk bowls, these pithoi may well have been the large transport vessels in which smaller Cypriot tablewares were shipped abroad, as was evidently the case on the late-14th-century B.C. wreck at Uluburun.[44] Most of these very large vessels found at Kommos were recovered from contexts close to the harbor area where they would have been off-loaded rather than from houses located on the slopes above the harbor. In this respect, their distribution on the site resembles those of other large imported transport vessels such as Canaanite jars and is noticeably different from that of the smaller, decorated, and more readily portable tablewares.

The provenience of two White Painted Wheelmade I jugs or tankards (Fig. 4: C10366, C10209) recovered from LM IB Late and IIIB contexts within House X at Kommos is uncertain, although they were probably produced at one and the same place on Cyprus. Unfortunately, no Plain White shapes other than pithoi were sampled in 1996, nor were any of the much earlier Red Slip and Proto Base Ring jugs from LM IA Final and LM IB Early contexts,[45] for the simple reason that none of the pieces in question had by that time been identified with confidence as Cypriot.

The single example of a Red Lustrous Wheelmade spindle bottle from Kommos (Fig. 5: C2753) cannot be confirmed as Cypriot, although the piece was certainly imported to Kommos from a non-Cretan production center. A Fine Gray Wheelmade juglet (C4734) initially mistaken as an example of Base Ring was confirmed as a central Cretan product.[46] A piece first identified as a Cypriot Monochrome bowl (C4577) is instead a possible western Cretan product, as are two of the three Protopalatial

40. Rutter 2006b, p. 654, table 3:104, p. 657.

41. Bryan et al. 1997. For the specialized manufacture of Base Ring ware at a limited number of production centers, see Vaughan 1991.

42. See n. 40, above.

43. For Cypriot pithoi, see Keswani 1989, 2009; Pilides 2000.

44. For a convenient summary of the finds from this wreck, see Pulak 1998.

45. Rutter 2006b, pp. 656–657.

46. For examples of the Fine Gray Wheelmade class at Kommos and their probable manufacture at one or more sites on Crete, see Rutter 2006b, pp. 678–680.

pieces once identified as Cypriot (Fig. 12: C7238, C7239). Lastly, pieces once considered Cypriot but subsequently identified as western Anatolian (C5731) and Syro-Palestinian (Fig. 5: C7639) were confirmed by NAA to be not obviously Cypriot.

The pattern of later Cypriot ceramic importation observed during the LM IIIA and LM IIIB periods suggests that tablewares manufactured at specialized production centers on Cyprus (e.g., White Slip milk bowls, Base Ring cups, bowls, and jugs, and White Painted Wheelmade I tankards) were shipped to Crete from discrete coastal emporia in Plain White pithoi produced at or near those emporia. The quantities of Cypriot tablewares being imported to Kommos were somewhat greater than those being imported from the Mycenaean mainland, and in both cases such importation appears to have flourished over approximately the same time span, although two Cypriot pouring vessels came from earlier Neopalatial contexts (one MM III, one LM IA Early) than anything identifiable as a mainland Greek product. Kommos has not furnished any mainland Greek functional equivalent to the large transport vessels, chiefly pithoi, imported from Cyprus, nor any Cypriot equivalent to the relatively numerous small and attractively decorated Mycenaean stirrup jars of LH IIIA2–IIIB date.

Despite the somewhat larger quantities of imported Cypriot as opposed to Mycenaean vessels from Kommos, by far the largest numbers of Cypriot ceramics to have been recovered so far from any Minoan site, there is no reason to believe that Cypriots were ever actually resident at Kommos in significant numbers. Indeed, the distribution of Cypriot pithoi at coastal emporia further to the west in Sardinia, Sicily, and northern Egypt strongly suggests that Kommos was simply a convenient stopover for Cypriot entrepreneurs engaged in long-distance exchanges with regions in the central Mediterranean, most notably Sardinia.[47]

## CONCLUSIONS

The program of chemical analyses initiated in 1996 on 21 pottery samples from Kommos regarded on stylistic grounds as Mycenaean imports and 48 samples considered likely to be Cypriot imports has confirmed that between 15 and 18 of the first group and between 40 and 42 of the second group were accurately identified at the outset (Table 6). Had the samples been selected a decade later, more would have been chosen, since the number of Mycenaean and Cypriot vessels recognized in 1996 constitutes less than two-thirds of the pieces now viewed as genuine imports (58.3% and 63.2%, respectively). Furthermore, some of the pieces that were incorrectly identified in 1996 as possible Cypriot imports (e.g., western Anatolian jug C5731, Canaanite jar C7639 [Fig. 5]) or that proved to be Cretan (e.g., the Fine Gray Wheelmade juglet C4734, the LM II pyxis C7643 [Figs. 3, 6]) would not have been included in the selection. Comparison of the last four rows of information in Table 6 makes clear what the differences are between the date, ware, and shape ranges of the Mycenaean and Cypriot imports to Kommos that were sampled in 1996 versus those that were recognized

47. Rutter 2006b, p. 658; for Cypriot pithoi, see n. 43, above. For the likelihood of Cypriot residents at Tiryns in very early LH IIIC, see most recently Stockhammer 2007, pp. 323–325; for Cypriot and Levantine contacts with Tiryns, see also Maran 2004; Stockhammer 2007, pp. 156–157.

## TABLE 6. MYCENAEAN AND CYPRIOT IMPORTS FROM KOMMOS: NAA SAMPLES TAKEN IN 1996 AND ADDITIONAL FINDS AS OF 2006

| | *Mycenaean Imports* | *Cypriot Imports* |
|---|---|---|
| Suspected imports sampled in 1996 | 21 | 48 |
| Sampled pieces confirmed as correctly attributed imports by NAA | 15–18 | 40–42 |
| Total identified imports in 2006 (Rutter 2006b) | 36 | 76 |
| Items sampled likely to be Minoan | 3 (C1473, C3896, C7643) | 4 (C4577, C4734, C7238, C7239) |
| Items identified as imports in 2006 perhaps to be disqualified as such by NAA results | 2 (C1473, C3896) | 1 (C4577) |
| Items sampled likely or certain to be imports from elsewhere | — | 2–4 (C5731 = western Anatolian, C7639 = Syro-Palestinian, C2753 and C7237 = unprovenienced) |
| Date (Mycenaean) or ware range (Cypriot) of items sampled in 1996 | LH I–LH IIIC Early (Table 1) | Base Ring I(?), Base Ring II, Monochrome, Plain White, Red Lustrous Wheelmade, White Painted Wheelmade I, White Slip II, White Slip IIA, White Slip II Late (Table 2) |
| Date (Mycenaean) or ware range (Cypriot) of imports identified as of 2006 | LH I–LH IIIC Early (Rutter 2006b, p. 668, table 3:110) | Base Ring I(?), Base Ring II, Monochrome, Plain White, Proto Base Ring, Red Lustrous Wheelmade, Red Slip, White Painted IV, White Painted Wheelmade I, White Slip II, White Slip IIA, White Slip II Late (Rutter 2006b, p. 654, table 3:104) |
| Shape range of items sampled in 1996 | *Open:* Vapheio cup, goblet, kylix, deep bowl, stemmed bowl; *Closed:* piriform jar, amphoroid krater, alabastron, jug, stirrup jar (Table 1) | bowl, carinated cup, jug, juglet, milk bowl, pithos, spindle bottle, tankard (Table 2) |
| Shape range of imports identified as of 2006 | *Open:* semiglobular cup, Vapheio cup, goblet, kylix, deep bowl, stemmed bowl; *Closed:* pithoid jar, piriform jar, amphoroid krater, alabastron, jug, stirrup jar (Rutter 2006b, p. 667, table 3:109) | basin, bowl, carinated cup, jug, juglet, krater, milk bowl, pithos, spindle bottle, tankard (Rutter 2006b, pp. 654–655, tables 3:104–105) |

by 2006.[48] Until the process of securing permits for work of this kind becomes more streamlined and the number of archaeological scientists and research facilities hosting such analyses in Greece has grown appreciably, the problem of scheduling the optimal moment for such sampling is likely to continue.

The chemical analyses presented here have interesting implications, nonetheless, especially when contextualized within the rapidly expanding corpus of data on Mycenaean ceramic imports at sites throughout the eastern Mediterranean. The chronological range of the Mycenaean imports to Kommos is unusually broad, extending for at least three and perhaps as many as four centuries from LH I to the beginning of LH IIIC. This range may be subdivided into three distinct stages (LH I–IIA, LH IIB–IIIA1, and LH IIIA2–LH IIIC Early), in each of which distinctive shapes

48. See also nn. 13, 14, and 34, above.

were utilized in particular spatial contexts at Neopalatial (LM I), Monopalatial or Early Postpalatial (LM II–IIIA1), and Final Palatial or Late Postpalatial (LM IIIA2–B) Kommos. Cypriot pottery was imported to Kommos mainly during the LM III period and seems to have consisted almost entirely of White Slip II milk bowls and Base Ring II cups and juglets. Such small to medium-sized tablewares were probably brought to the site in large Plain White pithoi of various types (see Figs. 5, 11: C9013, C3171), in much the same fashion as the Cypriot pottery recovered from the Uluburun wreck of ca. 1300 B.C. was being transported. Kommos is unique in the Aegean for the sheer quantities of imported Cypriot White Slip II and Base Ring II tablewares recovered, and the chemical analyses indicate that each of these classes of fine ware appears to have been produced in a discrete region within Cyprus.

# APPENDIX

# NAA DATA FROM KOMMOS AND SELECTED CHEMICAL REFERENCE GROUPS

The chemical compositions of the 69 samples from Kommos, along with multiple analyses of five sherds (C2058, C665, C3171, C5770, C9013), are presented in Table A. The elemental data are quoted to three significant figures and expressed in parts per million (ppm) except where noted as a percentage.

Table B lists the chemical profiles of the 19 reference groups with which at least one Kommos sample fits. As noted in the text above, the normal groups listed in the first part of the table have an average percentage standard deviation between 7.8% and 13.9%. The diffuse groups listed in the second part have values from 18.1% to 29.9%. These averages are calculated on the basis of the elements included in Table B and exclude the figures for Yb, Lu, and Ta.

The suggested proveniences of the 19 groups presented in Table B are as follows:

Asine 1: Argolid (Tomlinson, forthcoming)
Chania 4: central Crete (Tomlinson 1991)
CypHMB: Limassol area (Tomlinson, unpublished)
Cyprus 2: Argolid (Tomlinson, forthcoming)
Cyprus 3: Episkopi area (Bryan et al. 1997)
Cyprus 5: Kition area (Bryan et al. 1997)
Cyprus 9: Limassol area (Bryan et al. 1997)
Cyprus 10: Limassol area (Bryan et al. 1997)
Cyprus 11a: Limassol area (Bryan et al. 1997)
Cyprus 11b: Limassol area (Bryan et al. 1997)
Cyprus 15: Enkomi area (Bryan et al. 1997)
Hawam B: Limassol area (Hoffmann and Robinson 1993)
Hawam G: Argolid (Hoffmann and Robinson 1993)
Hawam I: Argolid (Hoffmann and Robinson 1993)
Lachish: Argolid (Tomlinson 2004)
MycLF1: Argolid (Tomlinson, forthcoming)
MycLF3: Argolid (Tomlinson, forthcoming)
MycSJ A2: Chania/West Crete (Tomlinson 1995a)
MycSJ B: central Crete (Tomlinson 1995a).

TABLE A. CHEMICAL COMPOSITION OF NAA SAMPLES FROM KOMMOS

| *Sample* | *Na%* | *Al%* | *K* | *Ca%* | *Sc* | *Ti%* | *V* | *Cr* | *Mn* | *Fe%* | *Co* | *Rb* | *Cs* | *La* | *Ce* | *Sm* | *Eu* | *Dy* | *Hf* | *Th* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUSPECTED MYCENAEAN IMPORTS | | | | | | | | | | | | | | | | | | | | |
| C1473 | 0.845 | 6.64 | 2.46 | 8.38 | 19.1 | 0.369 | 101 | 472 | 800 | 5.32 | 30.0 | 80.6 | 5.86 | 26.2 | 51.8 | 4.72 | 1.03 | 4.02 | 4.23 | 9.51 |
| C1771 | 0.826 | 8.25 | 3.13 | 9.70 | 22.3 | 0.438 | 138 | 250 | 919 | 5.29 | 27.2 | 131 | 9.34 | 33.4 | 61.5 | 5.62 | 1.04 | 4.55 | 3.58 | 11.8 |
| C2058a | 0.905 | 9.44 | 2.70 | 8.75 | 25.7 | 0.425 | 172 | 278 | 1035 | 5.88 | 34.4 | 122 | 9.43 | 35.3 | 67.9 | 5.65 | 1.33 | 4.69 | 3.33 | 12.2 |
| C2058b | 1.23 | 9.70 | 1.27 | 9.38 | 27.2 | 0.452 | 163 | 333 | 1030 | 6.05 | 36.0 | 89.2 | 11.4 | 33.6 | 73.4 | 5.02 | 1.23 | 4.80 | 3.42 | 13.1 |
| C2140 | 0.515 | 8.71 | 3.00 | 7.32 | 22.3 | 0.470 | 131 | 247 | 1021 | 5.36 | 28.5 | 153 | 8.36 | 32.5 | 61.7 | 5.53 | 1.18 | 4.36 | 3.53 | 11.3 |
| C2424 | 1.06 | 7.65 | 1.97 | 9.62 | 22.4 | 0.496 | 121 | 448 | 821 | 5.40 | 29.8 | 79.2 | 8.43 | 28.6 | 50.9 | 5.14 | 1.31 | 4.68 | 3.65 | 10.2 |
| C2949 | 0.495 | 7.98 | 2.44 | 11.5 | 20.4 | 0.438 | 130 | 231 | 850 | 4.89 | 26.6 | 140 | 6.71 | 30.1 | 57.0 | 4.88 | 1.29 | 4.45 | 3.34 | 9.88 |
| C3346 | 0.468 | 8.64 | 3.37 | 8.08 | 23.9 | 0.435 | 128 | 288 | 1006 | 5.75 | 38.6 | 205 | 12.5 | 33.6 | 67.1 | 5.83 | 1.17 | 4.49 | 3.42 | 12.5 |
| C3896 | 0.665 | 6.38 | 2.16 | 13.5 | 19.5 | 0.351 | 96.7 | 403 | 811 | 5.26 | 32.7 | 104 | 6.15 | 25.2 | 48.6 | 4.61 | 1.35 | 3.75 | 3.15 | 8.27 |
| C3897 | 0.749 | 7.97 | 2.50 | 9.64 | 20.2 | 0.464 | 117 | 256 | 1056 | 5.08 | 27.3 | 145 | 8.07 | 29.9 | 56.8 | 5.26 | 1.27 | 4.06 | 3.84 | 10.6 |
| C4271 | 0.621 | 8.76 | 3.12 | 8.29 | 22.3 | 0.452 | 141 | 244 | 931 | 5.37 | 28.4 | 159 | 8.87 | 32.2 | 60.3 | 5.30 | 1.33 | 4.80 | 3.17 | 10.8 |
| C4693 | 0.583 | 9.07 | 2.93 | 10.4 | 23.5 | 0.452 | 135 | 290 | 1045 | 6.12 | 31.6 | 142 | 10.1 | 31.6 | 63.5 | 5.15 | 1.31 | 4.60 | 2.77 | 11.0 |
| C5425 | 0.641 | 8.44 | 2.58 | 9.24 | 22.1 | 0.489 | 119 | 372 | 1000 | 5.63 | 31.7 | 120 | 8.05 | 27.4 | 54.9 | 4.89 | 1.12 | 4.70 | 3.78 | 9.19 |
| C5819 | 0.659 | 9.01 | 3.26 | 7.62 | 24.0 | 0.476 | 141 | 286 | 907 | 5.86 | 31.1 | 175 | 9.41 | 34.0 | 66.6 | 5.93 | 1.17 | 4.58 | 3.63 | 13.0 |
| C6709 | 0.667 | 7.48 | 2.75 | 8.72 | 22.2 | 0.440 | 102 | 320 | 955 | 5.39 | 29.7 | 141 | 8.05 | 31.5 | 62.6 | 5.54 | 1.26 | 4.31 | 4.86 | 10.7 |
| C6912 | 0.317 | 8.68 | 3.17 | 9.21 | 22.9 | 0.449 | 136 | 287 | 953 | 5.51 | 35.9 | 161 | 11.0 | 32.9 | 68.6 | 5.82 | 1.26 | 4.48 | 4.18 | 11.7 |
| C6919 | 0.488 | 8.52 | 3.25 | 5.89 | 24.1 | 0.505 | 152 | 351 | 741 | 5.59 | 38.3 | 149 | 13.5 | 32.7 | 67.6 | 6.45 | 1.57 | 4.98 | 3.93 | 11.1 |
| C7116 | 0.387 | 8.68 | 3.09 | 7.16 | 23.6 | 0.508 | 135 | 329 | 1110 | 5.50 | 39.8 | 146 | 12.1 | 31.3 | 62.4 | 5.46 | 1.47 | 4.77 | 3.65 | 11.3 |
| C7636 | 0.358 | 9.33 | 2.62 | 9.02 | 24.7 | 0.468 | 158 | 287 | 1040 | 6.15 | 32.1 | 120 | 9.06 | 31.4 | 62.0 | 4.94 | 1.26 | 4.18 | 3.29 | 11.1 |
| C7643 | 0.516 | 8.43 | 2.11 | 9.09 | 27.6 | 0.437 | 140 | 541 | 965 | 7.04 | 46.6 | 104 | 6.43 | 27.6 | 58.6 | 4.86 | 1.29 | 4.39 | 3.38 | 12.1 |
| C7876 | 0.721 | 8.18 | 2.51 | 9.01 | 20.7 | 0.447 | 105 | 232 | 1256 | 5.25 | 31.9 | 133 | 8.12 | 33.3 | 64.7 | 5.82 | 1.34 | 4.51 | 3.39 | 11.2 |
| C9126 | 0.321 | 8.86 | 2.40 | 8.65 | 26.8 | 0.475 | 104 | 336 | 991 | 7.22 | 34.8 | 120 | 6.39 | 36.2 | 67.1 | 6.25 | 1.26 | 4.67 | 4.40 | 14.0 |
| SUSPECTED CYPRIOT IMPORTS | | | | | | | | | | | | | | | | | | | | |
| C335 | 1.05 | 10.8 | 0.963 | 2.44 | 45.7 | 0.434 | 280 | 189 | 671 | 7.52 | 40.7 | 19.8 | 0.889 | 7.93 | 21.6 | 2.30 | 0.759 | 2.64 | 2.84 | 1.82 |
| C340 | 1.44 | 9.68 | 1.00 | 2.93 | 47.2 | 0.411 | 231 | 374 | 1018 | 8.36 | 44.0 | 22.9 | 1.06 | 7.22 | 17.6 | 2.24 | 0.739 | 2.89 | 1.82 | 1.56 |
| C344 | 0.663 | 9.23 | 3.26 | 4.16 | 19.5 | 0.564 | 126 | 153 | 1207 | 5.44 | 22.7 | 148 | 8.48 | 45.0 | 98.4 | 7.13 | 1.40 | 5.81 | 5.31 | 15.1 |

*Continued on next page*

TABLE A—*Continued*

| *Sample* | *Na %* | *Al%* | *K* | *Ca %* | *Sc* | *Ti %* | *V* | *Cr* | *Mn* | *Fe %* | *Co* | *Rb* | *Cs* | *La* | *Ce* | *Sm* | *Eu* | *Dy* | *Hf* | *Th* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C665a | 1.37 | 9.51 | 0.784 | 2.89 | 44.6 | 0.462 | 236 | 332 | 1142 | 7.91 | 43.6 | 10.8 | 1.61 | 5.39 | 21.4 | 2.64 | 0.673 | 3.09 | 1.99 | 1.06 |
| C665b | 1.42 | 9.41 | 0.431 | 3.07 | 42.1 | 0.313 | 239 | 640 | 1098 | 7.81 | 39.8 | 24.3 | 2.20 | 6.25 | 10.7 | 1.98 | 0.890 | 2.73 | 1.72 | 1.59 |
| C993 | 0.661 | 11.2 | 0.875 | 2.52 | 47.0 | 0.387 | 240 | 202 | 1136 | 7.59 | 48.7 | 27.9 | 1.33 | 8.13 | 24.1 | 1.95 | 0.615 | 2.59 | 1.48 | 1.82 |
| C1052 | 0.655 | 9.12 | 3.16 | 2.87 | 18.4 | 0.540 | 125 | 121 | 1224 | 5.14 | 21.5 | 160 | 8.86 | 40.2 | 87.2 | 2.78 | 1.23 | 5.57 | 5.22 | 14.9 |
| C1262 | 1.29 | 10.6 | 0.390 | 3.38 | 44.8 | 0.337 | 257 | 204 | 947 | 7.64 | 41.6 | 7.27 | 1.13 | 6.87 | 19.5 | 2.00 | 0.847 | 2.11 | 1.79 | 1.90 |
| C1981 | 1.42 | 9.49 | 0.568 | 2.69 | 42.4 | 0.372 | 246 | 177 | 1096 | 7.66 | 39.5 | 14.2 | 1.75 | 4.84 | 10.9 | 2.05 | 0.871 | 3.29 | 1.41 | 0.871 |
| C1982 | 1.15 | 10.7 | 0.097 | 3.40 | 46.8 | 0.367 | 282 | 249 | 992 | 7.88 | 42.8 | 18.5 | 1.94 | 6.12 | 14.7 | 1.75 | 0.780 | 2.03 | 1.38 | 1.40 |
| C2046 | 1.71 | 9.79 | 0.856 | 2.25 | 39.1 | 0.452 | 225 | 184 | 879 | 7.52 | 35.9 | 28.0 | 1.34 | 7.94 | 24.8 | 2.59 | 0.867 | 3.16 | 2.17 | 2.27 |
| C2141 | 1.53 | 9.01 | 0.639 | 2.11 | 41.3 | 0.391 | 237 | 354 | 1043 | 7.29 | 41.5 | 17.5 | 0.242 | 4.39 | 13.2 | 1.78 | 0.674 | 1.94 | 1.32 | 0.899 |
| C2753 | 0.318 | 10.8 | 2.77 | 3.57 | 23.3 | 0.559 | 141 | 149 | 410 | 6.36 | 23.8 | 191 | 9.79 | 41.6 | 87.0 | 7.14 | 1.39 | 5.03 | 4.99 | 17.1 |
| C3156 | 1.36 | 10.3 | 0.783 | 3.36 | 42.1 | 0.363 | 245 | 204 | 970 | 7.13 | 39.7 | 23.2 | 1.34 | 6.99 | 18.0 | 1.90 | 0.723 | 2.99 | 1.66 | 1.24 |
| C3171a | 1.13 | 6.14 | 1.61 | 9.32 | 33.6 | 0.578 | 260 | 2708 | 1247 | 6.61 | 34.9 | 24.5 | 2.08 | 11.7 | 32.1 | 2.97 | 0.906 | 2.92 | 2.46 | 2.15 |
| C3171b | 1.20 | 6.16 | 1.20 | 9.40 | 36.9 | 0.636 | 302 | 3065 | 1342 | 7.50 | 38.1 | 22.1 | 2.66 | 12.8 | 25.1 | 2.93 | 1.06 | 3.32 | 2.22 | 2.12 |
| C3171c | 1.19 | 6.18 | 1.19 | 9.19 | 34.2 | 0.609 | 293 | 2622 | 1301 | 7.23 | 37.4 | 34.3 | 2.13 | 12.5 | 29.1 | 3.18 | 0.899 | 3.03 | 2.24 | 1.93 |
| C3171d | 1.29 | 5.93 | 1.71 | 8.63 | 35.1 | 0.534 | 259 | 2525 | 1215 | 7.27 | 36.4 | 51.9 | 3.01 | 13.6 | 28.6 | 3.25 | 1.25 | 3.26 | 2.43 | 2.17 |
| C3171e | 1.37 | 5.95 | 0.726 | 9.24 | 33.7 | 0.554 | 231 | 3104 | 1216 | 7.17 | 36.9 | 31.0 | 2.23 | 14.7 | 26.3 | 3.38 | 0.994 | 2.38 | 2.25 | 2.16 |
| C3218 | 1.04 | 9.66 | 0.061 | 2.64 | 34.5 | 0.499 | 192 | 190 | 883 | 5.90 | 32.7 | 11.8 | 2.19 | 9.64 | 29.3 | 2.58 | 0.734 | 3.71 | 2.75 | 2.99 |
| C3249 | 1.05 | 10.5 | 0.773 | 3.27 | 42.3 | 0.379 | 254 | 243 | 1008 | 6.99 | 39.2 | 17.9 | 1.48 | 5.75 | 10.2 | 1.56 | 0.633 | 2.55 | 0.942 | 1.37 |
| C3681 | 1.40 | 9.74 | 0.930 | 2.69 | 40.6 | 0.486 | 243 | 231 | 1109 | 7.30 | 39.0 | 22.0 | 0.729 | 6.00 | 17.4 | 1.91 | 0.683 | 2.85 | 0.976 | 1.16 |
| C3729 | 0.924 | 11.0 | 0.582 | 3.18 | 37.6 | 0.283 | 222 | 347 | 934 | 6.24 | 37.1 | 26.9 | 0.870 | 6.67 | 19.0 | 1.66 | 0.575 | 1.52 | 1.52 | 1.79 |
| C3947 | 1.50 | 9.57 | 0.512 | 2.79 | 42.7 | 0.372 | 251 | 278 | 1062 | 7.70 | 39.9 | 13.7 | 1.47 | 6.29 | 14.8 | 1.96 | 0.729 | 2.20 | 1.38 | 1.03 |
| C4127 | 0.516 | 11.3 | 0.333 | 3.50 | 50.2 | 0.536 | 356 | 104 | 1247 | 8.53 | 50.0 | 10.4 | 1.54 | 6.62 | 24.4 | 1.83 | 0.807 | 2.27 | 1.67 | 1.13 |
| C4143 | 1.41 | 5.34 | 1.76 | 13.6 | 24.0 | 0.356 | 122 | 338 | 1006 | 4.83 | 23.8 | 52.5 | 4.90 | 18.8 | 35.9 | 3.86 | 0.938 | 3.09 | 2.98 | 5.43 |
| C4249 | 1.08 | 9.89 | 0.023 | 3.70 | 40.4 | 0.337 | 258 | 218 | 975 | 7.16 | 41.5 | 9.76 | 1.91 | 6.16 | 11.0 | 1.58 | 0.868 | 2.57 | 1.18 | 1.11 |
| C4432 | 1.01 | 10.6 | 0.721 | 3.08 | 42.8 | 0.426 | 285 | 180 | 962 | 7.43 | 39.7 | 25.7 | 0.941 | 9.31 | 15.5 | 2.10 | 0.764 | 3.34 | 1.52 | 2.24 |
| C4577 | 0.579 | 8.59 | 1.73 | 1.91 | 18.3 | 0.513 | 114 | 86.0 | 479 | 4.70 | 20.9 | 119 | 7.25 | 45.5 | 94.3 | 7.86 | 1.29 | 6.42 | 6.88 | 14.6 |
| C4734 | 0.806 | 6.76 | 2.53 | 9.37 | 19.6 | 0.407 | 131 | 417 | 579 | 5.09 | 29.8 | 147 | 6.41 | 26.6 | 53.7 | 4.70 | 1.10 | 3.17 | 3.87 | 9.41 |
| C4773 | 1.18 | 9.69 | 0.969 | 3.08 | 47.4 | 0.389 | 248 | 451 | 884 | 7.02 | 43.7 | 35.6 | 2.43 | 6.90 | 15.3 | 1.96 | 0.669 | 1.78 | 1.31 | 1.47 |
| C5122 | 1.05 | 9.96 | 0.250 | 3.31 | 42.2 | 0.382 | 291 | 287 | 1010 | 7.39 | 40.3 | 13.6 | 1.79 | 7.85 | 18.6 | 1.78 | 0.864 | 2.93 | 1.07 | 1.67 |

TABLE A—*Continued*

| *Sample* | *Na%* | *Al%* | *K* | *Ca%* | *Sc* | *Ti%* | *V* | *Cr* | *Mn* | *Fe%* | *Co* | *Rb* | *Cs* | *La* | *Ce* | *Sm* | *Eu* | *Dy* | *Hf* | *Th* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C5596 | 1.18 | 9.54 | 0.487 | 2.19 | 42.1 | 0.467 | 255 | 213 | 1324 | 8.25 | 42.7 | 8.95 | 1.02 | 7.53 | 17.9 | 2.10 | 0.728 | 3.04 | 2.04 | 1.50 |
| C5645 | 0.920 | 10.4 | 1.44 | 2.55 | 44.1 | 0.483 | 354 | 212 | 752 | 7.89 | 42.4 | 20.5 | 1.62 | 8.93 | 21.7 | 2.43 | 0.896 | 2.23 | 2.17 | 2.20 |
| C5731 | 0.590 | 10.2 | 2.87 | 0.649 | 23.0 | 0.601 | 164 | 153 | 483 | 7.54 | 24.9 | 70.7 | 6.15 | 42.2 | 91.8 | 7.48 | 1.56 | 6.41 | 7.94 | 14.0 |
| C5770a | 1.17 | 6.18 | 2.17 | 10.3 | 17.9 | 0.396 | 106 | 536 | 781 | 4.44 | 24.8 | 81.3 | 3.65 | 20.4 | 37.9 | 3.54 | 0.973 | 2.92 | 2.24 | 6.81 |
| C5770b | 1.15 | 6.12 | 2.41 | 9.76 | 18.7 | 0.381 | 97.5 | 608 | 767 | 4.69 | 25.8 | 73.3 | 4.80 | 21.2 | 40.0 | 3.87 | 1.41 | 4.00 | 3.08 | 6.46 |
| C5770c | 1.13 | 6.07 | 2.17 | 10.0 | 17.0 | 0.451 | 100 | 553 | 807 | 4.22 | 24.1 | 92.7 | 5.00 | 19.7 | 37.3 | 3.45 | 0.961 | 3.18 | 2.94 | 6.11 |
| C6743 | 1.63 | 9.51 | 0.339 | 3.35 | 44.3 | 0.440 | 264 | 240 | 1182 | 8.65 | 45.4 | 0.210 | 2.21 | 8.71 | 17.7 | 2.44 | 0.715 | 2.84 | 1.68 | 2.05 |
| C7237 | 0.513 | 10.3 | 2.36 | 0.236 | 22.3 | 0.751 | 144 | 163 | 181 | 7.64 | 14.7 | 110 | 5.31 | 51.0 | 105 | 8.58 | 1.50 | 6.09 | 8.95 | 15.6 |
| C7238 | 0.464 | 8.73 | 1.49 | 7.66 | 17.6 | 0.503 | 118 | 129 | 904 | 4.11 | 28.7 | 98.4 | 6.73 | 49.4 | 94.3 | 8.66 | 1.45 | 7.06 | 4.84 | 14.2 |
| C7239 | 0.937 | 7.63 | 1.95 | 2.97 | 19.7 | 0.395 | 106 | 158 | 599 | 4.34 | 16.6 | 76.7 | 6.32 | 31.9 | 64.4 | 5.23 | 1.16 | 4.31 | 4.64 | 10.4 |
| C7407 | 0.527 | 9.29 | 1.48 | 3.25 | 18.6 | 0.527 | 104 | 124 | 1154 | 5.18 | 19.8 | 115 | 4.64 | 42.0 | 88.8 | 6.71 | 1.29 | 5.22 | 5.15 | 13.4 |
| C7639 | 0.260 | 5.74 | 1.92 | 17.7 | 11.5 | 0.376 | 83.3 | 104 | 180 | 3.00 | 9.17 | 84.7 | 3.94 | 36.3 | 64.2 | 6.08 | 1.15 | 4.81 | 2.80 | 9.64 |
| C8154 | 0.652 | 8.80 | 2.49 | 3.26 | 18.8 | 0.544 | 127 | 132 | 1204 | 5.18 | 21.0 | 192 | 8.80 | 44.0 | 84.6 | 7.16 | 1.30 | 4.91 | 4.95 | 14.9 |
| C9013a | 1.27 | 7.55 | 2.15 | 7.68 | 20.8 | 0.437 | 148 | 495 | 683 | 5.18 | 24.5 | 91.9 | 6.59 | 25.3 | 48.0 | 4.59 | 1.03 | 2.91 | 4.17 | 9.33 |
| C9013b | 1.32 | 7.60 | 2.07 | 8.15 | 20.8 | 0.462 | 128 | 491 | 721 | 5.17 | 25.9 | 86.9 | 6.24 | 25.1 | 50.1 | 4.54 | 1.14 | 4.10 | 3.86 | 9.35 |
| C9013c | 1.33 | 7.71 | 2.55 | 7.76 | 21.7 | 0.375 | 129 | 515 | 681 | 5.28 | 26.1 | 73.4 | 6.73 | 25.7 | 56.4 | 4.52 | 1.05 | 4.11 | 3.94 | 8.96 |
| C9013d | 1.30 | 7.59 | 1.98 | 7.60 | 22.7 | 0.376 | 129 | 536 | 746 | 5.56 | 34.3 | 88.2 | 6.60 | 25.1 | 56.6 | 4.82 | 1.10 | 3.61 | 4.10 | 9.70 |
| C9382 | 0.635 | 9.30 | 3.36 | 2.30 | 19.2 | 0.619 | 139 | 129 | 1020 | 5.31 | 20.9 | 168 | 8.80 | 45.2 | 91.8 | 7.26 | 1.43 | 4.53 | 5.54 | 15.2 |
| C9567 | 1.32 | 9.23 | 0.685 | 2.26 | 42.0 | 0.420 | 219 | 316 | 1208 | 8.64 | 45.2 | 21.8 | 2.51 | 7.90 | 20.6 | 2.26 | 0.877 | 2.41 | 1.53 | 1.88 |
| C9612 | 0.634 | 10.3 | 0.763 | 2.99 | 43.0 | 0.334 | 216 | 201 | 895 | 6.81 | 41.9 | 18.8 | 2.11 | 8.99 | 16.3 | 1.90 | 0.781 | 2.51 | 1.81 | 2.32 |
| C9990 | 1.02 | 10.2 | 0.205 | 3.09 | 41.2 | 0.340 | 244 | 202 | 879 | 7.12 | 36.2 | 8.04 | 1.32 | 6.89 | 15.5 | 1.91 | 0.760 | 2.72 | 2.07 | 2.29 |
| C10034 | 1.68 | 9.10 | 0.285 | 2.31 | 44.1 | 0.461 | 233 | 201 | 1011 | 8.51 | 40.8 | 8.67 | 1.13 | 5.47 | 16.8 | 1.86 | 0.980 | 3.29 | 1.47 | 0.867 |
| C10111 | 1.11 | 10.1 | 1.09 | 2.76 | 37.9 | 0.381 | 183 | 186 | 692 | 7.10 | 34.0 | 7.17 | 1.01 | 7.07 | 16.9 | 2.09 | 0.663 | 2.50 | 1.54 | 1.91 |
| C10209 | 0.496 | 8.64 | 2.91 | 6.44 | 25.9 | 0.433 | 155 | 587 | 858 | 6.98 | 44.6 | 103 | 7.02 | 24.4 | 53.5 | 4.22 | 1.02 | 3.15 | 3.14 | 10.3 |
| C10366 | 0.505 | 8.46 | 2.83 | 6.06 | 25.3 | 0.414 | 157 | 590 | 890 | 7.01 | 44.3 | 120 | 7.16 | 23.2 | 53.9 | 3.72 | 0.849 | 3.02 | 3.30 | 9.51 |
| C10463 | 0.562 | 9.62 | 3.00 | 2.30 | 18.7 | 0.585 | 121 | 128 | 1003 | 5.28 | 20.8 | 137 | 7.85 | 41.9 | 89.3 | 6.76 | 1.16 | 4.96 | 5.48 | 15.0 |

## TABLE B. CHEMICAL PROFILES OF SELECTED REFERENCE GROUPS

| *Groups* | | *Na %* | *Al %* | *K* | *Ca %* | *Sc* | *Ti %* | *V* | *Cr* | *Mn* | *Fe %* | *Co* | *Rb* | *Cs* | *La* | *Ce* | *Sm* | *Eu* | *Dy* | *Hf* | *Th* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Normal Groups** | | | | | | | | | | | | | | | | | | | | | |
| Asine 1 | Mean | 0.659 | 8.53 | 2.60 | 8.79 | 22.3 | 0.462 | | 242 | 927 | 5.39 | 29.3 | 164 | 9.29 | 31.4 | 62.5 | | 1.18 | 4.40 | 3.71 | 11.4 |
| | StDev | 0.235 | 0.455 | 0.460 | 0.788 | 0.851 | 0.026 | | 14.2 | 40.6 | 0.217 | 1.44 | 18.2 | 0.386 | 1.37 | 2.21 | | 0.070 | 0.108 | 0.301 | 0.503 |
| | StDev(%) | 35.7 | 5.33 | 17.7 | 8.97 | 3.82 | 5.56 | | 5.86 | 4.38 | 4.03 | 4.90 | 11.1 | 4.15 | 4.35 | 3.54 | | 5.92 | 2.46 | 8.12 | 4.40 |
| Chania 4 | Mean | 0.698 | 6.95 | 2.18 | 7.89 | 19.5 | 0.413 | 125 | 412 | 802 | 5.23 | 31.4 | 97.6 | 6.36 | 25.9 | 51.8 | 4.62 | 1.02 | 3.94 | 3.36 | 8.65 |
| | StDev | 0.072 | 0.471 | 0.354 | 2.07 | 2.57 | 0.036 | 16.0 | 79.5 | 88.0 | 0.528 | 3.35 | 11.9 | 1.20 | 3.64 | 6.36 | 0.801 | 0.121 | 0.637 | 0.476 | 0.576 |
| | StDev(%) | 10.4 | 6.78 | 16.3 | 26.3 | 13.2 | 8.69 | 12.8 | 19.3 | 11.0 | 10.1 | 10.7 | 12.2 | 18.8 | 14.0 | 12.3 | 17.3 | 11.8 | 16.2 | 14.1 | 6.66 |
| Cyprus 2 | Mean | 0.570 | 8.21 | 2.47 | 8.86 | 21.6 | 0.447 | 132 | 248 | 915 | 5.34 | 28.0 | 135 | 8.80 | 31.1 | 60.0 | | 1.13 | 4.15 | 3.52 | 10.8 |
| | StDev | 0.162 | 0.317 | 0.380 | 0.883 | 1.40 | 0.052 | 19.0 | 21.8 | 127 | 0.353 | 2.57 | 21.2 | 1.05 | 2.44 | 6.60 | | 0.097 | 0.671 | 0.323 | 0.799 |
| | StDev(%) | 28.4 | 3.86 | 15.4 | 9.97 | 6.50 | 11.7 | 14.5 | 8.78 | 13.9 | 6.61 | 9.15 | 15.7 | 12.0 | 7.84 | 11.0 | | 8.59 | 16.2 | 9.19 | 7.42 |
| Cyprus 3 | Mean | 0.618 | 9.03 | 2.35 | 2.49 | 18.1 | 0.506 | 127 | 129 | 884 | 5.01 | 20.7 | 139 | 8.11 | 42.0 | 84.0 | | 1.34 | 4.92 | 5.04 | 13.9 |
| | StDev | 0.074 | 0.501 | 0.501 | 0.787 | 0.776 | 0.072 | 12.8 | 12.4 | 183 | 0.222 | 1.86 | 17.8 | 0.804 | 2.13 | 4.36 | | 0.137 | 1.39 | 0.330 | 0.863 |
| | StDev(%) | 11.9 | 5.55 | 21.3 | 31.6 | 4.29 | 14.2 | 10.1 | 9.63 | 20.7 | 4.44 | 8.99 | 12.8 | 9.91 | 5.08 | 5.20 | | 10.2 | 28.3 | 6.55 | 6.22 |
| Hawam G | Mean | 0.741 | 8.20 | 2.20 | 9.70 | 21.3 | 0.440 | | 245 | 913 | 5.38 | 29.1 | 157 | 9.52 | 31.8 | 62.0 | 5.06 | 1.16 | 4.34 | 3.75 | 10.9 |
| | StDev | 0.221 | 0.712 | 0.545 | 0.929 | 1.89 | 0.028 | | 12.2 | 45.9 | 0.432 | 1.82 | 30.7 | 1.50 | 2.31 | 4.05 | 0.182 | 0.066 | 0.104 | 0.406 | 0.608 |
| | StDev(%) | 29.8 | 8.68 | 24.8 | 9.58 | 8.87 | 6.35 | | 4.99 | 5.02 | 8.03 | 6.25 | 19.5 | 15.8 | 7.27 | 6.53 | 3.59 | 5.67 | 2.39 | 10.8 | 5.60 |
| Hawam I | Mean | 0.737 | 7.67 | 2.48 | 9.47 | 19.5 | 0.406 | | 241 | 860 | 4.98 | 26.4 | 145 | 8.15 | 29.4 | 57.7 | 4.84 | 1.14 | 4.37 | 4.07 | 10.4 |
| | StDev | 0.094 | 0.712 | 0.448 | 0.932 | 1.83 | 0.028 | | 21.0 | 103 | 0.342 | 1.76 | 21.0 | 1.01 | 2.00 | 3.24 | 0.243 | 0.072 | 0.250 | 0.648 | 0.832 |
| | StDev(%) | 12.8 | 9.28 | 18.0 | 9.84 | 9.40 | 6.82 | | 8.70 | 11.9 | 6.87 | 6.67 | 14.5 | 12.4 | 6.79 | 5.61 | 5.02 | 6.31 | 5.72 | 15.9 | 8.02 |
| Lachish | Mean | 0.610 | 7.75 | 2.38 | 11.7 | 19.9 | 0.391 | 120 | 265 | 892 | 4.91 | 27.7 | 121 | 7.94 | 29.8 | 55.9 | 4.94 | 1.34 | 4.27 | 3.45 | 10.7 |
| | StDev | 0.179 | 0.432 | 0.367 | 2.32 | 1.29 | 0.061 | 13.9 | 36.6 | 74.8 | 0.329 | 2.40 | 18.3 | 1.45 | 1.83 | 3.76 | 0.312 | 0.408 | 0.629 | 0.628 | 2.16 |
| | StDev(%) | 29.3 | 5.57 | 15.4 | 19.9 | 6.51 | 15.6 | 11.5 | 13.8 | 8.39 | 6.71 | 8.68 | 15.1 | 18.3 | 6.14 | 6.73 | 6.32 | 30.5 | 14.7 | 18.2 | 20.2 |
| MycLF 1 | Mean | 0.528 | 8.78 | 2.75 | 10.1 | 23.0 | 0.433 | 140 | 283 | 993 | 5.71 | 32.1 | 162 | 11.2 | 33.5 | 64.8 | 5.42 | 1.21 | 4.55 | 3.39 | 11.6 |
| | StDev | 0.200 | 0.229 | 0.393 | 1.36 | 0.950 | 0.038 | 10.6 | 42.4 | 49.3 | 0.347 | 2.68 | 10.1 | 4.50 | 1.41 | 5.27 | 0.232 | 0.158 | 0.278 | 0.140 | 0.287 |
| | StDev(%) | 37.9 | 2.61 | 14.3 | 13.4 | 4.13 | 8.72 | 7.61 | 15.0 | 4.96 | 6.08 | 8.35 | 6.22 | 40.0 | 4.22 | 8.13 | 4.29 | 13.0 | 6.11 | 4.14 | 2.48 |
| MycLF 3 | Mean | 0.612 | 7.45 | 2.61 | 11.0 | 19.0 | 0.389 | 110 | 236 | 990 | 4.98 | 28.2 | 121 | 7.39 | 29.2 | 55.7 | 4.91 | 1.10 | 4.14 | 3.32 | 10.2 |
| | StDev | 0.270 | 0.296 | 0.778 | 2.37 | 1.21 | 0.034 | 11.8 | 28.2 | 111 | 0.294 | 2.27 | 16.1 | 1.12 | 0.959 | 2.99 | 0.142 | 0.093 | 0.378 | 0.403 | 0.448 |
| | StDev(%) | 44.1 | 3.97 | 29.8 | 21.6 | 6.36 | 8.79 | 10.8 | 11.9 | 11.2 | 5.91 | 8.02 | 13.3 | 15.1 | 3.29 | 5.36 | 2.89 | 8.46 | 9.13 | 12.1 | 4.40 |

TABLE B—*Continued*

| *Groups* | | *Na%* | *Al%* | *K* | *Ca%* | *Sc* | *Ti%* | *V* | *Cr* | *Mn* | *Fe%* | *Co* | *Rb* | *Cs* | *La* | *Ce* | *Sm* | *Eu* | *Dy* | *Hf* | *Th* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIFFUSE GROUPS | | | | | | | | | | | | | | | | | | | | | |
| Cyprus 5 | Mean | 1.16 | 5.95 | 1.11 | 13.1 | 20.4 | 0.390 | 110 | 368 | 849 | 4.57 | 21.7 | 43.3 | 2.95 | 18.7 | 37.8 | | 1.02 | 3.18 | 2.78 | 5.48 |
| | StDev | 0.260 | 0.374 | 0.477 | 1.75 | 2.73 | 0.077 | 18.0 | 110 | 110 | 0.402 | 2.49 | 19.0 | 0.775 | 2.83 | 4.90 | | 0.126 | 0.953 | 0.341 | 0.678 |
| | StDev(%) | 22.4 | 6.27 | 43.2 | 13.3 | 13.4 | 19.8 | 16.4 | 30.0 | 13.0 | 8.80 | 11.5 | 43.9 | 26.3 | 15.2 | 13.0 | | 12.3 | 29.9 | 12.3 | 12.4 |
| Cyprus 9 | Mean | 1.54 | 8.98 | 0.756 | 3.19 | 39.5 | 0.349 | 217 | 201 | 889 | 6.96 | 35.5 | 17.7 | 0.574 | 4.82 | 9.57 | | 0.593 | 2.63 | 1.54 | 1.28 |
| | StDev | 0.426 | 0.572 | 0.319 | 0.760 | 2.42 | 0.066 | 27.0 | 61.5 | 200 | 0.654 | 4.51 | 7.49 | 0.209 | 0.864 | 6.74 | | 0.098 | 0.967 | 0.266 | 0.344 |
| | StDev(%) | 27.7 | 6.37 | 42.2 | 23.8 | 6.14 | 18.8 | 12.4 | 30.5 | 22.6 | 9.40 | 12.7 | 42.4 | 36.4 | 17.9 | 70.4 | | 16.5 | 36.8 | 17.2 | 26.8 |
| Cyprus 10 | Mean | 1.26 | 6.34 | 0.876 | 8.86 | 35.3 | 0.432 | 202 | 1313 | 1294 | 6.74 | 34.6 | 41.8 | 1.81 | 12.5 | 24.1 | | 0.930 | 2.82 | 2.18 | 2.96 |
| | StDev | 0.400 | 0.907 | 0.382 | 2.42 | 4.38 | 0.093 | 49.2 | 921 | 205 | 1.12 | 6.27 | 22.2 | 0.887 | 2.21 | 8.39 | | 0.186 | 0.851 | 0.730 | 1.02 |
| | StDev(%) | 31.7 | 14.3 | 43.6 | 27.3 | 12.4 | 21.6 | 24.4 | 70.1 | 15.9 | 16.6 | 18.1 | 53.2 | 49.1 | 17.7 | 34.8 | | 19.9 | 30.1 | 33.5 | 34.6 |
| Cyprus 11a | Mean | 0.834 | 10.4 | 0.802 | 3.03 | 44.0 | 0.346 | 215 | 324 | 905 | 6.85 | 40.9 | 24.4 | 0.819 | 7.63 | 19.0 | | 0.626 | 2.93 | 1.84 | 2.09 |
| | StDev | 0.151 | 1.02 | 0.527 | 0.369 | 3.02 | 0.069 | 30.7 | 146 | 171 | 0.697 | 3.96 | 11.5 | 0.279 | 1.44 | 7.42 | | 0.110 | 1.19 | 0.263 | 0.345 |
| | StDev(%) | 18.1 | 9.75 | 65.7 | 12.2 | 6.86 | 19.9 | 14.3 | 45.2 | 18.9 | 10.2 | 9.68 | 47.2 | 34.1 | 18.9 | 39.1 | | 17.6 | 40.7 | 14.3 | 16.6 |
| Cyprus 11b | Mean | 1.22 | 9.42 | 0.786 | 2.93 | 39.4 | 0.441 | 232 | 209 | 998 | 7.37 | 36.9 | 28.9 | 0.925 | 8.45 | 22.0 | | 0.829 | 2.82 | 2.23 | 2.24 |
| | StDev | 0.264 | 0.985 | 0.476 | 0.877 | 3.29 | 0.079 | 20.8 | 144 | 292 | 0.781 | 5.59 | 9.95 | 0.473 | 1.88 | 11.7 | | 0.151 | 0.792 | 0.460 | 0.610 |
| | StDev(%) | 21.6 | 10.5 | 60.5 | 29.9 | 8.34 | 17.8 | 8.96 | 69.1 | 29.2 | 10.6 | 15.1 | 34.4 | 51.2 | 22.2 | 53.1 | | 18.2 | 28.1 | 20.6 | 27.2 |
| Cyprus 15 | Mean | 0.897 | 7.48 | 1.80 | 6.06 | 22.4 | 0.444 | 132 | 668 | 902 | 5.77 | 27.3 | 74.0 | 4.25 | 25.8 | 54.0 | | 1.20 | 3.86 | 3.96 | 8.79 |
| | StDev | 0.152 | 0.599 | 0.556 | 2.14 | 2.51 | 0.078 | 18.8 | 256 | 146 | 0.482 | 3.16 | 12.4 | 0.961 | 4.61 | 7.29 | | 0.157 | 0.889 | 0.492 | 1.41 |
| | StDev(%) | 16.9 | 8.00 | 30.9 | 35.3 | 11.2 | 17.6 | 14.3 | 38.3 | 16.2 | 8.35 | 11.6 | 16.7 | 22.6 | 17.9 | 13.5 | | 13.1 | 23.0 | 12.4 | 16.0 |
| CypHMB | Mean | 0.820 | 8.94 | 0.726 | 1.89 | 35.8 | 0.478 | 239 | 116 | 1079 | 9.09 | 36.3 | | 0.506 | 5.67 | 12.6 | 2.03 | 0.784 | 3.41 | 1.87 | 1.61 |
| | StDev | 0.257 | 1.05 | 0.319 | 1.06 | 1.96 | 0.133 | 28.3 | 66.8 | 229 | 2.02 | 7.78 | | 0.304 | 1.47 | 2.99 | 0.460 | 0.152 | 0.780 | 0.465 | 0.470 |
| | StDev(%) | 31.4 | 11.7 | 43.9 | 56.2 | 5.47 | 27.8 | 11.9 | 57.5 | 21.2 | 22.2 | 21.4 | | 60.0 | 25.9 | 23.8 | 22.6 | 19.4 | 22.9 | 25.0 | 29.3 |
| Hawam B | Mean | 1.19 | 9.36 | 0.738 | 2.76 | 42.4 | 0.454 | | 261 | 1117 | 8.12 | 41.1 | 50.7 | 1.00 | 8.44 | 14.2 | 2.38 | 0.827 | 3.60 | 2.35 | 2.66 |
| | StDev | 0.431 | 0.928 | 0.284 | 0.910 | 4.34 | 0.102 | | 139 | 220 | 1.02 | 7.53 | 29.8 | 0.623 | 1.77 | 4.16 | 0.358 | 0.135 | 0.571 | 0.466 | 0.664 |
| | StDev(%) | 36.2 | 9.92 | 38.4 | 33.0 | 10.2 | 22.6 | | 53.4 | 19.7 | 12.6 | 18.3 | 58.9 | 62.3 | 21.0 | 29.2 | 15.1 | 16.4 | 15.8 | 19.9 | 24.9 |
| MycSJ A2 | Mean | 0.623 | 7.94 | 1.77 | 4.84 | 18.9 | 0.466 | 123 | 310 | 524 | 5.15 | | 101 | 7.44 | 43.3 | 81.6 | 7.87 | 1.55 | 5.60 | 6.52 | 13.9 |
| | StDev | 0.143 | 1.47 | 0.455 | 3.39 | 2.72 | 0.082 | 18.8 | 186 | 241 | 0.527 | | 29.3 | 4.61 | 4.10 | 8.04 | 0.724 | 0.170 | 1.46 | 1.10 | 1.19 |
| | StDev(%) | 22.9 | 18.5 | 25.7 | 70.1 | 14.4 | 17.5 | 15.3 | 60.0 | 46.0 | 10.2 | | 29.1 | 62.0 | 9.47 | 9.86 | 9.20 | 10.9 | 26.0 | 16.9 | 8.62 |
| MycSJ B | Mean | 0.566 | 6.87 | 1.64 | 7.82 | 19.0 | 0.388 | 116 | 511 | 858 | 5.39 | | 94.0 | 6.00 | 27.4 | 52.5 | 4.77 | 1.13 | 4.19 | 3.84 | 9.15 |
| | StDev | 0.221 | 0.865 | 0.476 | 3.86 | 1.65 | 0.043 | 10.8 | 274 | 121 | 0.418 | | 18.2 | 1.19 | 3.45 | 6.45 | 0.801 | 0.356 | 0.825 | 0.731 | 1.17 |
| | StDev(%) | 39.0 | 12.6 | 28.9 | 49.3 | 8.72 | 11.0 | 9.30 | 53.6 | 14.1 | 7.76 | | 19.3 | 19.8 | 12.6 | 12.3 | 16.8 | 31.5 | 19.7 | 19.0 | 12.8 |

Abbreviations: CypHMB = Cypriot Handmade Burnished; MycLF = Mycenae fabric samples; MycSJ = Mycenae stirrup jars.

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