Constructing Seriations from the Guthe Collection, the Central Philippines: Implications for Southeast Asian Ceramic Chronologies

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THE RECONSTRUCTION OF SOUTHEAST ASIAN PREHISTORY has been a goal pursued by many archaeologists working in the region (e.g., Bellwood 1985; Bronson 1977; Hall 1985; Higham 1989; Hutterer 1974, 1976, 1977; Hutterer and Macdonald 1982; Junker 1985, 1990*a*, 1990*b*, 1993; Nishimura 1992; Solheim 1964, 1970, 1972, 1981, 1984–1985; Thiel 1980, 1984–1985). A primary task in this pursuit has been to establish chronological sequences (e.g., Early, Intermediate, and Late periods). In the Philippines, as elsewhere, these sequences have usually been defined by archaeological materials such as ceramics and lithics (e.g., Beyer 1947; Evangelista 1967; Fox 1970; Fox and Evangelista 1957; Main 1982; Maye 1967; Solheim 1964, 1970, 1979, 1981; Tenazas 1970; Thiel 1984–1985).

For example, throughout Southeast Asia (including the Philippines) the Palaeolithic, Neolithic, and Iron Age periods are distinguished by the presence or absence of cultural materials such as lithic tools, cord-marked ceramics, type of burials (e.g., jar), Asian porcelains, and metals. In effect, cultural remains contained within archaeological assemblages are classified by the types of artifacts, and the distinctive combinations of types are often thought to represent particular prehistoric cultural groups (e.g., the Hoabinhian). Types became the foundation for establishing temporal periods or sequences (e.g., the Stone Age, the Bronze Age, the Iron Age, and the Porcelain Age), which in turn became the basis for constructing stages of cultural development (see Hutterer 1976 : 222). One consequence of this approach is that cultural change is not seen as a *process* but as a series of progressive stages.

In 1964, Wilhelm Solheim published his Ph.D. dissertation, a pioneering work entitled *The Archaeology of Central Philippines: A Study Chiefly of the Iron Age and Its Relationships*. During the 1950s, Solheim had excavated the Kalanay Cave site, which is located on the northwest coast of the island of Masbate (see Fig. 1) in

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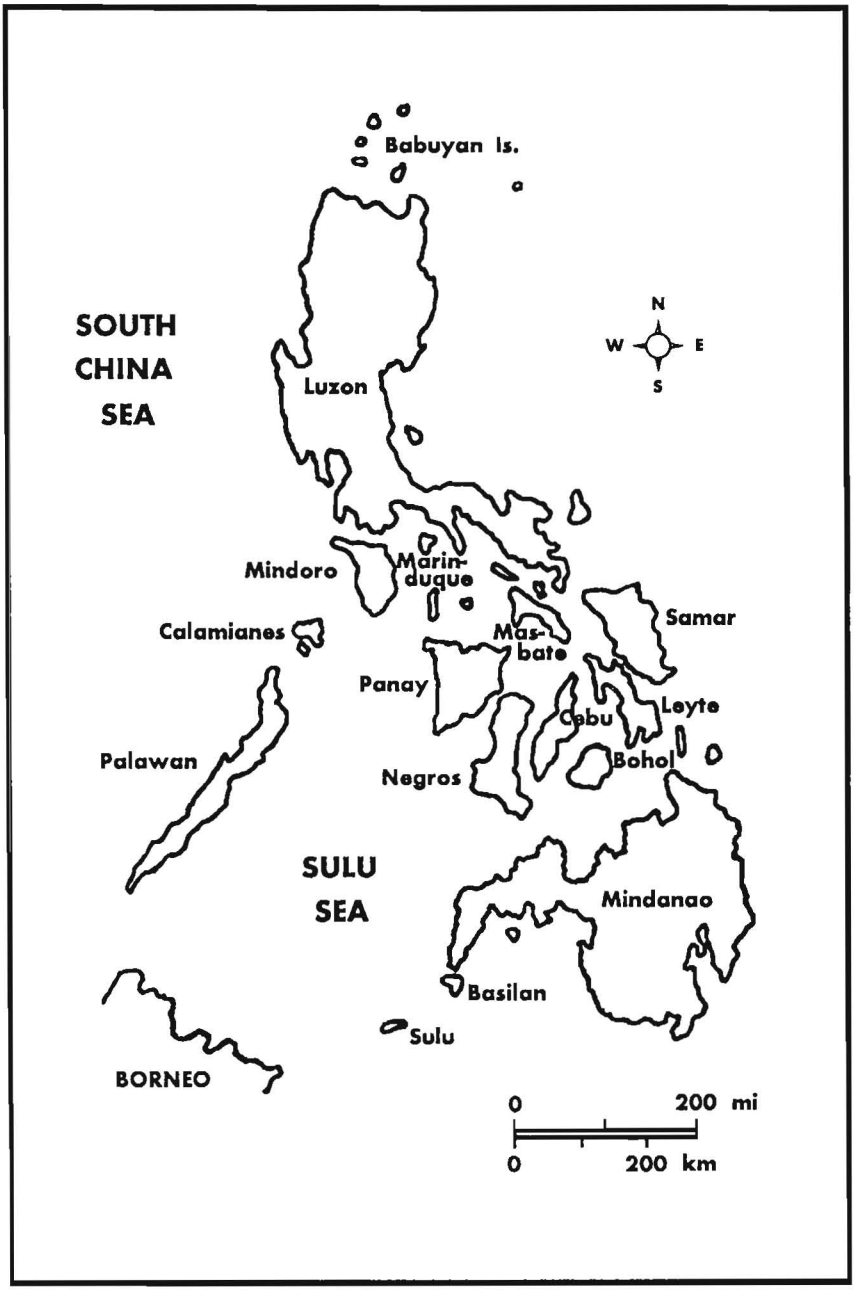

Fig. 1. Map of the Philippine Islands (adapted from Solheim 1964 : 20).

the central Philippines. From the earthenware ceramics he collected, and based on his previous work with other Philippine pottery, Solheim (1964 : 7–9, 13–16) devised a pottery classification system, based on surface treatment (e.g., plain, slipped, and incised) and morphology (e.g., bowl and jar) classes. He (1964 : 13)

argued that Kalanay Cave was the type site of the Kalanay pottery complex, which was defined by several pottery decoration and vessel forms recovered from the site. One of the characteristics of the Kalanay complex was the diversity of classes of decoration and form in this assemblage; Solheim identified 20 decorative modes and 16 morphological modes (1964 : 13, 16)! In addition to the Kalanay Pottery Complex, earlier excavations in the Philippines unearthed pottery that Solheim placed within the Bau and Novaliches Pottery Complexes. According to him, all three were associated with the Philippine Iron Age, dated to c. 400 B.C. to A.D. 1500 (Solheim 1964 : 11, 197, 211). Pottery from the Bau and Novaliches complexes exhibited less variation in form and decoration than that of the Kalanay complex (Solheim 1964 : 16). Using the pottery classifications and associated cultural materials, all three complexes were associated with partially overlapping geographic regions (Solheim 1964 : 20).

In addition to excavated materials from Kalanay Cave, Solheim analyzed assemblages from the Guthe Collection, an "archaeological reconnaissance expedition" (Solheim 1964 : 3) sponsored by the University of Michigan during the 1920s. Using the Kalanay assemblage and previously excavated materials as ceramic manifestations of the Philippine Iron Age, along with the earthenware ceramic classification system he had devised, the Guthe Collection assemblages were ordered into Early, Intermediate, and Late time periods, and also were identified by their associated pottery complex (along with its attendant geographic region). The assignment of assemblages to different time periods was accomplished, in part, by the occurrence of Asian porcelain within the assemblages. Of the Guthe Collection, Solheim (1964 : 117) wrote that "(w)ithout stratified sites, the one chronological indicator in the sites covered is the presence or absence of Chinese or Asiatic ceramics."

Solheim concluded his analysis with inferences about cultural group origins and migration routes into and out of the Philippines, along with spatial and temporal relationships between the analyzed assemblages and those excavated from other localities in Southeast Asia (e.g., Sa-Huynh and Samrong Sen from the South China region [Solheim 1964 : 199]). Despite his efforts to systematize pottery and cultural complexes in the Philippines and Southeast Asia, several methodological problems mar Solheim's work. The complexes were defined largely by ceramic design and morphological patterns, and variability among the complexes was attributed to their separation in time or space (or both). Yet, except for the type sites (e.g., Kalanay site), little attention was paid to within- or between-assemblage variation in these dimensions of pottery. Complexes thus became analytical units and ultimately were treated as real cultural entities. Unfortunately, this occurred before their boundaries and temporal and spatial relationships had been fully examined. In addition, the morphological classes employed by Solheim may be functionally constrained, and thus they may not be effective units for the description of homologous relationships between assemblages or complexes—the apparent goal of his study. Consequently, the complexes identified by Solheim, and their time and space relationships, would best be considered hypothetical units and statements; they have yet to be confirmed.

Solheim partly recognized this fact when he remarked that there were two problems for future research. "The first major problem of the Philippine Iron Age is to establish the relative chronology of the three major cultures [i.e., Kala-

nay, Novaliches, and Bau], and the second is to establish the routes and relative times of the Malay movement into the Philippines" (Solheim 1964:212). Since Solheim wrote these remarks over thirty years ago, no chronology either for the sites represented in the Guthe Collection or the complexes he first identified has been completed based on stylistic classes associated with Neolithic and Iron Age earthenware ceramics. Therefore, one goal of this paper is to illustrate how a relative chronology might be developed with the data presented by Solheim from the Guthe Collection.

Archaeologists typically have relied upon stratigraphic information and radiocarbon dating to place sites (and their ceramic assemblages) into a temporal order. However, because the assemblages represented in the Guthe Collection (as well as many other burial sites from the Philippines) do not include this type of information (or the material on which it would be based), a chronology based on the seriation method is the only currently viable alternative. Using the assemblages represented in the Guthe Collection and included in Solheim's study, we completed several different seriations. These include arrangements based on largely dimensional or paradigmatic (Dunnell 1971) classification of earthenware surface treatment and morphology. Not all of the seriations produce comparable results, and we consider how archaeologists who may hope to use seriation in their research must also examine the conditions necessary for its successful application. Finally, the implications our research raises for analyses of ceramic assemblages and exploring prehistoric cultural change and diversification in Southeast Asia will be explored in the final section of the paper.

THE SERIATION METHOD AND ARCHAEOLOGICAL CHRONOLOGIES

Ideally, the seriation method chronologically orders archaeological groups, such as assemblages (Dunnell 1981:67). Graves and Cachola-Abad (1995:2) define an archaeological chronology "as a device to describe: 1. the relative or absolute sequence in time among events ... associated with some set of objects ...; or 2. the duration in relative or absolute time of some set of [descriptive] classes ... identified among a group of objects." Although their original reference is to architectural units, this definition can be applied to all chronologies, including those based on ceramics. Here, we shall be concerned with producing a relative sequence of depositional events (the interment of humans along with associated mortuary goods) based on the differential occurrence of archaeological classes descriptively identified on ceramics associated with these events. This approach is not new in archaeology; in his monumental work, Flinders Petrie (1901) employed a similar approach to date over 500 burials from Egypt.

The seriation method uses stylistic classes, identified descriptively, to order groups (Dunnell 1970:308). Typically, each class is defined by the intersection of one or more dimensions, and each dimension is characterized by two or more mutually exclusive modes. For example, with ceramic form, one dimension could be the direction of the rim in relation to its neck or body, and rim modes might by dichotomized as direct or everted. For this paper, classes will be defined by: (1) types of artifacts (e.g., porcelain, iron tools, earthenware); (2) earthenware surface treatment and design unit dimensions; and (3) earthenware morphological dimensions. Groups will refer to the assemblages of portable material culture

recovered at different burial sites in the Philippines and represented in the Guthe Collection. Although earthenwares are emphasized in this study, we also examine other artifacts that occur with these burials.

One form of seriation involves tabulating the occurrence of modes or classes within groups or assemblages and then arranging the assemblages in conformity with the occurrence principle. This principle stipulates that, "the distribution of any historical or temporal class is continuous through time" (Dunnell 1970:308). "(T)he [differential] presence or absence of particular descriptive classes is the basis for arranging units or groups" (Graves and Cachola-Abad 1995 : 6; see also Cachola-Abad et al. 1995). We seek arrangements of groups that maximize continuous distributions of classes across groups.

Necessary Conditions for Seriated Groups

Certain conditions for a seriation must be met before one may infer chronology (Dunnell 1970, 1981; Graves and Cachola-Abad 1995). These will be described, along with our assessments of how well the assemblages from the Guthe Collection meet them. The first condition is that "(a)ll groups included in a seriation must be of comparable duration" (Dunnell 1970:311; see also Cachola-Abad et al. 1995 : 10; Dunnell 1981 : 73; Graves and Cachola-Abad 1995 : 11; Moniz et al. 1995 : 12; Teltser 1995 : 56). That is, groups (or, in the present case, assemblages) must be roughly equivalent in the duration of time represented by their formation and/or deposition. Lacking independent information on duration, comparability may be inferred from the fact that all of the sites represented in this analysis of assemblages from the Guthe Collection are associated with human interments (Solheim 1964 : 79). Most have relatively similar arrays and numbers of artifacts. However, a few assemblages of exceptionally large size are included in the Guthe Collection. It is possible that such large sets were deposited over a *longer* period of time (or alternatively, they may represent a different event in terms of human interment).

The second condition is that "(a)ll the groups included in a seriation must belong to the same cultural tradition, that is, they must be 'genetically' related" (Dunnell 1970 : 311; see also Cachola-Abad et al. 1995 : 8; Graves and Cachola-Abad 1995 : 9; Moniz et al. 1995 : 12; Teltser 1995 : 59–60). In other words, the human groups (and their material products) represented within a particular cultural tradition will be assumed to have a common ancestry (i.e., meet the condition necessary to establish homologous relationships); otherwise, the groups represented cannot be properly ordered. As Dunnell (1970 : 311) noted, this condition would limit the effects of migration, but it is also necessary to control for groups within a region that might have separate origins and might have maintained their separate participation in different cultural systems. Does the Guthe Collection meet this condition? Solheim assigned all of the assemblages in the collection to the Iron Age from the central Philippines, a region he thought was more culturally similar than dissimilar. Yet Solheim's interpretation of the different pottery complexes represented in the collection suggests that some of them derive from different areas of Southeast Asia. If so, it might be difficult to seriate all of the assemblages if indeed some of them are the products of separate migrations into the central Philippines.

The third condition is that "(a)ll the groups included in a seriation must come from the same local area" (Dunnell 1970:311; see also Cachola-Abad et al. 1995:8; Graves and Cachola-Abad 1995:9; Moniz et al. 1995:12; Teltser 1995:56). This condition attends to the potential effects diffusion through space have on stylistic traits. If diffusion occurs more rapidly through space than through time, a seriation may, in fact, order assemblages along a spatial gradient corresponding with the direction(s) of diffusion. Except for one unknown site, provenience information is available for all of the sites. Although the geographic area represented by the sites is relatively large, the local area refers to the islands of the central Philippines (see Fig. 2 for site locations of the Guthe Collection). Fortunately, this condition may be tested through seriation by employing geographic subdivisions (see Graves and Cachola-Abad 1995 for a recent effort). Assemblages that do not conform to this condition of the seriation method may be geographically separable from those which do, or may be ordered along the dimension of interassemblage distance.

The fourth condition is that "seriated groups must be comparable artifacts" (Cachola-Abad et al. 1995:8; see also Graves and Cachola-Abad 1995:8). For this paper, comparable artifacts are earthenware vessels and associated artifacts that were deposited during the Philippine Iron Age. However, the assemblages do contain both jars and bowls, forms that may not be comparable in terms of stylistic dimensions (see Graves 1982). Comparability also applies to the groups. A number of assemblages in the Guthe Collection contained relatively few earthenware vessels. Whether this is a function of recovery, duration, or the nature of interment we cannot say for certain. However, it does render these assemblages suspect with respect to this condition.

The final condition for seriation is that "the groups seriated reflect the diversity displayed within the larger population such that no significant sampling errors are created through the exclusion of a subset of the group being ordered" (Cachola-Abad et al. 1995:9; see also Graves and Cachola-Abad 1995:10). It is unlikely that the assemblages in the Guthe Collection represent a cross-section of residential sites. It is also unclear to us that the collection necessarily reflects the diversity of Iron Age burial sites in the central Philippines (Solheim 1964:3–4). Thus, we shall be cautious about any extrapolation of the results of the seriations to other sites in the region or Southeast Asia.

THE ARCHAEOLOGICAL ASSEMBLAGES FROM THE GUTHE COLLECTION AND THE CLASSIFICATION OF ARTIFACTS

From 1922 to 1925, the University of Michigan sponsored an "archaeological reconnaissance expedition" to the central islands of the Philippines (Solheim 1964:3). The purpose was to collect as many Asiatic ceramics as possible. According to Solheim (1964:3), there are no Neolithic or earlier sites represented in the collection, and few artifacts from pre–Porcelain Age sites were collected. There are, however, a number of sites with only earthenware ceramics (i.e., no porcelains or metal objects) that are conceivably of Neolithic age. The sites were burial caves, burial grounds, or graves (Solheim 1964:3). No stratigraphic data are available from the sites. By comparing the Guthe Collection to excavated materials from the Kalanay Cave site on Masbate Island, Solheim attempted to organize

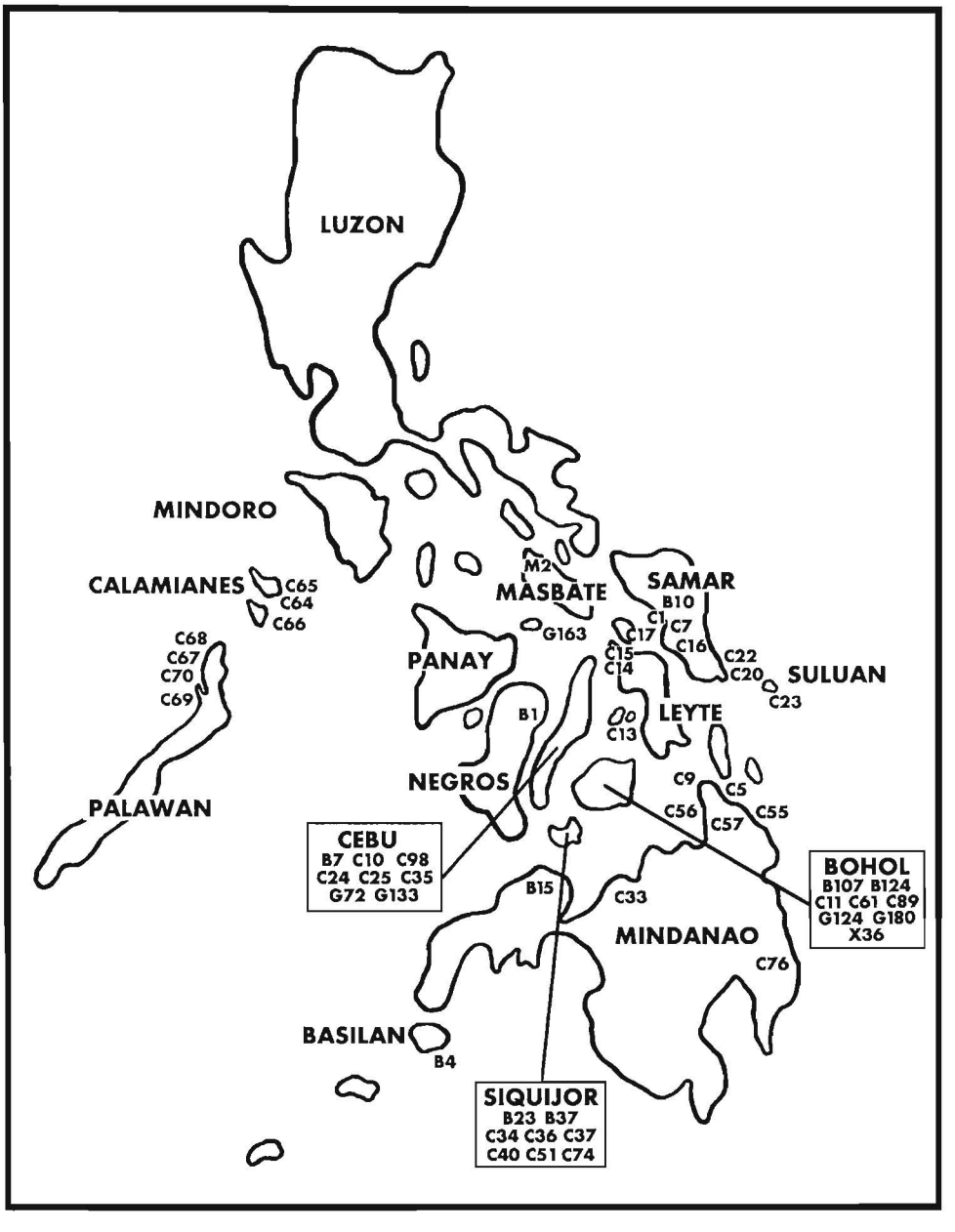

Fig. 2. Map of site locations for the ceramic assemblages of the Guthe Collection (adapted from Solheim 1964 : 81).

the assemblages by time and pottery complex. He divided the assemblages into four ceramic complexes—Kalanay, Novaliches, Bau, and Loboc—and organized them into Early, Intermediate, and Late time periods. This latter arrangement was based on the occurrence of Asian porcelains in the assemblages. According to Solheim (1964 : 11), the Kalanay and Novaliches complexes corresponded to the

TABLE 1. SERIATION OF GUTHE COLLECTION ASSEMBLAGES BY FOUR GENERAL ARTIFACT CLASSES

SITE	POTTERY COMPLEX	TIME PERIOD	LOCATION	ISLAND	PORCELAIN	IRON	OTHER METALS	GLASS	NO. OF FORMS
0000	Kalanay	Intermed.	?	?	+				59
C1	Kalanay	Late	Central	Samar	+				7
B4	Bau	Late	South	Basilan	+				5
C17	Bau	Late	Central	Samar	+				4
C22	Kalanay	Late	Central	Samar	+				3
C61	Bau	Late	Central	Bohol	+				2
B107	Loboc	Late	Central	Bohol	+				2
G180	Loboc	Late	Central	Bohol	+				2
B37	Kalanay	Intermed.	Central	Siquijor	+				1
C16	Kalanay	Late	Central	Samar	+				1
B124	Loboc	Late	Central	Bohol	+				1
C89	Loboc	Late	Central	Bohol	+				1
G133	Loboc	Late	Central	Cebu	+				1
C23	Kalanay	Late	Central	Suluan	+				1
C37	Kalanay	Late	Central	Siquijor	+				1
C10	Bau	Late	Central	Cebu	+				1
G124	Bau	Late	Central	Bohol	+				1
G72	?	Late	Central	Cebu	+				1
C57	Bau	Late	South	Mindanao	+				1
B15	Bau	Late	South	Mindanao	+				1
C70	Bau	?	West	Palawan	+				0
C11	Kalanay	Intermed.	Central	Bohol	+	+	+	+	13
B1	Kalanay	Late	Central	Negros	+	+	+	+	12
C55	Bau	Intermed.	South	Mindanao	+	+	+	+	7
C64	Bau	Late	West	Calamianes	+	+	+	+	7
C56	Bau	Late	South	Mindanao	+	+	+	+	2
M2	Kalanay	Late	Central	Masbate	+	+	+		3
B23	Kalanay	Intermed.	Central	Siquijor	+	+		+	15

(*Continued*)

TABLE I (*Continued*)

C76	Bau	Intermed.	South	Mindanao	+	+			11
C69	Novalich	Late	West	Palawan	+	+			6
C7	Kalanay	Late	Central	Samar	+	+			6
C9	Kalanay	Late	South	Mindanao	+	+			2
B7	Kalanay	Intermed.	Central	Cebu	+	+			2
C33	Bau	Late	South	Mindanao	+	+			1
C24	?	Late	Central	Cebu	+	+			1
C20	Kalanay	Late	Central	Samar	+	+			1
C13	Kalanay	Early	Central	Camotes		+	+	+	13
C5	Bau	Intermed.	South	Mindanao		+	+	+	10
C65	Novalich	Early	West	Calamianes		+		+	97
C14	Kalanay	Early	Central	Leyte		+			8
C74	Kalanay	Intermed.	Central	Siquijor		+			3
B10	?	?	Central	Samar		+			0
C35	Kalanay	Early	Central	Cebu				+	2
C67	Bau	Early	West	Palawan					7
C66	Novalich	Early	West	Calamianes					6
C98	?	Early	Central	Cebu					3
C40	Kalanay	Intermed.	Central	Siquijor					3
X36	Loboc	Late	Central	Bohol					3
G163	Novalich	Late	Central	NE Panay					2
C25	Kalanay	Early	Central	Cebu					2
C68	Kalanay	Early	West	Palawan					2
C36	Kalanay	Early	Central	Siquijor					1
C51	Kalanay	Early	Central	Siquijor					1
C15	Kalanay	Early	Central	Leyte					1
C34	Kalanay	Early	Central	Siquijor					1
Total Forms									350

Early Iron Age, the Bau complex to the Late Iron Age, and the Loboc complex to the historic period (i.e., sixteenth to eighteenth centuries A.D.). The Intermediate time period is associated with assemblages having a variety of vessel forms and designs, and artifacts that were typical of both Early and Late periods (see Solheim 1964:120, 150).

"In the total [Guthe C]ollection, there are 485 sites represented: 120 caves, 134 burial grounds, and 231 graves" (Solheim 1964:79). From this total, Solheim presented data on 55 sites (see Table 1), including descriptions of earthenware ceramics (e.g., surface treatments, morphology, measurements, and remarks) and descriptions of associated artifacts such as iron objects, glass beads and bracelets, and shell bracelets. These sites represented "a survey of Philippine Iron Age burial sites south of Luzon" (Solheim 1964:207). He also presented Guthe's notes when available and pertinent.

In the present study, two primary morphological modes (see Figure 3) were recognized in our classification of the earthenwares from the Guthe Collection. These modes were developed by examining the illustrations of all vessel forms provided by Solheim (1964:15, 17, 19) and then were identified consistently in the assemblages from the different sites based on his original assignments. However, rather than an extensive set of vessel forms, we employed just two (Fig. 3,I): (1) jar/pot/cup (hereafter, jar)—vessels with a neck to shoulder portion, "typically characterized by a marked constriction of the maximum body diameter" (Rice 1987:479); and (2) bowl/plate/lid (hereafter, bowl)—generally shallow vessels that do not have a shoulder or a marked constriction (see Rice 1987:218). For the jars in the assemblages, four potentially stylistic dimensions were established and modes defined for each. The dimensions are (Fig. 3,II) form of rim; (Fig. 3,III) width of neck; (Fig. 3,IV) form of body, and (Fig. 3,V) occurrence of a stem or stand. Rim modes are (1) direct, in a line with the vessel neck, or (2) everted, here defined as angled out from the neck of the vessel. Vessel neck modes are dichotomized into those with (1) narrow (less than 15 cm diameter) and (2) wide (equal to or greater than 15 cm diameter) necks (see Solheim 1964:68). Body-form modes included (1) those with a carination (having a corner point on the body), and (2) those lacking a corner (i.e., whose profile was smoothed). Vessel stands refer to the placement on the base of a form of a stand that elevates the bottom of the vessel above a surface. This dimension is dichotomized into present (1) or absent (0). For bowls, three dimensions were used, including rim form, body form, and the occurrence of a stem or stand. Rim- and body-form modes, as well as the modes for stands, are similar to those presented for jars. There are a total of 40 possible morphological classes in this system. For each assemblage represented in the Guthe Collection, individual vessels were classified first by the basic form of the vessel and by their respective dimensions and modes (Fig. 3). The number of morphological classes identified in the assemblages of the Guthe Collection range from one to nine.

For design, five dimensions were identified, using the drawings published by Solheim (1964:14, 17, 19), and from two to four mutually exclusive modes were defined for each dimension (Table 2). Five modes were employed to describe primary surface treatment: (1) none (other than scraping and perhaps polishing); (2) liquid (including slipping, glazing, or painting); (3) incised; (4) impressed; and (5) appliqué treatments. The dimension of primary horizontal

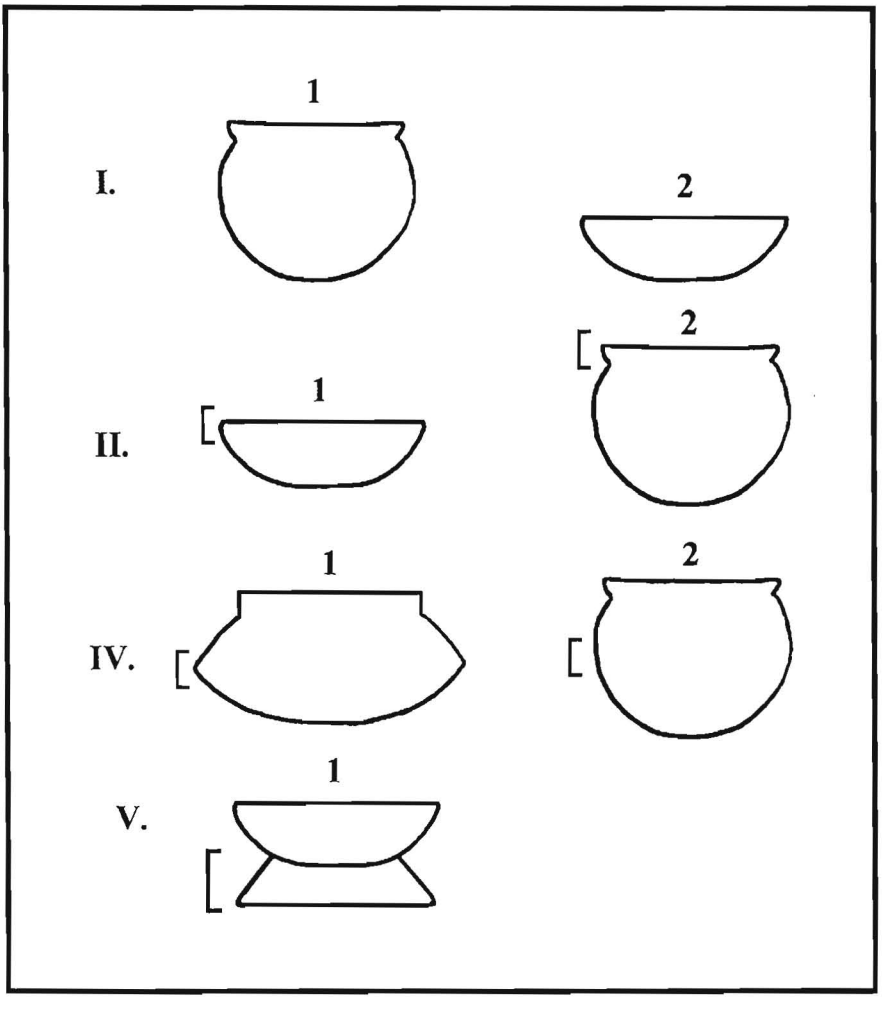

Fig. 3. Form dimensions are coded as follows: I. Kind of vessel (1) jar/pot/cup and (2) bowl/plate/lid; II. Rim form (1) direct and (2) everted; III. (Not shown in the figure.) Neck width (1) narrow (<15 cm diameter) and (2) wide (≥15 cm diameter); IV. Body form (1) carinated and (2) rounded; and V. Stand (0) absent and (1) present.

framing (i.e., design borders) refers to the occurrence of lines along the exterior or edge of the design units. Modes for this dimension were dichotomized as present (1) or absent (0). The primary unit of repetition refers to the elements of the design, with three modes defined: absent (0), the presence of unenclosed single or double lines (1), and the presence of enclosed single or double lines (2). Repetition of the primary unit included two modes: absent (0), and continuously repeating or continuously alternating units (1). Secondary design refers to units employed to supplement primary units, again dichotomized into absent (0) or present (1). The latter mode was identified by infilled enclosed lines or design units appended to enclosed or unenclosed lines. Multiple dimensions of surface treatments could occur on a vessel, and thus there are more design cases than

TABLE 2. SURFACE TREATMENT DESIGN DIMENSIONS, MODES, AND CODING CONVENTIONS

I. *Primary Horizontal Framing (Border)*
   0. Absent
   1. Present: the appearance of an open line along the periphery of the design
II. *Primary Unit of Repetition*
   0. Absent
   1. Open line: the appearance of a line with or without a break in orientation
   2. Enclosed line or curve: the appearance of a line that forms a geometric shape such as a triangle or a circle
III. *Repetition of Primary Unit*
   0. Absent
   1. Continuous: unit repeats itself; *or*, alternatively, unit appears with other modes (e.g., repeating triangles with interspersed circles) or as a different orientation of the same mode (e.g., triangles with interspersed upside-down triangles)
IV. *Secondary Design*
   0. Absent
   1. Present: the design may be infilled or within the primary design (e.g., open line, enclosed line or curve), or it may be appended or outside the primary design (e.g., open line, enclosed curve)

Examples: 1111 = design unit with a border, repeating line, and circles below the repeating line; 1211 = design unit with a border, repeating circles, and triangles within the circles; 0111 = design unit with no border, a repeating line, and triangles below the repeating line; 0211 = design unit with no border, repeating squares, and slash marks below the repeating squares.

morphological cases in this seriation. In addition, we separated the first dimension (surface treatment modes) from the latter four design dimensions. There was a total of 24 possible design classes for the latter four dimensions of this classification that occurred in the collection; the number of design classes ranged from one to ten in the assemblages.

We encountered several problems with the data from the Guthe Collection that affect their utility in this analysis. In a few cases, Solheim listed a single vessel with multiple forms. We chose to treat each vessel form as a separate case for the purposes of morphological classification. The number of vessel forms represented in each assemblage is the sample size shown in Table 1. For site C65 on the island of Calamianes, Solheim listed the same vessel numbers more than once in his inventory of vessels. When different forms and surface treatments were identified for vessels with the same identification number, we chose to treat them as separate cases. Some forms listed by Solheim are not represented in his illustrations, but if there was sufficient descriptive information provided in his remarks, the vessel was placed into the morphological classification presented above. Where surface treatment or design dimensions were missing, these cases were eliminated from the seriations. Two sites were given the same number (C22) by Solheim; we renumbered one C20.

As previously mentioned, many sites have only a few earthenware vessels represented in their published collections. This posed a problem for the seriations we attempted because these assemblages clearly do not represent the variation in stylistic dimensions or modes that might have been possible. Thus, assemblages with two or fewer vessels were excluded from most of the seriations we attempted. Two sites, one of which has no provenance information (it is listed as 0000 in

Table 1), have unusually large numbers of vessels in their assemblages. These large collections, because they may have been formed and deposited over a longer duration (or represent a qualitatively different mortuary event) than the remainder of the assemblages, often have substantially more stylistic variation than most other assemblages. Consequently, they are difficult to place successfully in an otherwise satisfactory array. We have left the unprovenanced site out of the seriations, although we do make an effort to establish its temporal position and geographic location based on the classes represented among its artifact assemblage.

RESULTS OF GUTHE COLLECTION SERIATION

Table 1 shows the set of 55 sites originally employed in this study. A total of 350 earthenware vessels was recorded for these sites, the number of vessels ranging from a high of nearly 100 to a low of zero. Each site is designated by a specific alpha-numeric number (see Fig. 2 for site location). Each site is also classified by pottery complex (Kalanay, Bau, Novaliches, and Loboc); time period (Early, Intermediate, and Late Iron Age); island; geographic location; and the occurrence of major artifact classes (other than earthenwares). This information was taken from Solheim (1964). The dimension of location separates the area of the central Philippines into a western section (including the islands of the Calamianes and Palawan), a southern section (Mindanao and Basilan), and a core central section (the remaining islands included in the study and generally referred to as the Visayas). The arrangement of the sites listed in Table 1 illustrates one of our efforts to develop a satisfactory seriation using the major artifact classes represented in these burial collections. The arrangement of sites conforms to the occurrence principle for seriation: sites are ordered so that the distribution of classes across sites is maximally continuous. This is not, however, a satisfactory ordering, because of the sizeable gaps represented in columns for two of the classes. Also, this array places several sites that Solheim identified as belonging to the Late period prior to the Intermediate period.[1]

If the 54 sites (whose provenance is known) are first grouped by their regional geographic location, a satisfactory seriation of the major artifact classes is achieved (see Table 3). There are now three separate seriations, one for each geographic

TABLE 3. SERIATION OF GUTHE COLLECTION ASSEMBLAGES BY FOUR GENERAL ARTIFACT CLASSES, GROUPED BY GEOGRAPHIC LOCATION

SITE	POTTERY COMPLEX	TIME PERIOD	PORCELAIN	IRON	OTHER METALS	GLASS
	Central					
B107	Loboc	Late	+			
G180	Loboc	Late	+			
B124	Loboc	Late	+			
C89	Loboc	Late	+			
G133	Loboc	Late	+			
C17	Bau	Late	+			
C61	Bau	Late	+			

(*Continues*)

TABLE 3. (*Continued*)

SITE	POTTERY COMPLEX	TIME PERIOD	PORCELAIN	IRON	OTHER METALS	GLASS
C10	Bau	Late	+			
G124	Bau	Late	+			
C1	Kalanay	Late	+			
C22	Kalanay	Late	+			
C16	Kalanay	Late	+			
C23	Kalanay	Late	+			
C37	Kalanay	Late	+			
G72	?	Late	+			
B37	Kalanay	Intermed.	+			
C20	Kalanay	Late	+	+		
C7	Kalanay	Late	+	+		
C24	?	Late	+	+		
B7	Kalanay	Intermed.	+	+		
M2	Kalanay	Late	+	+		
B1	Kalanay	Late	+	+		
C11	Kalanay	Intermed.	+	+		
C13	Kalanay	Early		+		
B23	Kalanay	Intermed.	+	+		
C74	Kalanay	Intermed.		+		
C14	Kalanay	Early		+		
B10	?	?		+	+	
C35	Kalanay	Early			+	+
X36	Loboc	Late			+	+
G163	Novalich	Late			+	+
C40	Kalanay	Intermed.				+
C25	Kalanay	Early				
C36	Kalanay	Early				
C51	Kalanay	Early				
C15	Kalanay	Early				+
C34	Kalanay	Early				
C98	?	Early				
	West					
C70	Bau	?	+			
C69	Novalich	Late	+	+		
C64	Bau	Late	+	+	+	+
C65	Novalich	Early		+		+
C66	Novalich	Early				
C67	Bau	Early				
C68	Kalanay	Early				
	South					
B4	Bau	Late	+			
C57	Bau	Late	+			
B15	Bau	Late	+			
C33	Bau	Late	+	+		
C9	Kalanay	Late	+	+		
C76	Bau	Intermed.	+	+		
C56	Bau	Late	+	+	+	+
C55	Bau	Intermed.	+	+	+	+
C5	Bau	Intermed.		+	+	+

location, yet there are also many fewer gaps, and where gaps do occur they are expectable, that is, near the end of an occurrence distribution for a class. The one unprovenanced site (0000) has only porcelain associated with it among the potential major artifact classes; and, at best, we can say that it most likely is not among the Early period sites in the three seriations. Solheim would probably have placed it in the central geographic location based on his identification of Kalanay complex earthenwares at the site. The three arrays in Table 2 suggest that geographic location can be a significant variable in achieving a satisfactory seriation of Philippine and Southeast Asian assemblages. Thus we have included it in all the subsequent seriations we performed with the Guthe Collection. Whether the effects of location reflect differential diffusion of traits, the migration and persistence of different cultural groups, or some other factor cannot be determined from the information provided by these assemblages.

Despite the success of this first seriation using the major artifact classes, we remain somewhat skeptical about its chronological significance. If the seriation is accurate, it suggests that iron and other artifact classes dropped out of use in burial assemblages in the late prehistory of the central Philippines, a conclusion we find difficult to accept. Rather, because the assemblages are derived from burial contexts, we suspect the artifact classes used to order sites in Table 3 may indicate the relative investment made in mortuary goods for different members of prehistoric Filipino society. A number of studies (e.g., Binford 1971; Brown 1971) have shown that the number and diversity of artifacts placed in burial assemblages can be related to the age, gender, kinship relations, economic access, and status of the individual(s) represented in the burial. It would not be surprising if these social factors were not also structuring variation in the distribution of the artifact classes represented in Table 3. As such, the order may not represent chronology so much as it does the social position(s) of the individual(s) represented at the sites, with a fairly wide range of interment possibilities.

Table 4 employs the five modes for vessel surface treatment as the basis for arranging 29 assemblages. As before, the assemblages were first grouped by their respective geographic locations. A total of 491 cases (types of treatment) were included in the seriation. All assemblages with fewer than two cases were dropped from the table (as was the assemblage lacking provenance information). This results in a satisfactory arrangement of the sites by these five modes and also conforms well to the expectations of the occurrence principle. A single gap is represented in the array. These three arrays improve over our efforts to arrange the assemblages without first separating the geographical groups. Site 0000, which lacked locational data, was characterized by all four surface treatment modes and would be placed in the lower portion (i.e., possible earlier distribution) of the arrays.

The three arrangements represented in Table 4 do not order the sites in a manner concordant with the time periods inferred by Solheim—this is especially the case for the array of sites in the core, central area. Three sites assigned a late date by Solheim occur near the bottom of the list of centrally located sites, and two supposedly early sites occur between several sites that Solheim placed in the Intermediate period. In addition, the three geographic areas vary somewhat in terms of the sequence in which the surface treatment classes occur and the extent to which the different classes co-occur within sites. The central and southern areas show

TABLE 4. SERIATION OF GEOGRAPHICALLY GROUPED SITES, BASED ON FIVE SURFACE TREATMENT MODES

SITE	POTTERY COMPLEX	TIME PERIOD	PLAIN	LIQUID	INCISED	IMPRESSED	APPLIQUÉ	NO. OF TREATMENTS
	Central							
C17	Bau	Late	+			+		5
C20	Kalanay	Late	+			+		3
M2	Kalanay	Late	+			+		5
C1	Kalanay	Late	+		+	+		9
B1	Kalanay	Late	+		+	+		14
C7	Kalanay	Late	+		+	+		7
B23	Kalanay	Intermed.	+		+	+		18
B7	Kalanay	Intermed.	+		+	+		5
C74	Kalanay	Intermed.	+		+	+		7
C11	Kalanay	Intermed.	+	+	+	+	+	38
C40	Kalanay	Intermed.			+	+		6
C14	Kalanay	Early	+		+	+		22
C36	Kalanay	Early	+		+	+		7
C23	Kalanay	Late	+		+			4
C22	Kalanay	Late	+		+			3
C13	Kalanay	Early	+		+			15
C98	?	Early	+					3
	West							
C69	Novalich	Late	+					7
C64	Bau	Late	+		+	+		16
C65	Novalich	Early	+		+	+		192
C66	Novalich	Early	+		+	+		11
C67	Bau	Early	+		+	+		13
C68	Kalanay	Early	+		+	+		7
	South							
C56	Bau	Late				+		4
C76	Bau	Intermed.			+	+		20
C5	Bau	Intermed.	+		+	+	+	21
C55	Bau	Intermed.	+	+	+	+	+	17
B4	Bau	Late		+	+	+		9
B15	Bau	Late		+	+	+		3
Total Types of Treatment			139	15	132	200	5	491

quite divergent trends. Considerably more change occurs with respect to the surface treatment classes in the southern assemblages than is the case with either the western or central area assemblages. Based on the assemblages included in Table 4, plainware and either incised or impressed surface treatments (or both) overlapped substantially in time. Both appliqué and liquid-based surface treatments are more common in the southern assemblages than in either of the other two locations. Although we cannot determine from the evidence presented in Table 4 which ends of any of the three arrays are the most recent, we have arranged them so that they match as closely as possible the best order of Solheim's inferred time periods, with the top of the arrays being most recent and the bottom representing the oldest sites. However, for each geographic area this should be viewed as a hypothesis; each would require further support to determine if the inferred temporal order is indeed correct. Table 4 also illustrates how the three different

geographical locations are associated with somewhat different trends in earthenware surface treatment modes. Only the southern assemblages show much change in the diversity of modes: fewer modes occur at these sites through time. The western sites show relatively little change in mode richness for surface treatment. Only among the centrally located sites does Solheim's observation about decorative diversity appear to hold: maximum diversity occurs in the middle of the array, with less diverse sets of surface treatment modes at both early and late ends of the table.

Table 5 illustrates an occurrence seriation of the remaining design dimensions for the Guthe Collection. Again, only assemblages with more than two cases

TABLE 5. SERIATION OF GEOGRAPHICALLY GROUPED SITES, BASED ON THREE DIMENSIONS OF SURFACE TREATMENT DESIGN UNITS

			CLASSES[1]					
SITE	POTTERY COMPLEX	TIME PERIOD	000	100	110/1	201	210/1	NO. OF UNITS
	Central							
B1	Kalanay	Late	+				+	12
C36	Kalanay	Early	+				+	6
C61	Bau	Late	+				+	2
C17	Bau	Late	+				+	5
M2	Kalanay	Late	+				+	3
C1	Kalanay	Late	+		+		+	8
C7	Kalanay	Late	+		+		+	7
B7	Kalanay	Intermed.	+		+		+	4
C11	Kalanay	Intermed.	+		+		+	28
C13	Kalanay	Early	+		+		+	14
C14	Kalanay	Early	+		+		+	20
C74	Kalanay	Intermed.	+		+	+	+	7
B23	Kalanay	Intermed.	+		+	+	+	18
C22	Kalanay	Late	+		+			3
C40	Kalanay	Intermed.			+		+	5
C98	?	Early	+					3
	West							
C69	Novalich	Late	+					7
C64	Bau	Late	+				+	14
C65	Novalich	Early	+	+	+		+	189
C66	Novalich	Early	+	+	+		+	11
C67	Bau	Early	+		+			10
C68	Kalanay	Early	+		+			3
	South							
C56	Bau	Late					+	4
B4	Bau	Late			+		+	2
C76	Bau	Intermed			+		+	18
C5	Bau	Intermed.	+		+		+	14
C55	Bau	Intermed.	+		+		+	5
Total Types of Design Units			134	23	131	2	138	422

[1] *Classes*: 000 = no design; 100 = nonrepeating line with no secondary design; 110/1 = repeating line with or without a secondary design; 201 = nonrepeating enclosed line or circle with a secondary design; 210/1 = repeating enclosed line or circle with or without a secondary design.

were included in this table, limiting the analysis to 27 assemblages. A total of 422 cases are included; all three geographic areas are represented (although in different numbers). Three design dimensions were employed to define stylistic classes for this seriation. They include: (1) the primary unit of repetition (absent [0], present as unenclosed line [1], present as enclosed line [2]); (2) the form of design repetition (absent [0], present [1]); and (3) secondary design units (absent [0], present [1]). There are nine potential classes, defined taxonomically. If the first dimension, the primary design unit, was absent, all other dimensions were also absent (000). The other eight classes shown in Table 5 were formed by the combinations of the two remaining modes of the primary design unit and the two modes for each of the other design dimensions (repetition and secondary design units). We combined two sets of classes (110 and 111, 210 and 211) in Table 5 as a means of achieving a better fit for the requirement of relatively continuous class distributions across assemblages. For this seriation, we excluded one dimension originally employed in the classification, primary horizontal framing (hereafter, lined borders). This dimension occurred irregularly in these assemblages, and when the other dimensions were cross-classified by it, it produced a table in which the assemblages could not be suitably arranged (i.e., satisfy the occurrence principle of maximum continuity among assemblages).

Once again, the seriation of Philippine earthenware stylistic dimensions produces suitable results when assemblages from the three geographic locations are arranged separately. Somewhat different arrays of the stylistic classes are displayed for each location in Table 5. Undecorated pottery (class 000) has a somewhat different distribution in the south (where it declines in abundance) than in either the west or central areas, where it occurs throughout the sequence (and often in increasing relative abundance). In the west, unenclosed design units may have been replaced by enclosed units in the sequence. Among the centrally located sites, assemblages lacking design units were followed by those with both unenclosed and enclosed units (with the latter occurring late in the sequence after unenclosed units were eclipsed). The three geographic areas are also distinguished by the resolution of their respective design-unit seriations. There is relatively less resolution among the southern assemblages (especially compared to the previous seriation) when compared to those from the west (which were coarsely ordered in Table 4). In the central area, there is little difference in the resolution offered by the seriations based on either design units or surface treatment. Finally, the greatest diversity of earthenware design-unit classes occurred among the earlier assemblages in the south (although Solheim placed these in an Intermediate period) and the greatest diversity occurred in the middle of the central and west assemblages.

Table 6 sorts the assemblages of the Guthe Collection by kind of vessel (jar or bowl) and by geographic location for three of the four remaining morphological dimensions (rim form, neck width [applies to jars only], body form, and occurrence of a stand [applies to bowls only]). Seven morphological classes were used in this table, most of which were undifferentiated with respect to the final dimension, occurrence of a stand (which was therefore eliminated from this table). No suitable seriation could be achieved for the jar assemblages from the central area where more sites with these forms were located. The seriations for the western and southern sites, though acceptable in terms of the occurrence principle, in-

TABLE 6. SERIATION OF EARTHENWARE JAR AND BOWL FORMS BY THREE MORPHOLOGICAL CLASSES AND GROUPED BY GEOGRAPHIC LOCATION

			JAR CLASSES[a]							
SITE	POTTERY COMPLEX	TIME PERIOD	111	112	122	211	212	221	222	NO. OF FORMS
	Central									
C74	Kalanay	Intermed.				+	+			3
C1	Kalanay	Late		+		+	+			3
C13	Kalanay	Early		+			+		+	5
B23	Kalanay	Intermed.		+		+	+		+	11
C11	Kalanay	Intermed.						+	+	5
C40	Kalanay	Intermed.			+	+		+		3
B1	Kalanay	Late			+	+	+	+	+	12
C14	Kalanay	Early			+				+	5
	West									
C64	Bau	Late				+	+			4
C65	Novalich	Early	+				+			8
C67	Bau	Early					+			3
	South									
C55	Bau	Intermed.		+	+		+			6
C5	Bau	Intermed.		+	+	+	+		+	9
B4	Bau	Late			+	+			+	4
C76	Bau	Intermed.					+		+	9
Total No. of Forms			2	7	8	17	37	3	16	90

			BOWL CLASSES[b]			
			120	121	221	
	Central					
X36	Loboc	Late		+		3
C11	Kalanay	Intermed.	+	+		4
B23	Kalanay	Intermed.	+	+	+	4
C14	Kalanay	Early	+			3
	West					
C65	Novalich	Early		+	+	65
C66	Novalich	Early	+	+		4
Total No. of Forms			7	56	20	83

[a] *Classes*: 111 = vessel with a direct rim, narrow neck, carinated body, and with or without a stand; 112 = vessel with a direct rim, narrow neck, rounded body, and with or without a stand; 122 = vessel with a direct rim, wide neck, rounded body, and with or without a stand; 211 = vessel with an everted rim, narrow neck, carinated body, and with or without a stand; 212 = vessel with an everted rim, narrow neck, rounded body, and with or without a stand; 221 = vessel with an everted rim, wide neck, carinated body, and without a stand; 222 = vessel with an everted neck, wide neck, rounded body, and with or without a stand.

[b] *Classes*: 120 = vessel with a direct rim, rounded body, and without a stand; 121 = vessel with a direct rim, rounded body, and with a stand; 221 = vessel with an everted rim, rounded body, and with a stand.

clude few assemblages. Only a few assemblages contained bowl forms, and thus we do not regard the seriations of these forms as reliable.

Because we suspected that some of the morphological dimensions we used were functional units, we eliminated the dimensions of vessel form, neck width, and the occurrence of stands from the next analysis (see Table 7). In this table,

TABLE 7. SERIATION OF EARTHENWARE FORMS BY TWO MORPHOLOGICAL CLASSES (RIM[1]/BODY[2])

SITE	POTTERY COMPLEX	TIME PERIOD	LOCATION	11	12	21	22	NO. OF FORMS
C66	Novalich	Early	West		+			4
X36	Loboc	Late	Central		+			3
C40	Kalanay	Intermed.	Central		+	+		3
C1	Kalanay	Late	Central		+	+	+	3
B23	Kalanay	Intermed.	Central		+	+	+	15
C11	Kalanay	Intermed.	Central		+	+	+	9
B4	Bau	Late	South		+	+	+	4
C5	Bau	Intermed.	South		+	+	+	9
B1	Kalanay	Late	Central		+	+	+	12
C64	Bau	Late	West			+	+	4
C74	Kalanay	Intermed.	Central			+	+	3
C65	Novalich	Early	West	+	+		+	73
C55	Bau	Intermed.	South		+		+	6
C13	Kalanay	Early	Central		+		+	5
C14	Kalanay	Early	Central		+		+	8
C76	Bau	Intermed.	South				+	9
C67	Bau	Early	West				+	3
Total No. of Forms				2	78	20	73	173

[1] *Rim Classes*: 1 = direct rim; 2 = everted rim.
[2] *Body Classes*: 1 = carinated body; 2 = rounded body.

only rim form and body forms were included, and the sites were once again identified by their respective locations. Four classes representing the possible combinations of the two dimensions (each with two modes) were employed in this seriation. A total of 173 cases were included in the seriation. In this case, it was possible to generate a suitable array of the assemblages without grouping them by geographic location. Only a single gap occurs in the seriation, and although it is located near the middle of the distribution, the assemblage represented included only a few vessels. The array produced by the seriation suggests that carinated vessels developed later in the sequence and have a more limited temporal distribution among these assemblages. Rounded body forms are associated with everted rim forms in the earliest portion of the sequence; then, with both everted and direct rim forms; and finally, during the latest portion of the sequence, with direct rim forms.

DISCUSSION

Several points emerge from these analyses of prehistoric ceramic variation in the Philippines. The first is that seriation can be a useful method for analyzing assemblages at the level of general artifact types (porcelains, metals), but most significantly within types of artifacts (e.g., earthenwares). The application of seriation to the assemblages represented in the Guthe Collection illustrates that even materials collected in the past under poor conditions may still be suitable for reexamination. In this study, we have developed occurrence seriations for a number of the assemblages represented in Solheim's (1964) monograph. Note that

the units, both in terms of the sites and the classes we employed, were largely derived from the original fieldwork and Solheim's description of the materials. Thus, they are not necessarily the units with which we would have chosen to work; but the fact that they produce results consistent with the expectations of the seriation method suggests that the groups and classes meet the general conditions for their application to this method. Assuming for the moment that the orders produced by these seriations reflect the temporal dimension, we have achieved sequences of greater resolution than currently offered by the periods Solheim employed. Instead of only three temporal units, we have as many as six to ten units (each comprised of a somewhat different set of stylistic classes) for the central area, and somewhat less for the western and southern areas where there are fewer sites. Given the time represented by Iron Age sites in the Philippines, on the order of c. 2000 years, the scale of temporal units within the seriations is on average less than 250 years. We conclude that the opportunity to monitor and interpret prehistoric change at a finer scale is correspondingly improved when seriation is employed to construct relative chronologies.

The classes we employed to construct seriations varied considerably, and all were developed based on descriptions of assemblages and objects within assemblages presented by Solheim (1964). The application of general artifact classes to the seriation of burial assemblages from the Philippines, although it produced results consistent with the method, is suspect with respect to the dimension being ordered by the classes. In this case, we argue that it may reflect a functional dimension, that of the social differences reflected in the effort devoted to mortuary events for different groups or classes of individuals. Our efforts to construct seriations based on ceramic morphological traits were similarly constrained. Dimensions such as the width of necks on jars and the occurrence of stands on bowls are probably functional traits, and thus not well suited for seriation, where the objective is to track homologous relationships among assemblages.

Because the variation in stylistic traits can be the result of both temporal and spatial processes, acceptable seriations cannot simply be assumed to be relative chronologies; additional evidence is required. Lacking absolute dates associated with cultural materials from the sites included in the Guthe Collection, Solheim's placement of the assemblages into Early, Intermediate, and Late Iron Age periods might be used for this purpose, and we note that, generally (but not always), the seriations support his assignments. We believe that Solheim's temporal assignments are most useful in helping to determine which ends of the arrays represented in the seriations are most recent (although even here there are occasional uncertainties, e.g., the southern sites in Table 4). Dunnell (1970, 1981) has suggested that it should be possible to evaluate seriations for their temporal significance by the extent to which similar arrangements of the same groups are provided by different sets of stylistic classes.

Fifteen assemblages located in the central geographic area were sequentially arranged by the two seriations illustrated in Tables 4 and 5. A rank-order correlation coefficient was calculated for these 15 sites, based on their respective position in each seriation. Where two or more assemblages were characterized by the same set of classes, they were given the average rank of those represented. The coefficient calculated for the 15 assemblages was 0.65 ($p < .05$), indicating a relatively strong correspondence between the rank orders of the same assemblages in each

of the two seriations. We infer that the same underlying dimension is represented by the ranks, and that this dimension is time.

Although we have inferred that the temporal dimension is the primary axis along which the assemblages are arranged with respect to surface treatment, design unit, and morphological modes, the seriations also illustrate the effects of geographic location (or what Dunnell [1970] would call local area) on ceramic variation. This was especially the case for the dimensions of surface treatment and design units. In both cases, the assemblages from the three geographic areas could not be combined into a single seriation for the entire Guthe Collection. Only when the assemblages from the three areas were separately grouped and arrayed were acceptable seriations achieved. In contrast, an acceptable seriation of morphological dimensions was produced without partitioning the assemblages into geographic subunits. These results suggest that different aspects of style, even though they may be arrayed into chronological orders through seriation, may exhibit different geographical distributions at different spatial scales. The stylistic dimensions that differ in geographic variation are separable into those involving modification of vessel exterior surfaces and those representing elaboration of vessel forms. This is congruent with ethnoarchaeological research among the Kalinga (Stark 1993) of the Philippines, in which stylistic traits linked to vessel morphology varied less over a larger area than did stylistic traits associated with surface treatments. As one of us has previously suggested (Graves 1982), based on analyses of ceramic design traits, there are hierarchical relations among ceramic traits involving construction and completion of vessels that have a systematic effect on geographic variation in the stylistic traits associated with the different stages of manufacture. In our study, the traits that show less geographic variation are those which are also more visible (i.e., part of the vessel form as opposed to the vessel's surface) and are created during earlier stages of the manufacturing process. Finally, the detection of geographically differentiated stylistic variation through the application of seriation is one means by which we may pursue our research into the formation and evolution of prehistoric social groups.

The examples presented here also show how the potential effects of geographic scale may be evaluated within the context of the seriation method. Although there is much we can do to control for the condition of local area in our seriations, by separating the groups into smaller geographic units, it is possible to determine if these can be ordered into acceptable sequences and whether or not these arrays improve over a single ordering of all the groups. These examples also demonstrate why the provenance of groups used in seriation is necessary: without it, we cannot establish the effect of geographic location on our efforts to order groups into a temporal array.

Throughout this analysis, our attempts to use seriation were also constrained by the size of our ceramic samples from the site assemblages. Solheim presented information on over 50 sites; we used no more than one-half of these assemblages in the seriations. Although it would have been possible to undertake an object-based seriation, when each group represents a collection of artifacts and the goal is to arrange the assemblages, then the smaller assemblages are less likely to represent the underlying stylistic variation than are larger assemblages. For this reason, we eliminated the very smallest groups from our seriations and, in doing so, reduced the number of assemblages that we could potentially place into a

sequence. Similarly, the resolution of our seriations was constrained by the relatively small samples of most of the assemblages, which made it difficult to exploit the full potential of either the morphological or surface treatment classifications. The more dimensions and modes we employed, the more potential classes there were to be descriptively identified in the groups. Small-sized assemblages, under these circumstances, are less likely to represent the diversity of stylistic classes than are larger-sized assemblages. With larger samples from more localized areas it would be possible to refine the stylistic classification so as to produce more classes and potentially provide even finer temporal resolution than we have achieved here.

IMPLICATIONS FOR FUTURE STUDIES

We have shown in this paper that it is possible to create a reliable and replicable relative chronology of assemblages from the Philippines using the seriation method. This approach offers archaeologists an empirical means to construct chronologies whose conditions for application and whose outcomes can be explicitly evaluated. Thus, we can build on previous work to develop chronologies of increasingly finer temporal and geographic scale. In addition, the stylistic dimensions we employed are sufficiently general (and the criteria for their identification suitably described) that they can be applied to earthenware assemblages throughout Southeast Asia. As we all recognize, this need not be the endpoint of our archaeological investigations. However, because the seriation method treats time as a continuous dimension, the arrays we generate through seriation are compatible with the objectives of processual archaeology.

Again, the archaeological collections associated with the Guthe Collection are instructive. Even assuming that the chronological periods developed by Solheim for the Philippines and the different archaeological complexes are reliable constructs, these units reduce stylistic variability to one of differences in kind (i.e., typological). In so doing, such units render interpretation of prehistoric change as inherently transformational, the replacement of one kind by another. In much of Southeast Asian archaeology these units are equated with cultural groups, and changes from one period or complex to the next are interpreted as the outcome of population movement and (to some extent) replacement. Yet this need not be the case and seriations can be used as means of monitoring stylistic variability and interpreting this variability in nontransformational terms. The results of our analyses, especially the seriations produced for morphological stylistic traits and for stylistic traits associated with exterior surface treatments, suggest that the traditional interpretive model used in Southeast Asian archaeology is incorrect. Ceramic style at the level of vessel form varies through time across a wide area stretching from Mindanao to southern Luzon (and perhaps beyond). At the same time, ceramic style at the level of surface treatment varies both by time and across at least three geographic units within this larger area. Together they support an interpretive model in which ceramic style (and, perhaps, prehistoric social groups) had diverged geographically prior to the onset of the Iron Age in the Philippines. However, based on the morphological traits they shared across the larger area, these groups diverged from what appears to have been a common ancestral group. These results are not congruent with migration-based scenarios

for the Philippines. Rather, they suggest that prehistoric stylistic change during this period of time reflects localized processes.

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NOTE

1. This may reflect a problem with Solheim's original chronological placement of sites in his study.

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ABSTRACT

Using ceramic assemblages from the Guthe Collection that were studied by Solheim (1964), we employ the seriation method to arrange Philippine earthenware vessels by major artifact class, surface treatment, design, and morphology. While general artifact classes such as porcelain and iron produced successful seriations across all of the sites, we found that, for certain vessel dimensions, seriations produced "best-fit" arrangements when sites were grouped by geographic location. The results of our analyses may support a divergence model of social groups sharing common ceramic styles, reflected by similar morphological traits, spreading out from a central location rather than the foreign-based migration scenarios proposed by many Southeast Asian archaeologists. KEYWORDS: seriation, ceramics, style, Southeast Asia, Philippines.