BINOCULAR AND PETROGRAPHIC ANALYSIS OF POTTERY FROM YUMA WASH

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The results of binocular and petrographic examination of pottery from the Desert Archaeology, Inc., excavation at the Yuma Wash site are presented here. The geologic background of the Tucson Basin and the specific setting of the site are discussed first. The results of the binocular temper identification are presented, followed by the petrographic temper assessment. Next, the results of the discriminant model run on the point-count data acquired petrographically are discussed, along with the relationship between the binocular temper identification, petrographic assignment, and discriminant model petrofacies prediction. Some attempt was made to relate the petrographic results to the sherd assemblage as a whole through the binocular temper group designations; however, for reasons discussed below, this was challenging. Finally, the implications of this work are outlined, and the results are related to previous ceramic and petrographic analyses. The goal of this study was to assess the degree to which ceramics were made locally at the Yuma Wash site and the extent of exchange of ceramics within the Tucson Basin during the Hohokam Classic period (A.D. 1150-1450).

GEOLOGIC SETTING

The geology of the Tucson Basin is characterized by the Basin and Range setting in the southern part of Arizona (Chronic 1983:25-39). This comprises linear north-south or northwest-southeast trending mountain ranges with deep sediment-filled basins between them. The ranges bordering the Tucson Basin include the Tortolita Mountains to the northwest, the Santa Catalina Mountains to the north, the Rincon Mountains to the east, the Empire Mountains to the southeast, the Santa Rita Mountains to the south, the Sierrita Mountains to the southwest, and the Tucson Mountains to the west.

The basement Proterozoic rocks, primarily granites, granite-gneisses, gneisses, and schists, formed approximately 1.7-1.4 billion years ago (Nations and Stump 1997). They are found predominantly in the Tortolita, Catalina, and Rincon mountains. Paleozoic era sedimentary rocks, such as sandstone, siltstone, mudstone, and limestone, are rare in the Tucson Basin. They are mostly found in small outcrops in the Empire, Santa Rita, and Sierrita mountains. Volcanic activity in the Mesozoic era resulted in many outcrops of felsic and intermediate igneous rocks, found mostly in the Tucson and Sierrita mountains. Smaller volcanic outcrops are located in the Catalina, Rincon, and Santa Rita mountains, as well as on the western side of the Tortolita Mountains.

At the beginning of the Cenozoic era, the large-scale tectonic extension of the western North American crust created normal faulting, which produced the long narrow mountain ranges (horsts) and deep basins (graben) seen today. Additionally, the granite and gneiss beneath the Tortolita-Catalina-Rincon complex was pushed upwards. This caused the sedimentary rocks to erode away, while the volcano top moved toward the west. The Sierrita and Santa Rita mountains also feature an underlying granite batholith, although in these cases, a volcano erupted through this layer. The remaining Cenozoic era featured the mass deposition of sediments within the basin as the mountains underwent erosion. Although some similar rocks are present in most of the ranges, the locations and types of volcanic activity have created notable differences. In addition to the geographic separation of the individual mountains, this results in each range consisting of a unique suite of rocks that form distinctive sands when eroded. This is the basis for petrofacies, that is, petrographic facies, modeling in the Tucson Basin.

Several rivers traverse the basin, most notably the Santa Cruz River, flowing northward and joining the Gila River near Phoenix. Major tributaries include Rillito Creek and the Cañada del Oro. Smaller washes feed into these tributaries and bring sediments into the basin from the mountain ranges.

SITE SETTING

The Yuma Wash site is located on an active, late Holocene alluvial fan, the T1 geomorphic unit (McKittrick 1988), and within the floodplain of the Santa Cruz River (Figure K.1) (Huckleberry 2005; Katzer and Schuster 1984; also, Chapter 2, this volume). The alluvial fan material is primarily volcanic, composed of different rhyolites deriving from the Tucson Mountains and comprising the Wasson (J3) Petrofacies (Kring 2002). The Tucson Mountain eastern piedmont, where the Yuma Wash site is located, encompasses a large catchment area of approximately 30 km^2, reaching as far as the slopes of Wasson Peak. The rapid runoff close to the mountains slows into many distributary channels or broad sheetflow as it reaches the Santa Cruz River, eventually integrating with other alluvial fans.

These channels carry material from the older Pleistocene surfaces located near the mountains and contain gravels and coarse sands. As the channels reach the floodplain, their sediments become finer and create a broad area of thin deposits overlaying older sediments, including flood deposits from the Santa Cruz River. Particularly where Yuma Wash itself has cut into the alluvial fan, these micaceous, fine-textured flood deposits are exposed underneath the alluvial sediments. Archaeological remains vis-

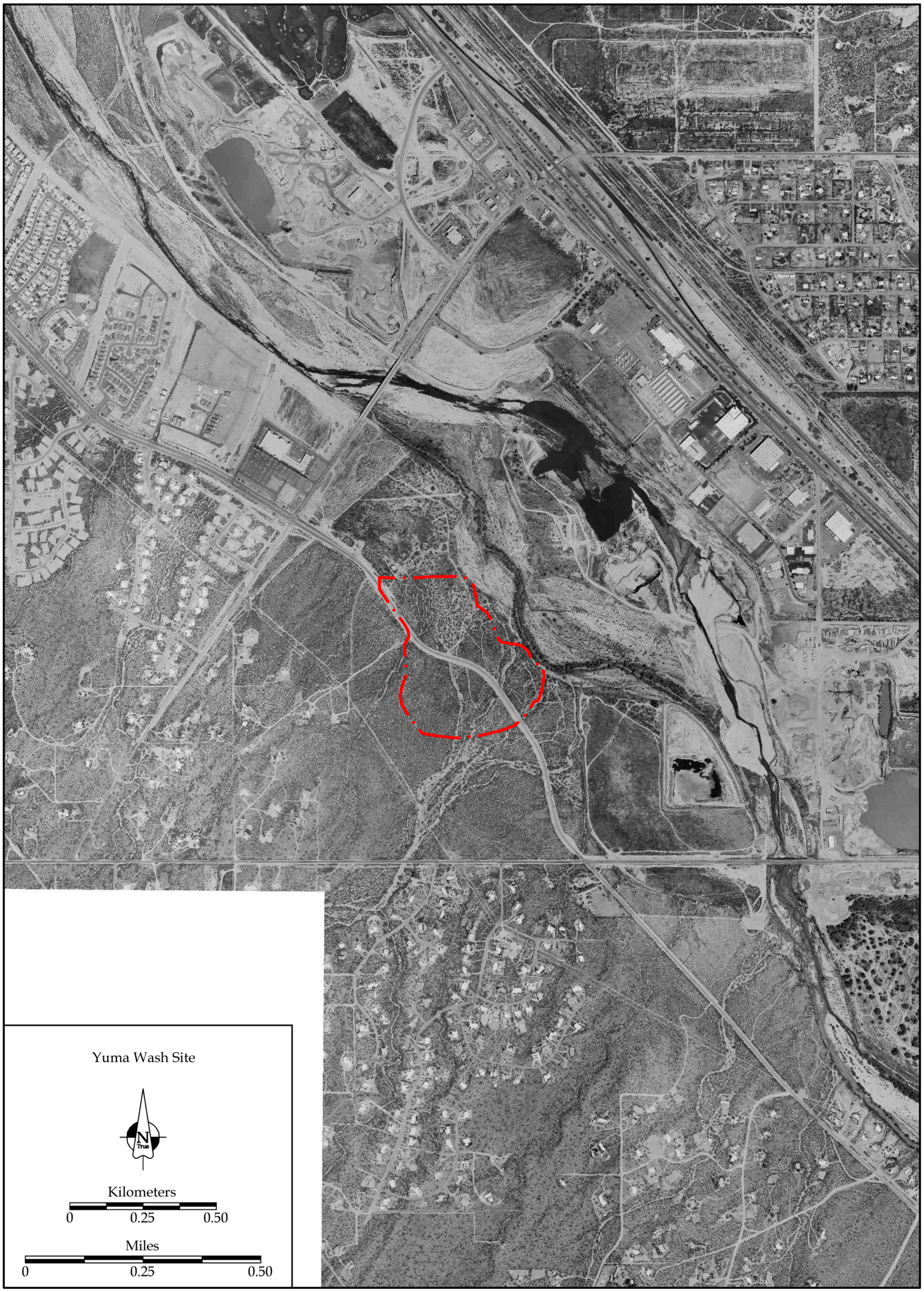

Figure K.1. View of the Yuma Wash site, showing alluvial fan and Santa Cruz River.

ible in the cut suggest that the creation of an alluvial fan over the flood deposits allowed human habitation in the area where the floodplain is roughly 1-2 km wide between the Tucson Mountain and Tortolita piedmonts. Near the Yuma Wash site, downstream from Rillito Creek and the Cañada del Oro, the main channel of the Santa Cruz River flows on the western side of the floodplain. Importantly, before moving back to the eastern side, past Yuma Wash, this channel cuts the edge of the Yuma Wash alluvial fan. Thus, an area where alluvial fan and flood deposits co-occur exists near the site. Further, this dynamic geomorphic area would have resulted in frequent changes to the landscape that may have affected the history of the site.

BINOCULAR ANALYSIS

Binocular analysis was conducted on 5,488 sherds to establish the type and origin of their temper. The sherds were analyzed by three individuals and divided into three projects. Acronyms used in this report include the following.

(1) MAR3: most of the non-mortuary sherds from the eastern portion of the AZ AA:12:312 (ASM) locus; examined by C. Lavayen.

(2) TOM1: all the ceramic material from the AZ AA:12:311 (ASM) locus and all the mortuary ceramics from the AZ AA:12:314 (ASM) site; examined by J. Heidke.

(3) TOM2: non-mortuary sherds from the AZ AA:12:122 (ASM) locus and the western portion of AA:12:312, as well as sites AA:12:314 and AZ AA:12:1047 (ASM); examined by T. Clark.

Because the petrographic analysis of the pottery was carried out to verify the temper identifications made by these individuals, the discussion of the binocular and petrographic results are divided by project.

Decorated wares and plain ware sherds that were not body sherds were selected for binocular analysis. Body sherds accounted for 54 percent of the assemblage, while rim sherds were 28 percent. The remaining 18 percent included handles, shoulders, bases, and indeterminate vessel parts. Most of the sherds were from bowls or jars (36 percent and 25 percent, respectively). The remainder were either indeterminate, or from scoops, pitchers, cups, and other vessel shapes (31 percent and 8 percent, respectively).

Tucson Basin Red-on-brown types were the dominant category of the selected sample comprising, 51.9 percent for all three projects (MAR3 = 57.7 percent; TOM1 = 45.2 percent; TOM2 = 75.6 percent) (Table K.1). The next most common were plain ware types at 40.7 percent (MAR3 = 36.3 percent; TOM1 = 46.5 percent; TOM2 = 19.8 percent). Red ware types were 3.3 percent (MAR3 = 4.4 percent; TOM1 = 3.4 percent; TOM2 = 1.8 percent), while the Salado Polychrome types made up 1.1 percent (MAR3 = 0.9 percent; TOM1 = 1.3 percent; TOM2 = 0.7 percent). The remaining wares, termed "Other," were less common, and together, comprised 3.0 percent (MAR3 = 0.7 percent; TOM1 = 3.6 percent; TOM2 = 2.1 percent).

As a whole, the analyzed corpus was tempered primarily with sand, 67.4 percent, comprising 73.5 percent of MAR3 sherds, 61.3 percent of TOM1 sherds, and 88.1 percent of TOM2 sherds (Table K.2). Other common tempering materials were sand and grog, at 4.5 percent (MAR3 = 6.4 percent; TOM1 = 4.2 percent; TOM2 = 3.8 percent), gneiss/schist and muscovite mica, at 3 percent (MAR3 = 5.8 percent; TOM1 = 3.0 percent; TOM2 = 0.8 percent), and mixed sand and muscovite mica, at 2.7 percent (MAR3 = 10.3 percent; TOM1 = 1.3 percent; TOM2 = 2.4 percent). Less common tempering materials were present at 5.4 percent (MAR3 = 4.0 percent; TOM1 = 6.3 percent; TOM2 = 3.9 percent). Indeterminate tempering materials comprised 16.9 percent (MAR3 = 0.0 percent; TOM1 = 24.0 percent; TOM2 = 1.1 percent).

Sand temper was seen in most of the wares, as was temper composed of sand and grog, gneiss/schist and muscovite mica, and mixed sand and muscovite mica. The plain ware sherds were dominated by sand temper, but had the greatest variety of temper types (Table K.3). Tucson Basin Red-on-brown ware sherds were overwhelmingly sand tempered, 90 percent of samples, with other temper types present below 5 percent (Table K.4). More than half the red ware ceramics contained sand, although these sherds also had a high percentage of temper types with metamorphic rock fragments (Table K.5). The Salado Polychrome ceramics were all sand tempered except two with mixed sand and muscovite mica, and one with mostly sand and some metamorphic rock fragments (Table K.6). Expectedly, the Hohokam Buff wares typically had temper composed of metamorphic rock fragments, such as gneiss or schist. The more unusual wares often had indeterminate or more rare tempering materials, although 56 percent had sand temper (Table K.7). Overall, most wares were tempered with more than one material type.

In cases where the temper was assigned a more specific type, the most common was indeterminate plutonic sand, seen in 10.7 percent of the whole assemblage, in 7.2 percent of MAR3 sherds, 8.8 percent of TOM1 sherds, and 21.4 percent of TOM2 sherds (Table K.8). Another fairly common temper

Table K.1. Sherds analyzed during binocular analysis, separated by project, the Yuma Wash site.

Ware	MAR3	TOM1	TOM2	Total
Plain	271	1,774	180	2,225
Vahki Plain	0	1	0	1
Stucco Plain	0	1	0	1
San Carlos Plain	0	3	1	4
Unknown intrusive plain ware (to Hohokam area)	0	1	0	1
Total plain ware	271	1,780	181	2,232
Tucson Basin Rillito Red-on-brown	0	10	1	11
Tucson Basin Rillito or Rincon red-on-brown	0	1	0	1
Tucson Basin Rillito or Early Rincon red-on-brown	0	2	0	2
Tucson Basin Early or Middle Rincon red-on-brown	0	1	0	1
Tucson Basin Early or Middle or Late Rincon red-on-brown	0	1	0	1
Tucson Basin Late Rincon Red-on-brown	0	0	2	2
Tucson Basin Rincon or Tanque Verde red-on-brown	11	24	34	69
Tucson Basin Late Rincon or Tanque Verde red-on-brown	75	71	111	257
Tucson Basin Tanque Verde Red-on-brown	226	1,207	406	1,839
Tucson Basin Middle or Late Rincon or Tanque Verde red-on-brown	25	80	2	107
Tucson Basin Indeterminate Preclassic red-on-brown	0	9	0	9
Tucson Basin Indeterminate red-on-brown	94	324	133	551
Tucson Basin Post-Cañada Del Oro red-on-brown	0	0	2	2
Total Tucson Basin red-on-brown	431	1,730	691	2,852
San Carlos Red	6	10	0	16
Tortolita Red	3	5	0	8
Vahki Red	0	1	0	1
Gila Red	0	1	1	2
Sells Red	1	2	1	4
Valshni or Sells red	1	5	1	7
Classic period red	1	5	3	9
Indeterminate Classic period red	0	0	3	3
Indeterminate red	21	101	7	129
Total red ware	33	130	16	179
Salado Polychrome, Tonto	0	3	0	3
Salado Polychrome, Cliff	0	6	0	6
Salado Polychrome, Gila	1	11	4	16
Salado Polychrome, Pinto or Gila	5	0	0	5
Salado Polychrome, Gila or Tonto	0	0	1	1
Salado Polychrome, indeterminate	1	29	1	31
Total Salado Polychrome	7	49	6	62
Indeterminate Red-on-brown or plain ware	0	4	6	10
Indeterminate Red-on-brown or red ware	1	3	0	4
Indeterminate red or plain ware	1	35	2	38
San Carlos Red-on-brown	0	4	0	4
San Carlos Brown ware, polished and unpainted	0	0	5	5
Tanque Verde Polychrome, black and red	0	2	0	2
Tanque Verde Polychrome, indeterminate	0	1	0	1
Brown corrugated, clapboard	0	18	0	18
Brown corrugated, flattened	0	16	1	17
Brown corrugated, obliterated	0	7	1	8
Brown corrugated, indented	0	1	0	1
Brown corrugated, indented obliterated	0	9	0	9
Brown corrugated, other	0	1	0	1

Table K.1. Continued.

Ware	MAR3	TOM1	TOM2	Total
Brown corrugated, indeterminate	1	4	0	5
Possible Salado Red corrugated	0	0	1	1
Mogollon corrugated, indeterminate	1	0	0	1
Hohokam Snaketown or Gila Butte red-on-buff/gray	0	1	0	1
Hohokam Gila Butte or Santa Cruz or Early Sacaton red-on-buff	0	1	0	1
Hohokam Middle or Late Sacaton or Casa Grande red-on-buff	0	1	0	1
Hohokam Santa Cruz Red-on-buff	0	5	0	5
Hohokam Santa Cruz or Early Sacaton red-on-buff	0	1	0	1
Hohokam Casa Grande Red-on-buff	1	3	0	3
Hohokam Unidentified red-painted on buff	0	4	0	4
Hohokam Unidentified, no paint	0	3	0	3
Cibola White Ware, Tularosa or Pinedale black-on-white	0	1	0	1
Cibola White Ware, Pinedale Black-on-white	0	5	3	8
Cibola White Ware, undifferentiated Pueblo II	0	1	0	1
Cibola White Ware, undifferentiated Pueblo II or III	0	1	0	1
Cibola White Ware, indeterminate black-on-white	0	4	0	4
Little Colorado or Cibola white ware, indeterminate no paint	0	1	0	1
Papago Plain	0	1	0	1
Papago Red	0	1	0	1
Total Other	5	139	19	163
Total	747	3,828	913	5,488

Table K.2. Temper types for all sherds analyzed during binocular analysis, by project, the Yuma Wash site.

Temper Type	MAR3	TOM1	TOM2	Total
Sand	549	2,346	804	3,699
Gneiss/schist and muscovite mica	43	113	7	163
Sand and grog	48	162	35	245
High muscovite mica	8	44	6	58
Low LMT[a]/high sand	1	9	1	11
Mixed sand and muscovite mica	77	49	22	148
Mixed sand, gneiss/schist, and muscovite mica	2	10	7	19
Sand and fiber	0	2	0	2
Sand, schist, and grog	7	0	0	7
Grog and schist	0	0	1	1
High LMT	0	75	9	84
High LMT/low sand	4	73	1	78
High phyllite	8	25	10	43
Indeterminate	0	920	10	930
Total	747	3,828	913	5,488

[a]LMT = Lithic metamorphic tectonic; that is, schist or gneiss.

was plutonic or metamorphic core complex sand identified in 7.1 percent of the sherds (MAR3 = 1.3 percent; TOM1 = 8.8 percent; TOM2 = 4.9 percent). Plutonic and mixed lithic sand from the Black Mountain (K) Petrofacies was noted in 6.5 percent of the sherds (MAR3 = 4.6 percent; TOM1 = 8.3 percent; TOM2 = 0.3 percent), while indeterminate plutonic and mixed lithic sand was present at 6.2 percent (MAR3 = 11.0 percent; TOM1 = 3.4 percent; TOM2 = 13.9 percent). Volcanic sand was less common, with 4.1 percent having indeterminate volcanic sand (MAR3 = 3.5 percent; TOM1 = 3.2 percent; TOM2 = 8.5 percent), and 8.9 percent with Twin Hills (J2) Petrofacies sand (MAR3 = 3.6 percent; TOM1 = 11.5 percent; TOM2 = 2.4 percent) found just south of the Yuma Wash site. However, almost half, 42.2 percent of the temper in the sherds, was not identified more specifically (MAR3 = 0.0 percent; TOM1

Table K.3. Temper types, by project, for plain ware sherds, the Yuma Wash site.

Temper Type	MAR3	TOM1	TOM2	Total
Sand	136	608	129	873
Gneiss/schist and muscovite mica	34	87	5	126
Sand and grog	22	119	8	149
High muscovite mica	4	37	4	45
Low LMT[a]/high sand	0	7	1	8
Mixed sand and muscovite mica	60	39	16	115
Mixed sand, gneiss/schist, and muscovite mica	2	7	7	16
Sand and fiber	0	0	0	0
Sand, schist, and grog	6	0	0	6
Grog and schist	0	0	1	1
High LMT	0	27	0	27
High LMT/low sand	4	2	7	13
High phyllite	3	8	2	13
Indeterminate	0	839	1	840
Total	271	1,780	181	2,232

[a]LMT = Lithic metamorphic tectonic; that is, schist or gneiss.

Table K.4. Temper types, by project, for Tucson Basin Red-on-brown ware sherds, the Yuma Wash site.

Temper Type	MAR3	TOM1	TOM2	Total
Sand	389	1,535	657	2,581
Gneiss/schist and muscovite mica	4	5	0	9
Sand and grog	23	18	24	65
High muscovite mica	3	6	0	9
Low LMT[a]/high sand	0	2	0	2
Mixed sand and muscovite mica	10	3	2	15
Mixed sand, gneiss/schist, and muscovite mica	0	2	0	2
Sand and fiber	0	0	0	0
Sand, schist, and grog	0	0	0	0
Grog and schist	0	0	0	0
High LMT	0	21	0	21
High LMT/low sand	0	69	0	69
High phyllite	2	3	0	5
Indeterminate	0	66	8	74
Total	431	1,730	691	2,852

[a]LMT = Lithic metamorphic tectonic; that is, schist or gneiss.

= 50.4 percent; TOM2 = 42.5 percent)[1]. The remaining sherds had a variety of sand temper from other volcanic, plutonic, metamorphic core complex, or mixed lithic sources.

The plain ware sherds were made primarily with volcanic (Twin Hills or indeterminate) or plutonic (indeterminate or with mixed lithic) sand, with a lesser amount containing sand from either plutonic or metamorphic core complex sources (Table K.9). In contrast, Tucson Basin Red-on-brown ware sherds had predominantly sand derived from plutonic and mixed lithic sources, and some with plutonic or volcanic sand temper (Table K.10). The red ware sherds were mostly tempered with plutonic sand (Table K.11). Examples with either plutonic or metamorphic core complex sand, or volcanic sand were also present. Salado Polychrome sherds were generally tempered with volcanic sand, although plutonic and plutonic or metamorphic core complex sands were also identified (Table K.12). Notably, many of the Brown Corrugated and Tanque Verde Polychrome sherds had volcanic sand from the Twin Hills Petrofacies, possibly suggesting production not far from the Yuma Wash site. This contributed to the high percentage of "Other" wares with volcanic sand,

[1]That 0.0 percent were indeterminate for the MAR3 sherds, while the other projects had 50.4 and 42.5 percent, reflects a difference in how the analysts assigned the temper to categories.

Table K.5. Temper types, by project, for red ware sherds, the Yuma Wash site.

Temper Type	MAR3	TOM1	TOM2	Total
Sand	15	72	8	95
Gneiss/schist and muscovite mica	4	17	1	22
Sand and grog	3	13	1	17
High muscovite mica	1	0	2	3
Low LMT[a]/high sand	0	0	0	0
Mixed sand and muscovite mica	6	2	1	9
Mixed sand, gneiss/schist, and muscovite mica	0	1	0	1
Sand and fiber	0	0	0	0
Sand, schist, and grog	1	0	0	1
Grog and schist	0	0	1	1
High LMT	0	10	1	11
High LMT/low sand	0	0	1	1
High phyllite	3	10	0	13
Indeterminate	0	5	0	5
Total	33	130	16	179

[a]LMT = Lithic metamorphic tectonic; that is, schist or gneiss.

Table K.6. Temper types, by project, for Salado Polychrome sherds, the Yuma Wash site.

Temper Type	MAR3	TOM1	TOM2	Total
Sand	5	49	5	59
Gneiss/schist and muscovite mica	0	0	0	0
Sand and grog	0	0	0	0
High muscovite mica	0	0	0	0
Low LMT[a]/high sand	1	0	0	1
Mixed sand and muscovite mica	1	0	1	2
Mixed sand, gneiss/schist, and muscovite mica	0	0	0	0
Sand and fiber	0	0	0	0
Sand, schist, and grog	0	0	0	0
Grog and schist	0	0	0	0
High LMT	0	0	0	0
High LMT/low sand	0	0	0	0
High phyllite	0	0	0	0
Indeterminate	0	0	0	0
Total	7	49	6	62

[a]LMT = Lithic metamorphic tectonic; that is, schist or gneiss.

while the Hohokam Buff wares often featured schist as a part of the temper (Table K.13).

Although these results speak to the diversity of the assemblage in terms of tempering materials used, it should be noted that the different analysts did not always assign temper to the same categories, which is why the results are presented by project in the same table. However, more of the temper was thought to derive from a plutonic or plutonic and mixed lithic source than from a volcanic source. Temper materials from a metamorphic origin were the least common. This likely reflects the presence of an unusual sand, noted during the binocular inspection and discussed further below, which contains small grains of volcanic rock fragments in addition to a few large granite and granite to gneiss fragments that would have been more noticeable. Within the wares, the common volcanic sand in the plain wares seems indicative of their local production, while the red wares had sand from a more plutonic origin, possibly suggesting they were nonlocal. The Tucson Basin Red-on-brown sherds often contained a plutonic and mixed lithic sand, which may be the local unusual sand specially utilized for producing local decorated types. Based on the binocular results, the Salado Polychrome types may have been produced near the site, but are also likely to have been imported. To test these initial hypotheses, petrographic analysis was conducted on a selection of the sherds examined by binocular microscopy.

Table K.7. Temper types, by project, for other ware sherds, the Yuma Wash site.

Temper Type	MAR3	TOM1	TOM2	Total
Sand	4	82	5	91
Gneiss/schist and muscovite mica	1	4	1	6
Sand and grog	0	12	9	21
High muscovite mica	0	1	0	1
Low LMT[a]/high sand	0	0	0	0
Mixed sand and muscovite mica	0	5	2	7
Mixed sand, gneiss/schist, and muscovite mica	0	0	0	0
Sand and fiber	0	2	0	2
Sand, schist, and grog	0	0	0	0
Grog and schist	0	0	0	0
High LMT	0	17	1	18
High LMT/low sand	0	2	0	2
High phyllite	0	4	1	5
Indeterminate	0	10	0	10
Total	5	139	19	163

[a]LMT = Lithic metamorphic tectonic; that is, schist or gneiss.

PETROGRAPHIC ANALYSIS

A stratified random sample was selected based on the ware and the type of temper in the sherds, determined during the binocular analysis. Each ware-temper group was sampled in proportion to its representation in the data set. Thus, samples for petrographic analysis included 25 plain ware (9 MAR3, 10 TOM1, 6 TOM2), 71 Tucson Red-on-brown, mostly Tanque Verde (15 MAR3, 26 TOM1, 30 TOM2), and a few less common wares, such as 1 Mogollon Corrugated (MAR3), 2 Brown Corrugated (TOM1), 1 Stucco Plain ware (TOM1), 3 red ware (1 TOM1, 2 TOM2), and 2 Salado Polychrome (1 TOM1, 1 TOM2) (Table K.14).

As far as temper, the types encompassed by these samples were mostly sand temper, 18 from MAR3, 38 from TOM1, and 34 from TOM2. Other temper types included seven samples (3 MAR3, 1 TOM1, 3 TOM2) with mixed sand and muscovite mica, two samples (TOM1) with high muscovite mica, two samples (MAR3) with gneiss/schist and muscovite mica, and four samples (2 MAR3, 2 TOM2) with sand and crushed sherd. Sand temper was seen throughout the different wares, while the tempers with high muscovite mica seemed to be found mostly in plain wares.

Many different temper generic and specific sources identified during the binocular analysis were tested petrographically. Twenty-one samples (5 MAR3, 12 TOM1, 4 TOM2) had volcanic sands that were thought to be from the Beehive (J1), Twin Hills (J2), or Wasson (J3) petrofacies, or were indeterminate. Two MAR3 samples had sand that was mixed volcanic and granitic. Seventeen samples (6 MAR3, 2 TOM1, 9 TOM2) had plutonic sands from either the Sierrita (O) Petrofacies or indeterminate. An additional six samples (4 MAR3, 2 TOM1) with this generic sand source were determined to have sand from the Central Tortolita (E2), Eastern Tortolita (E3) or Sutherland (S) petrofacies. Twenty-one samples (4 MAR3, 12 TOM1, 5 TOM2) had plutonic and mixed lithic sands from either an indeterminate source or the Black Mountain (K) Petrofacies. Seven samples (4 TOM1, 3 TOM2) had indeterminate plutonic or metamorphic core complex sands, although one was believed to be from the Sutherland Petrofacies. Four samples (2 TOM1, 2 TOM2) had indeterminate plutonic or plutonic and mixed lithic sand. Four samples (2 MAR3, 2 TOM1) had metamorphic core complex sands mostly from an indeterminate source, except for one specified as from the Catalina (B) Petrofacies. The two MAR3 sherds with this temper source had mixed sand and muscovite mica temper. Likewise, two MAR3 sherds with gneiss/schist and muscovite mica temper were assigned as indeterminate crushed rock for the temper source. The remaining 21 samples (5 TOM1, 16 TOM2) had an indeterminate generic and specific source for their temper.

As clearly seen, there is a wide variety of temper sources within the samples, which reflects that seen in the corpus as a whole. The selected samples also cover the most common sand types identified during the binocular analysis and they were selected specifically to test these temper groups. The resulting 105 sherds included 25 from MAR3, 41 from TOM1, and 39 from TOM2.

Each section was prepared in the normal way, including feldspar staining and a cover slip (Miksa and Heidke 2001). C. Lavayen point counted the

Table K.8. Temper generic and specific sources for all sherds analyzed during binocular analysis, by project, the Yuma Wash site.

Temper	MAR3	TOM1	TOM2	Total
Volcanic, Beehive	15	44	2	61
Volcanic, Twin Hills	27	440	22	489
Volcanic, Wasson	62	11	0	73
Volcanic, indeterminate	26	122	78	226
Plutonic, Western Tortolita	4	9	0	13
Plutonic, Central Tortolita	3	18	0	21
Plutonic, Eastern Tortolita	99	0	0	99
Plutonic, Sierrita	99	0	0	99
Plutonic, Sutherland	1	32	0	33
Plutonic, indeterminate	54	337	195	586
Plutonic or metamorphic core complex	10	336	45	391
Metamorphic core complex, Cañada del Oro	1	0	0	1
Metamorphic core complex, Rincon	1	0	0	1
Metamorphic core complex, Catalina	16	5	1	22
Metamorphic core complex, Catalina Volcanic	3	0	0	3
Metamorphic core complex, indeterminate	53	28	5	86
Other metamorphic source	5	0	0	5
Mixed volcanic and granitic, Rillito	15	0	0	15
Mixed volcanic and granitic, indeterminate	80	1	0	81
Mixed volcanic, granitic, and sedimentary	4	0	0	4
Plutonic or plutonic/mixed lithic	0	43	47	90
Plutonic and mixed lithic, Cienega Creek	2	0	0	2
Plutonic and mixed lithic, Airport	1	0	0	1
Plutonic and mixed lithic, Black Mountain	34	318	3	355
Plutonic and mixed lithic, indeterminate	82	130	127	339
Crushed rock	40	0	0	40
Santan/Gila Butte schist and sand	0	7	0	7
Naturally schistose sand	8	0	0	8
Coarse muscovite schist	2	12	0	14
"Microgranite"	0	7	0	7
Indeterminate	0	1,928	388	2,316
Total	747	3,828	913	5,488

samples, provided a qualitative description, and assigned a petrofacies. The method for point counting was based on the modified Gazzi-Dickinson technique (Lombard 1987a; Miksa and Heidke 2001). This procedure involves point counting the monocrystalline mineral grains and the grains in coarse-grained rocks as the mineral phase to which they belong, while fine-grained rocks are classified according to their fabric, internal texture, and mineral composition. This method aims to reduce the effects of sand maturity, so that minerals in coarse-grained rocks are counted in a similar manner whether they are still a part of the rock or have separated out due to the distance the grains have travelled from the source. This is particularly important when comparing sand-tempered sherds and sand collected recently as the exact location along a wash where the potter collected the sand is unknown. The point-counted parameters and their definitions are given in Table K.15. The recorded qualitative attributes are listed in Table K.16. For each sample, the point-count and qualitative data are presented in Tables K.17 and K.18, respectively.

STATISTICAL ANALYSIS

Data from point counting the thin sections were examined by discriminant analysis based on the 2010 Tucson Basin petrofacies model[2] (Figure K.2). This model is generally the same as that presented for the Julian Wash site, AZ BB:13:17 (ASM) (Miksa

[2]Data on file at Desert Archaeology, Inc.

Table K.9. Temper generic and specific sources, by project, for plain ware sherds, the Yuma Wash site.

Temper	MAR3	TOM1	TOM2	Total
Volcanic, Beehive	5	15	0	20
Volcanic, Twin Hills	18	209	9	236
Volcanic, Wasson	23	7	0	30
Volcanic, indeterminate	10	49	21	80
Plutonic, Western Tortolita	1	6	0	7
Plutonic, Central Tortolita	1	14	0	15
Plutonic, Eastern Tortolita	25	0	0	25
Plutonic, Sierrita	21	0	0	21
Plutonic, Sutherland	0	26	0	26
Plutonic, indeterminate	18	87	47	152
Plutonic or metamorphic core complex	7	174	23	204
Metamorphic core complex, Cañada del Oro	0	0	0	0
Metamorphic core complex, Rincon	0	0	0	0
Metamorphic core complex, Catalina	12	2	0	14
Metamorphic core complex, Catalina Volcanic	1	0	0	1
Metamorphic core complex, indeterminate	28	15	5	48
Other metamorphic source	4	0	0	4
Mixed volcanic and granitic, Rillito	2	0	0	2
Mixed volcanic and granitic, indeterminate	22	0	0	22
Mixed volcanic, granitic, and sedimentary	3	0	0	3
Plutonic or plutonic/mixed lithic	0	8	5	13
Plutonic and mixed lithic, Cienega Creek	0	0	0	0
Plutonic and mixed lithic, Airport	11	0	0	11
Plutonic and mixed lithic, Black Mountain	22	24	0	46
Plutonic and mixed lithic, indeterminate	32	14	11	57
Crushed rock	3	0	0	3
Santan/Gila Butte schist and sand	0	0	0	0
Naturally schistose sand	0	0	0	0
Coarse muscovite schist	2	1	0	3
"Microgranite"	0	6	0	6
Indeterminate	0	1,123	60	1,183
Total	271	1,780	181	2,232

2011). Using point-count data from sand samples to create a known set of sand compositions for comparison, the discriminant analysis model will classify the sherd samples (input for evaluation as unweighted "unknowns"). The discriminant analysis output, especially the Mahalanobis distance from the group centroid and the posterior probability of group membership, can be used to evaluate the strength of the discriminant model classification for each sherd sample (Klecka 1980).

In some cases, the petrofacies determined by the discriminant model was different from that assigned during the petrographic analysis and/or during binocular analysis. In these cases, the final temper classification for the sherds is based on the totality of the evidence: binocular analysis and visual inspection of the sherd and its temper, petrographic analysis, point-count data, comparison of qualitative aspects of a sample to sands in the petrofacies to which it has been assigned, and the results of statistical analyses. To be characterized as belonging to a petrofacies, the sherd must have not only the same proportion of a grain type as the sands from its assigned petrofacies, but similar grain size, type, and morphology as well. The point-count data provide the quantity of grain types in the sample, and descriptive statistics can be used to help assess which sands have similar grain proportions. All of the information is employed to establish the final designation for a sample.

The discriminant model run for the Yuma Wash site sherds correctly predicted the petrofacies of 32 samples, a success rate of 30 percent. This was mostly for samples with typical sands from the Beehive, Twin Hills, Black Mountain, and Eastern Tortolita petrofacies. The low success rate is due to the use of

Table K.10. Temper generic and specific sources, by project, for Tucson Basin Red-on-brown ware sherds, the Yuma Wash site.

Temper	MAR3	TOM1	TOM2	Total
Volcanic, Beehive	10	25	2	37
Volcanic, Twin Hills	9	190	12	211
Volcanic, Wasson	38	1	0	39
Volcanic, indeterminate	15	62	54	131
Plutonic, Western Tortolita	3	3	0	6
Plutonic, Central Tortolita	1	1	0	2
Plutonic, Eastern Tortolita	67	0	0	67
Plutonic, Sierrita	71	0	0	71
Plutonic, Sutherland	0	2	0	2
Plutonic, indeterminate	33	224	143	400
Plutonic or metamorphic core complex	1	129	20	150
Metamorphic core complex, Cañada del Oro	1	0	0	1
Metamorphic core complex, Rincon	1	0	0	1
Metamorphic core complex, Catalina	4	1	1	6
Metamorphic core complex, Catalina Volcanic	1	0	0	1
Metamorphic core complex, indeterminate	20	6	0	26
Other metamorphic source	0	0	0	0
Mixed volcanic and granitic, Rillito	13	0	0	13
Mixed volcanic and granitic, indeterminate	54	1	0	55
Mixed volcanic, granitic, and sedimentary	1	0	0	1
Plutonic or plutonic/mixed lithic	0	35	42	77
Plutonic and mixed lithic, Cienega Creek	2	0	0	2
Plutonic and mixed lithic, Airport	1	0	0	1
Plutonic and mixed lithic, Black Mountain	22	289	3	314
Plutonic and mixed lithic, indeterminate	57	112	116	285
Crushed rock	4	0	0	4
Santan/Gila Butte schist and sand	0	0	0	0
Naturally schistose sand	2	0	0	2
Coarse muscovite schist	0	0	0	0
"Microgranite"	0	0	0	0
Indeterminate	0	649	298	947
Total	431	1,730	691	2,852

a local Wasson "mixed" composition sand for many of the vessels (see below). The discriminant model often predicted samples with this sand composition to the Rillito (M) Petrofacies, which would be the best match of those samples used for the model. If these are considered correct assignments, the success rate improves to 50 percent (52 of 105 samples). An additional unusual composition is one with volcanic and granitic grains that is mostly likely found in the northern Tucson Mountains. As this sand was not within the samples analyzed for the model, it is not expected the sherds containing this sand will be correctly predicted. For the two samples with high muscovite mica, the seven samples with mixed sand and muscovite, and the two samples with gneiss/schist and muscovite the discriminant model correctly predicted the petrofacies for two samples and was close for six samples. The addition of other components beside sand to the ceramic paste is understandably a challenge for a model based on sand composition alone. However, for the four samples with sand and grog temper, the predicted assignment was accurate for three of the samples.

The primary reason for the lack of concordance between the discriminant model and the results from the other analyses appeared during the binocular and petrographic examinations when an unusual fine sand composition was noted. The fine sand contained volcanic inclusions characteristic of the Tucson Mountains, i.e., Wasson Petrofacies; however, granite and granite-gneiss rock fragments commonly associated with the Tortolita Mountains were also seen. The latter were often large grains and sometimes appeared angular. This sand was inter-

Table K.11. Temper generic and specific sources, by project, for red ware sherds, the Yuma Wash site.

Temper	MAR3	TOM1	TOM2	Total
Volcanic, Beehive	0	4	0	4
Volcanic, Twin Hills	0	4	0	4
Volcanic, Wasson	1	0	0	1
Volcanic, indeterminate	1	5	1	7
Plutonic, Western Tortolita	0	0	0	0
Plutonic, Central Tortolita	1	3	0	4
Plutonic, Eastern Tortolita	4	0	0	4
Plutonic, Sierrita	4	0	0	4
Plutonic, Sutherland	1	3	0	4
Plutonic, indeterminate	2	21	4	27
Plutonic or metamorphic core complex	2	13	0	15
Metamorphic core complex, Cañada del Oro	0	0	0	0
Metamorphic core complex, Rincon	0	0	0	0
Metamorphic core complex, Catalina	0	1	0	1
Metamorphic core complex, Catalina Volcanic	1	0	0	1
Metamorphic core complex, indeterminate	4	1	0	5
Other metamorphic source	1	0	0	1
Mixed volcanic and granitic, Rillito	0	0	0	0
Mixed volcanic and granitic, indeterminate	2	0	0	2
Mixed volcanic, granitic, and sedimentary	0	0	0	0
Plutonic or plutonic/mixed lithic	0	0	0	0
Plutonic and mixed lithic, Cienega Creek	0	0	0	0
Plutonic and mixed lithic, Airport	0	0	0	0
Plutonic and mixed lithic, Black Mountain	0	0	0	0
Plutonic and mixed lithic, indeterminate	3	0	0	3
Crushed rock	3	0	0	3
Santan/Gila Butte schist and sand	0	0	0	0
Naturally schistose sand	3	0	0	3
Coarse muscovite schist	0	2	0	2
"Microgranite"	0	1	0	1
Indeterminate	0	72	11	83
Total	33	130	16	179

preted as a local Wasson Petrofacies "mixed" composition sand. Its use in the ceramics would have made it difficult for the discriminant model to assign a petrofacies because it was developed based on unmixed sands from discrete washes. The sand from the Rillito Petrofacies is the most similar of those within the model. Nevertheless, it was necessary to reexamine all of the thin sections in light of the discriminant model results to establish those samples with this "mixed" composition and those with "unmixed" sand that had been correctly classified during the analysis.

To illustrate the success and difficulties in the discriminant model, several specific examples will be discussed in terms of the binocular, petrographic, and discriminant model assignments. Samples TOM1-045 to TOM1-054, coded as 4/53/J2, or, "sand temper, J2 or J3, J2" during binocular analysis, were confirmed as containing Twin Hills Petrofacies sand through petrographic examination. The discriminant model supported this assignment, correctly classifying the samples as containing sand rich in volcanic lithic fragments. However, the sand in one sample, TOM1-045, was assigned to the Wasson Petrofacies. Reexamination of the thin section suggested it was more likely to contain sand from the Twin Hills Petrofacies, though probably deriving from the border of the two petrofacies. Similarly, TOM1-049 had a sand with characteristics of both petrofacies, but appeared more similar to that from the Wasson Petrofacies. The successful assignment of 9 of 10 samples by binocular, petrographic, and discriminant analysis to the same petrofacies shows that there were instances where the methodology worked well.

Most of the problems with the discriminant analysis arose with samples containing the local

Table K.12. Temper generic and specific sources, by project, for Salado Polychrome sherds, the Yuma Wash site.

Temper	MAR3	TOM1	TOM2	Total
Volcanic, Beehive	0	0	0	0
Volcanic, Twin Hills	0	10	0	10
Volcanic, Wasson	0	0	0	0
Volcanic, indeterminate	0	5	0	5
Plutonic, Western Tortolita	0	0	0	0
Plutonic, Central Tortolita	0	0	0	0
Plutonic, Eastern Tortolita	2	0	0	2
Plutonic, Sierrita	2	0	0	2
Plutonic, Sutherland	0	1	0	1
Plutonic, indeterminate	0	2	1	3
Plutonic or metamorphic core complex	0	9	1	10
Metamorphic core complex, Cañada del Oro	0	0	0	0
Metamorphic core complex, Rincon	0	0	0	0
Metamorphic core complex, Catalina	0	0	0	0
Metamorphic core complex, Catalina Volcanic	0	0	0	0
Metamorphic core complex, indeterminate	1	0	0	1
Other metamorphic source	0	0	0	0
Mixed volcanic and granitic, Rillito	0	0	0	0
Mixed volcanic and granitic, indeterminate	2	0	0	2
Mixed volcanic, granitic, and sedimentary	0	0	0	0
Plutonic or plutonic/mixed lithic	0	0	0	0
Plutonic and mixed lithic, Cienega Creek	0	0	0	0
Plutonic and mixed lithic, Airport	0	0	0	0
Plutonic and mixed lithic, Black Mountain	0	1	0	1
Plutonic and mixed lithic, indeterminate	0	2	0	2
Crushed rock	0	0	0	0
Santan/Gila Butte schist and sand	0	0	0	0
Naturally schistose sand	0	0	0	0
Coarse muscovite schist	0	0	0	0
"Microgranite"	0	0	0	0
Indeterminate	0	19	4	23
Total	7	49	6	62

Wasson "mixed" composition sand. To illustrate, samples MAR3-018, TOM1-021 to TOM1-031, and TOM2-032 to TOM2-036 that were coded as 4/30/-9 or 4/30/K, i.e., "sand temper, plutonic and mixed lithic sands, indeterminate or K" were found to have the "mixed" composition sand. The use of this binocular code highlights that there were lithic grains of several types in the samples. Petrographically, one sample was thought to contain Wasson Petrofacies sand, while the remainder was assigned to the Black Mountain Petrofacies (at this time the "mixed" composition sand was unknown). At the family level, when the model determines between granitic-metamorphic and volcanic-rock bearing petrofacies, seven samples were assigned to the former, while five were assigned to the latter (Figure K.3). This is due to the presence of both volcanic and granitic grains in the sand in varying proportions. For those samples placed in the granitic-metamorphic model, and then subsequently into the granitic rich in microcline model, they were eventually predicted to either the Santa Rita (G) Petrofacies or the Black Mountain Petrofacies. However, the large distances were indicative of difficulties in placing these samples. Both the Santa Rita and Black Mountain petrofacies have granite and volcanic rock fragments, so these assignments are not unreasonable for a sand also featuring such inclusions. The samples placed into the volcanic model, and then subsequently into the volcanic only model, were ultimately predicted to the Rillito Petrofacies. The distances were quite small, indicative of the similarity of these sands to the Wasson "mixed" composition sand. This is not surprising, as the "mixed" composition sand probably derives from near the Yuma Wash site, which is located next to the bound-

Table K.13. Temper generic and specific sources, by project, for other ware sherds, the Yuma Wash site.

Temper	MAR3	TOM1	TOM2	Total
Volcanic, Beehive	0	0	0	0
Volcanic, Twin Hills	0	27	1	28
Volcanic, Wasson	0	3	0	3
Volcanic, indeterminate	0	1	2	3
Plutonic, Western Tortolita	0	0	0	0
Plutonic, Central Tortolita	0	0	0	0
Plutonic, Eastern Tortolita	1	0	0	1
Plutonic, Sierrita	1	0	0	1
Plutonic, Sutherland	0	0	0	0
Plutonic, indeterminate	1	3	0	4
Plutonic or metamorphic core complex	0	11	1	12
Metamorphic core complex, Cañada del Oro	0	0	0	0
Metamorphic core complex, Rincon	0	0	0	0
Metamorphic core complex, Catalina	0	1	0	1
Metamorphic core complex, Catalina Volcanic	0	0	0	0
Metamorphic core complex, indeterminate	0	6	0	6
Other metamorphic source	0	0	0	0
Mixed volcanic and granitic, Rillito	0	0	0	0
Mixed volcanic and granitic, indeterminate	0	0	0	0
Mixed volcanic, granitic, and sedimentary	0	0	0	0
Plutonic or plutonic/mixed lithic	0	0	0	0
Plutonic and mixed lithic, Cienega Creek	0	0	0	0
Plutonic and mixed lithic, Airport	0	0	0	0
Plutonic and mixed lithic, Black Mountain	1	4	0	5
Plutonic and mixed lithic, indeterminate	0	2	0	2
Crushed rock	1	0	0	1
Santan/Gila Butte schist and sand	0	7	0	7
Naturally schistose sand	0	0	0	0
Coarse muscovite schist	0	9	0	9
"Microgranite"	0	0	0	0
Indeterminate	0	65	15	80
Total	5	139	19	163

ary of the Wasson and Rillito Petrofacies. In fact, as far as the sands utilized in the model, the Rillito Petrofacies sands are the most analogous. However, during reexamination of these samples, it was clear they contained a sand from an area just to the south of the Rillito Petrofacies and within the floodplain, thus their attribution to the Wasson "mixed" composition sand.

Another unusual sand composition encountered during the analysis also contained northern Tucson Mountains volcanic inclusions along with granite grains. However, these grains were distinct in their composition and texture, and appeared similar to grains in some of the sands from the Amole (Q) and Rillito West (Mw) petrofacies. This indicated a probable source for the sand somewhere in the northern part of the Tucson Mountains. Samples with this sand were given various binocular and petrographic assignments, which is expected for a composition that was unknown at the time of these analyses. The discriminant model predicted the samples to a number of Tucson Mountains petrofacies, with the specific assignment based on whether the sand was dominated by volcanic or granitic rock fragments. These disparities prompted a second examination of the thin sections in which this unusual sand was identified. As there is no comparable sand in the database used for the model, the difficulties encountered by the discriminant model are expected.

Finally, four samples appeared similar to sand from the Eastern Tortolita Petrofacies but contained more volcanic grains than is typical for this petrofacies. During the binocular analysis, they were coded as 4/2/-9 or 4/-9/-9, i.e., "sand temper, plutonic

Table K.14. Sample inventory and results of petrographic analysis, the Yuma Wash site.

Sample	Ware	Temper Type	Temper Generic Source[a]	Temper Specific Source[a]	Petrofacies[a]
MAR3-001	Tanque Verde Red-on-brown	Sand	J2 or J3	Indeterminate	J3
MAR3-002	Plain ware	Sand	J2 or J3	J2	J2
MAR3-003	Late Rincon or Tanque Verde red-on-brown	Sand and grog	J3 or M	Indeterminate	M
MAR3-004	Plain ware	Sand and grog	J3 or M	J3	J3
MAR3-005	Middle or Late Rincon or Tanque Verde red-on-brown	Sand	J3 or M	J3	J3
MAR3-006	Plain ware	Sand	Plutonic	Indeterminate	J2
MAR3-007	Indeterminate red-on-brown	Sand	Plutonic	Indeterminate	J2
MAR3-008	Tanque Verde Red-on-brown	Sand	Plutonic	O	J3
MAR3-009	Indeterminate Mogollon Corrugated	Sand	Plutonic	O	Unknown
MAR3-010	Plain ware	Mixed sand and muscovite mica	Plutonic	O	J3
MAR3-011	Tanque Verde Red-on-brown	Sand	Plutonic	O	J2
MAR3-012	Plain ware	Sand	E1 or E3	E3	E1
MAR3-013	Tanque Verde Red-on-brown	Sand	E1 or E3	E3	Unknown
MAR3-014	Tanque Verde Red-on-brown	Sand	E1 or E3	E3	M
MAR3-015	Tanque Verde Red-on-brown	Sand	E1 or E3	E3	Unknown
MAR3-016	Tanque Verde Red-on-brown	Sand	Mixed volcanic and granitic	Indeterminate	J2
MAR3-017	Late Rincon or Tanque Verde red-on-brown	Sand	Mixed volcanic and granitic	Indeterminate	J3
MAR3-018	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	J3
MAR3-019	Late Rincon or Tanque Verde red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
MAR3-020	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	J3
MAR3-021	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	Bv
MAR3-022	Plain ware	Mixed sand and muscovite mica	Metamorphic core complex	Indeterminate	J3
MAR3-023	Plain ware	Mixed sand and muscovite mica	Metamorphic core complex	Indeterminate	E3
MAR3-024	Plain ware	Gneiss/schist and muscovite mica	Crushed rock	Indeterminate	K
MAR3-025	Plain ware	Gneiss/schist and muscovite mica	Crushed rock	Indeterminate	Unknown
TOM1-003	Plain ware	High muscovite mica	Indeterminate	Indeterminate	J2
TOM1-004	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	J2
TOM1-005	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	Unknown
TOM1-007	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	E3
TOM1-008	Plain ware	High muscovite mica	Indeterminate	Indeterminate	Unknown
TOM1-014	Stucco Plain ware	Sand	Volcanic	Indeterminate	J2
TOM1-016	Middle or Late Rincon or Tanque Verde red-on-brown	Sand	Volcanic	J2	J2

Table K.14. Continued.

Sample	Ware	Temper Type	Temper Generic Source[a]	Temper Specific Source[a]	Petrofacies[a]
TOM1-017	Tanque Verde Red-on-brown	Sand	Plutonic	Indeterminate	E1
TOM1-018	Plain ware	Sand	Plutonic	Indeterminate	E1
TOM1-019	Tanque Verde Red-on-brown	Sand	Metamorphic core complex	Indeterminate	B
TOM1-020	Middle or Late Rincon or Tanque Verde red-on-brown	Sand	Metamorphic core complex	B	B
TOM1-021	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
TOM1-022	Late Rincon or Tanque Verde red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
TOM1-023	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
TOM1-024	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	E1
TOM1-025	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-026	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-027	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-028	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-029	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-030	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-031	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-032	Late Rincon or Tanque Verde red-on-brown	Sand	Plutonic and mixed lithic	K	K
TOM1-034	Plain ware	Sand	Plutonic or metamorphic core complex	Indeterminate	Bv
TOM1-036	Plain ware	Sand	Plutonic or metamorphic core complex	Indeterminate	B
TOM1-038	Late Rincon or Tanque Verde red-on-brown	Sand	Plutonic or metamorphic core complex	Indeterminate	E1
TOM1-040	Tortolita Red	Sand	E1 or E2	E2	E2
TOM1-041	Tanque Verde Red-on-brown	Sand	Plutonic or plutonic and mixed lithic	Indeterminate	E1
TOM1-042	Tanque Verde Red-on-brown	Sand	Plutonic or plutonic and mixed lithic	Indeterminate	J2
TOM1-043	Indeterminate Polychrome	Sand	Plutonic or metamorphic core complex	S	E3
TOM1-044	Plain ware	Sand	E2 or S	E2	E2
TOM1-045	Tanque Verde Red-on-brown	Sand	J2 orJ3	J2	J2
TOM1-046	Tanque Verde Red-on-brown	Sand	J2 or J3	J2	J2
TOM1-047	Plain ware	Sand	J2 or J3	J2	J2
TOM1-048	Plain ware	Mixed sand and muscovite mica	J2 or J3	J2	J2
TOM1-049	Plain ware	Sand	J2 or J3	J2	J2
TOM1-050	Tanque Verde Red-on-brown	Sand	J2 or J3	J2	J2
TOM1-051	Plain ware	Sand	J2 or J3	J2	J2
TOM1-052	Middle or Late Rincon or Tanque Verde red-on-brown	Sand	J2 or J3	J2	J2

Table K.14. Continued.

Sample	Ware	Temper Type	Temper Generic Source[a]	Temper Specific Source[a]	Petrofacies[a]
TOM1-053	Flattened Brown Corrugated	Sand	J2 or J3	J2	J2
TOM1-054	Clapboard Brown Corrugated	Sand	J2 or J3	J2	J2
TOM2-001	Gila Polychrome	Sand	Indeterminate	Indeterminate	J2
TOM2-002	Indeterminate Classic red	Mixed sand and muscovite mica	Indeterminate	Indeterminate	J2
TOM2-003	Middle or Late Rincon or Tanque Verde red-on-brown	Sand	Indeterminate	Indeterminate	K
TOM2-004	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	E1
TOM2-005	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	K
TOM2-006	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	E1
TOM2-007	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	K
TOM2-008	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	J2
TOM2-009	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	J2
TOM2-010	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	K
TOM2-011	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	J2
TOM2-012	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	K
TOM2-013	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	K
TOM2-014	Tanque Verde Red-on-brown	Sand	Indeterminate	Indeterminate	K
TOM2-015	Plain ware	Mixed sand and muscovite mica	Plutonic or metamorphic core complex	Indeterminate	K
TOM2-017	Plain ware	Sand	Indeterminate	Indeterminate	K
TOM2-019	Tanque Verde Red-on-brown	Sand	Volcanic	J1	K
TOM2-020	Tanque Verde Red-on-brown	Sand	Volcanic	Indeterminate	J2
TOM2-021	Plain ware	Sand	Volcanic	Indeterminate	J2
TOM2-022	Tanque Verde Red-on-brown	Sand	Volcanic	J2	J2
TOM2-023	Plain ware	Sand	Plutonic	Indeterminate	K
TOM2-025	Tanque Verde Red-on-brown	Sand	Plutonic	Indeterminate	E1
TOM2-026	Tanque Verde Red-on-brown	Sand	Plutonic	Indeterminate	K
TOM2-027	Tanque Verde Red-on-brown	Sand	Plutonic	Indeterminate	K
TOM2-028	Tanque Verde Red-on-brown	Sand	Plutonic	Indeterminate	J2
TOM2-029	Tanque Verde Red-on-brown	Sand	Plutonic	Indeterminate	K
TOM2-030	Tanque Verde Red-on-brown	Sand	Plutonic	Indeterminate	K
TOM2-031	Indeterminate Redware	Sand	Plutonic	Indeterminate	K
TOM2-032	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
TOM2-033	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K

Table K.14. Continued.

Sample	Ware	Temper Type	Temper Generic Source[a]	Temper Specific Source[a]	Petrofacies[a]
TOM2-034	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
TOM2-035	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
TOM2-036	Tanque Verde Red-on-brown	Sand	Plutonic and mixed lithic	Indeterminate	K
TOM2-037	Tanque Verde Red-on-brown	Sand	Plutonic or metamorphic core complex	Indeterminate	J2
TOM2-038	Plain ware	Mixed sand and muscovite mica	Plutonic or metamorphic core complex	Indeterminate	Unknown
TOM2-039	Tanque Verde Red-on-brown	Sand	Plutonic or plutonic and mixed lithic	Indeterminate	K
TOM2-040	Tanque Verde Red-on-brown	Sand	Plutonic or plutonic and mixed lithic	Indeterminate	J2
TOM2-041	Plain ware	Sand and grog	Plutonic	Indeterminate	J2
TOM2-042	Tanque Verde Red-on-brown	Sand and grog	Indeterminate	Indeterminate	J2

[a]B = Catalina Petrofacies, Bv = Catalina Volcanic Petrofacies, E1 = Western Tortolita Petrofacies, E2 = Central Tortolita Petrofacies, E3 = Eastern Tortolita Petrofacies, J1 = Beehive Petrofacies, J2 = Twin Hills Petrofacies, J3 = Wasson Petrofacies, K = Black Mountain Petrofacies, M = Rillito Petrofacies, O = Sierrita Petrofacies, S = Sutherland Petrofacies.

Table K.15. Point-count parameters used in the petrographic analysis of the data set, the Yuma Wash site.

Parameter	Description
Monomineralic Grains	
Qtz	All sand-sized quartz grains, except those derived from or contained within coarse-foliated rocks; unstained
Kspar	Alkali feldspars, except those derived from or contained within coarse-foliated rocks; potassium feldspar stained yellow, unstained plagioclase feldspar, perthite, antiperthite
Micr	Microcline/anorthoclase: alkali feldspar with polysynthetic (cross-hatch) twinning; stained yellow or unstained
Plag	Plagioclase feldspar, stained pink, except grains derived from or contained within coarse-foliated rocks; grains commonly have albite and/or carlsbad twinning. Alteration, sericitization affect less than 10 percent of the grain
Plagal	Altered plagioclase, except grains derived from or contained within coarse-foliated rocks; alteration affects 10 to 90 percent of the grain; alteration products include sericite, clay minerals, carbonate, epidote
Plaggn	Considerably altered plagioclase, except grains derived from or contained within coarse-foliated rocks; alteration affects more than 90 percent of the grain
Px	Undifferentiated members of the pyroxene group
Amph	Undifferentiated members of the amphibole group
Opaq	Undifferentiated opaque minerals, such as magnetite/ilmenite, rutile, and iron oxides
Biot	Biotite mica
Musc	Muscovite mica
Chlor	Chlorite group minerals
Oliv	Undifferentiated members of the olivine group
Epid	Undifferentiated members of the epidote family (epidote, zoisite, clinozoisite)
Sphene	Sphene
Gar	Undifferentiated members of the garnet group
Caco	Calcium carbonate minerals
Metamorphic Lithic Fragments	
Lmm	Microgranular quartz aggregate: non-oriented polygonal aggregates of newly grown strain-free quartz with sutured, planar, or curved grain boundaries
Lmf	Foliated quartz aggregate: planar-oriented fabric developed in mostly strained quartz crystals with sutured crystallite boundaries; quartzite
Lma	Quartz-feldspar (mica) aggregate: quartz, feldspars, mica, and opaque oxides in aggregates with highly sutured grain boundaries but no planar-oriented fabric; some represent schists or gneisses viewed on edge, some are metasediments or metavolcanics
Lmt	Quartz-feldspar-mica tectonite (schists or gneisses): quartz, feldspars, micas, and opaque oxides, with strong planar oriented fabric; often display mineral segregation with alternating quartz-felsic and mica ribbons; grains are often extremely sutured and/or elongated
Lmtp	Phyllite: like Lmt, but the grains are silt sized or smaller, with little or no mineral segregation; also argillaceous grains, which exhibit growth of planar-oriented micas, silt sized or smaller
Lmvf	Metamorphosed volcanic rock such as rhyolite; massive-to-foliated aggregates of quartz and feldspar grains with relict phenocrysts of feldspar
Lmss	Metamorphosed sedimentary rock, such as a meta-siltstone; massive fine-grained aggregates of quartz and feldspar, with or without relict sedimentary texture
Volcanic Lithic Fragments	
Lvfb	Biotite-bearing felsic volcanic: microgranular nonfelted mosaics of submicroscopic quartz and feldspars, often with microphenocrysts of feldspar, quartz, always with phenocrysts of biotite; groundmass is fine to glassy, always has well-developed potassium feldspar (yellow) stain
Lvf	Felsic volcanic such as rhyolite: microgranular nonfelted mosaics of submicroscopic quartz and feldspars, often with microphenocrysts of feldspar, quartz, or rarely, ferromagnesian minerals; groundmass is fine to glassy, always has well-developed potassium feldspar (yellow) stain, may also have plagioclase (pink) stain.

Table K.15. Continued.

Parameter	Description
Lvi	Intermediate volcanic rock such as rhyodacite, dacite, latite, and andesite
Lvm	Mafic volcanic: visible microlites or laths of feldspar crystals in random to parallel fabrics, usually with glassy, devitrified, or otherwise altered dark groundmass; often with phenocrystals of opaque oxides, occasional quartz, pyroxene, or olivine; rarely yellow-stained, usually has well-developed pink stain, representing intermediate to basic lavas such as latite, andesite, quartz-andesite, basalt, or trachyte
Lvv	Glassy volcanics: vitrophyric grains showing relict shards, pumiceous fabric, welding or perlitic structure, sometimes with microphenocrysts, representing pyroclastic or glassy volcanic rocks
Lvh	Hypabyssal volcanics (shallow igneous intrusive rocks): equigranular anhedral-to-subhedral feldspar-rich rocks, with no glassy or devitrified groundmass, coarser-grained than Lvf, most have yellow and pink stain
Sedimentary Lithic Fragments	
Lss	Siltstones: granular aggregates of equant subangular-to-rounded silt-sized grains, with or without interstitial cement; may be well-to-poorly sorted, with or without sand-sized grains; composition varies from quartzose to lithic-arkosic, with some mafic-rich varieties
Lsch	Chert: microcrystalline aggregates of pure silica
Lsca	Carbonate: mosaics of very fine calcite crystals, with or without interstitial clay- to sand-sized grains; most appear to be fragments of soil carbonate (caliche) and are subround to very round
Monomineralic Grains in Coarse Foliated Rocks	
Sopaq	Undifferentiated opaque minerals derived from or contained within coarse foliated rocks
Smusc	Muscovite mica derived from or contained within coarse foliated rocks
Schlor	Undifferentiated chlorite group minerals derived from or contained within coarse foliated rocks
Totals and Paste Parameters	
Total	The total number of point-counted sand-sized grains.
Total Foliated Rocks	SQTZ + SPLAG + SMUSC + SCHLOR + SOPAQ + SKSPAR + LMA + LMT + LMTP + LMF + LMM
Total Sand Temper	If temper type is "Crushed rock," or "Crushed rock + sand," then Total sand temper = Total - Total Foliated Rocks; if temper type is "Sand," then Total sand temper = Total; counts for grog and clay lumps are also removed to create this total
Paste	The total number of points counted in the silt- to clay-sized fraction of the paste
Percent Temper	Total/(Total+Paste) x 100
Grog	Sherd temper: Dark, semiopaque angular to subround grains with discrete margins, including silt to sand size temper grains in a clay, iron oxides, and/or micaceous matrix; the grains differ in color and/or texture from the surrounding matrix of the "host" ceramic.
Clay lumps	Discrete sand-sized grains or "lumps," of untempered clay; they comprise clay that lacks silt- to sand-sized grains; the grains are often similar in color to the surrounding paste, but have well-defined, abrupt boundaries; their internal texture is finer than the paste and has a different orientation; they are interpreted as clay that was insufficiently mixed with the surrounding clay body
Unknown and Indeterminate Grains	
Unkn	Grains that cannot be identified, grains that are indeterminate, and grains such as zircon and tourmaline that occur in extremely low percentages.

sands, indeterminate" or "sand temper, indeterminate, indeterminate." This signifies the difficulty in attributing this sand to a specific petrofacies. Petrographically, the samples were assigned to either the Black Mountain or Western Tortolita (E1) petrofacies, while the discriminant model predicted two samples to the Eastern Tortolita Petrofacies, one to adjacent Big Wash (Z) Petrofacie[3], and one to the Wasson Petrofacies. This last assignment by the

[3]This petrofacies was recently more clearly defined with acquired sand samples. The discriminant model suggested they could be separated from the adjacent Eastern Tortolita Petrofacies (Miksa et al. 2011).

Table K.16. Qualitative attribute codes applied to the samples during petrographic analysis, the Yuma Wash site.

QUALITATIVE ATTRIBUTES OF THE LESS-THAN-SAND-SIZED FRACTION

Matrix Opacity

0	Opaque	5	Translucent
1	Almost opaque	6	More than translucent
2	Sort of opaque	7	Sort of transparent
3	Sort of translucent	8	Almost transparent
4	Almost translucent	9	Transparent

Matrix Color

10	Black	25	Reddish-brown
12	Brownish-gray	30	Red
15	Brownish-black	40	Orange
19	Dark brown	41	Brownish-orange
20	Brown	42	Yellowish-orange
21	Yellowish-brown	50	Yellow
22	Light brown	-9	Indeterminate (i.e., too much stain)
23	Orangish-brown		

Matrix Heterogeneity

0	None	4	Zoned margin to core
1	Few clay lumps in the paste	5	Mottled
2	Several clay lumps	6	Zoned and mottled
3	Many clay lumps	7	Zoned, mottled, lumpy, and otherwise highly heterogeneous

Composition Information (composition codes are given at the end of this table)

Silt Dominant: composition of the most abundant grain type in the silt fraction

Silt Secondary: composition of the second most abundant grain type in the silt fraction

Clay Dominant: composition of the most abundant grain type in the clay fraction

Clay Secondary: composition of the second most abundant grain type in the clay fraction

QUALITATIVE ATTRIBUTES OF THE SAND-SIZED FRACTION

Temper Type

1	Sand	6	Self-tempered clay
2	Sand plus grog	7.0	Sand + > 25 percent crushed rock
3	Grog	7.1	Sand + 7-25 percent crushed rock
4	Sand and disaggregated rock	7.2	Sand + 1-7 percent crushed rock
5	Disaggregated rock	8	Crushed rock
5.1	High muscovite mica (> 25 percent)	-9	Indeterminate

Grain size codes

Modal Schist Size: size mode of the schist or gneiss temper component

Modal Sand Size: size mode of the sand temper component

Finest: size of the finest temper grain

Coarsest: size of the coarsest temper grain

Mode: overall size mode of the temper

The codes are as follows:

0	does not exist	5	coarse sand (0.5-1.0 mm)
1	silt (< 0.0625 mm)	6	very coarse sand (1.0-2.0 mm)
2	very fine sand (0.0625-0.125 mm)	7	granule (> 2.0 mm)
3	fine sand (0.125-0.250 mm)	9	bimodal
4	medium sand (0.250-0.5 mm)		

Sorting (of the overall temper)

1	well sorted	4	moderately-poorly sorted
2	moderately-well sorted	5	poorly sorted
3	moderately sorted	9	bimodally sorted

Table K.16. Continued

Grain composition codes	
Only those identified in the analysis are reported here	
Dominant: dominant grain in the sand-sized fraction of the temper	
Secondary: second most abundant grain type in the sand-sized fraction of the temper	
Tertiary: third most abundant grain type in the sand-sized fraction of the temper	
The codes are as follows:	
1	Quartz, monocrystalline
5	Quartz, undifferentiated
9	Quartz and/or feldspars
10	Feldspars, undifferentiated
11	Potassium feldspar
19	Microcline from granitic rock
20	Plagioclase feldspar, undifferentiated
21	Altered plagioclase feldspar
30	Opaque oxides, undifferentiated
40	Micas, undifferentiated
41	Muscovite
43	Chlorite
45	Biotite and chlorite
50	Pyribole, undifferentiated pyroxene and amphibole
51	Amphibole, probably hornblende
53	Pyroxene group minerals
54	Amphibole group minerals, may be altered
100	Felsic volcanics, undifferentiated
101	Rhyolite
101.01	Tuff of Beehive Peak, Tucson Mountains
101.02	Felsic volcanic with a glassy, Ca-stained pink color; glassy, moderately vacuolar matrix and plagioclase as well as K-feldspar (sanidine) phenocrysts
105	Dacite: Plagioclase rich volcanic with strong lath structure, lathwork to glassy or devitrified banded groundmass
108	Tuff (felsic to mafic, vitreous), undifferentiated
115.05	Intermediate related series of volcanic rocks – "St. Mary's dirty snowballs" and related rocks of intergranular texture
119	Undifferentiated related suite of felsic to mafic volcanics

model indicates the high proportion of volcanic grains in the sand. When these samples were reexamined, it was clear the granite and granite-gneiss grains were similar to those from the Tortolita Mountains. However, the origin of this sand remains unclear due to the abundance of volcanic grains that are not typical for any of the comparative sands from the Tortolita petrofacies.

RESULTS

As previously stated, the final assignments for the samples were based on the totality of evidence from the binocular, petrographic, and statistical data. When these results are compared to the vessel ware, some interesting correlations were noted. For example, the plain ware samples, predominantly jars, were mostly tempered with sand from the Tucson Mountains (Twin Hills or Wasson petrofacies, including the local Wasson "mixed" composition) (Table K.19). Crushed schist was another temper component. Less frequently used for plain ware temper were sands from the Tortolita petrofacies, including sand from the Big Wash Petrofacies. The single Stucco Plain ware jar sample had Twin Hills Petrofacies sand, indicating its production just south of the Yuma Wash site.

Of the 59 samples of Tanque Verde Red-on-brown ware, 27 samples had the local "mixed" composition sand and one had unmixed Wasson Petrofacies sand. Sand from the Twin Hills Petrofacies and of the northern Tucson Mountains composition were the next most common tempering materials, with eight

Table K.17. Point-count data for the analyzed samples, the Yuma Wash site. (Parameter definitions are given in Table K.15.)

A. Inventory data, totals, and other inclusions.

Sample	TT	TSG	TSS[a]	Petrofacies[a]	Total	Total Foliated Rocks[b]	Total Sand Temper	Paste	Percent Temper	Grog	Clay Lumps	Unkn
MAR3-001	4	53	-9	J3	215	0	214	415	34.13	1	0	0
MAR3-002	4	53	J2	J2	434	2	432	228	65.56	0	2	0
MAR3-003	9.1	54	-9	M	180	0	175	288	38.46	5	0	0
MAR3-004	9.1	54	J3	J3	153	0	153	223	40.69	0	0	0
MAR3-005	4	54	J3	J3	378	3	377	562	40.21	1	0	0
MAR3-006	4	2	-9	J2	376	4	369	478	44.03	6	1	0
MAR3-007	4	2	-9	J2	506	2	506	345	59.46	0	0	0
MAR3-008	4	2	O	J3	455	5	455	375	54.82	0	0	0
MAR3-009	4	2	O	Unknown	378	6	377	540	41.18	1	0	1
MAR3-010	6	2	O	J3	392	5	390	385	50.45	1	1	0
MAR3-011	4	2	O	J2	406	2	406	410	49.75	0	0	0
MAR3-012	4	42	E3	E1	253	1	253	428	37.15	0	0	0
MAR3-013	4	42	E3	Unknown	319	1	318	531	37.53	0	1	0
MAR3-014	4	42	E3	M	456	3	453	541	45.74	0	3	0
MAR3-015	4	42	E3	Unknown	414	15	414	358	53.63	0	0	0
MAR3-016	4	7	-9	J2	356	2	355	422	45.76	0	1	1
MAR3-017	4	7	-9	J3	319	2	317	498	39.05	1	1	0
MAR3-018	4	30	-9	J3	353	17	352	320	52.45	0	1	0
MAR3-019	4	30	-9	K	291	4	291	354	45.12	0	0	0
MAR3-020	4	30	-9	J3	254	4	254	461	35.52	0	0	0
MAR3-021	4	30	K	Bv	262	2	262	475	35.55	0	0	0
MAR3-022	6	3	-9	J3	275	3	240	439	38.52	35	0	0
MAR3-023	6	3	-9	E3	227	3	227	386	37.03	0	0	0
MAR3-024	7	5	-9	K	380	5	374	358	51.49	0	1	0
MAR3-025	7	5	-9	Unknown	291	14	277	382	43.24	0	0	0
TOM1-003	5	-9	-9	J2	329	3	326	725	31.21	0	0	0
TOM1-004	4	-9	-9	J2	543	0	542	484	52.87	0	1	0
TOM1-005	4	-9	-9	Unknown	321	5	321	535	37.50	0	0	1
TOM1-007	4	-9	-9	E3	309	0	308	533	36.70	1	0	0
TOM1-008	5	-9	-9	Unknown	249	8	249	580	30.04	0	0	0
TOM1-014	4	1	-9	J2	274	0	274	589	31.75	0	0	0
TOM1-016	4	1	J2	J2	328	1	328	533	38.10	0	0	0
TOM1-017	4	2	-9	E1	486	6	486	580	45.59	0	0	0
TOM1-018	4	2	-9	E1	412	4	412	485	45.93	0	0	0
TOM1-019	4	3	-9	B	389	29	389	589	39.78	0	0	0
TOM1-020	4	3	B	B	327	12	315	567	36.58	0	0	0
TOM1-021	4	30	-9	K	549	1	549	533	50.74	0	0	0
TOM1-022	4	30	-9	K	527	1	527	515	50.58	0	0	0
TOM1-023	4	30	-9	K	377	9	376	472	44.41	1	0	0
TOM1-024	4	30	K	E1	485	2	485	546	47.04	0	0	0
TOM1-025	4	30	K	K	479	2	479	615	43.78	0	0	0
TOM1-026	4	30	K	K	444	0	444	545	44.89	0	0	0
TOM1-027	4	30	K	K	521	1	521	522	49.95	0	0	0
TOM1-028	4	30	K	K	475	0	475	563	45.76	0	0	0
TOM1-029	4	30	K	K	471	4	465	643	42.28	1	5	1
TOM1-030	4	30	K	K	468	4	468	635	42.43	0	0	0

Table K.17a. Continued.

Sample	TT	TSG	TSS[a]	Petrofacies[a]	Total	Total Foliated Rocks[b]	Total Sand Temper	Paste	Percent Temper	Grog	Clay Lumps	Unkn
TOM1-031	4	30	K	K	723	4	723	844	46.14	0	0	0
TOM1-032	4	30	K	K	798	0	798	917	46.53	0	0	0
TOM1-034	4	40	-9	Bv	323	13	323	568	36.25	0	0	0
TOM1-036	4	40	-9	B	379	6	376	605	38.52	3	0	0
TOM1-038	4	40	-9	E1	408	6	408	467	46.63	0	0	0
TOM1-040	4	41	E2	E2	328	8	328	563	36.81	0	0	0
TOM1-041	4	45	-9	E1	500	6	498	485	50.76	0	2	0
TOM1-042	4	45	-9	J2	281	5	281	745	27.39	0	0	0
TOM1-043	4	40	S	E3	367	1	366	534	40.73	0	0	0
TOM1-044	4	47	E2	E2	467	1	467	347	57.37	0	0	0
TOM1-045	4	53	J2	J2	382	0	382	648	37.09	0	0	0
TOM1-046	4	53	J2	J2	420	1	420	845	33.20	0	0	0
TOM1-047	4	53	J2	J2	474	4	474	617	43.45	0	0	0
TOM1-048	6	53	J2	J2	314	2	311	704	30.84	1	0	0
TOM1-049	4	53	J2	J2	386	6	384	975	28.36	2	0	0
TOM1-050	4	53	J2	J2	515	1	515	825	38.43	0	0	0
TOM1-051	4	53	J2	J2	402	4	402	802	33.39	0	0	0
TOM1-052	4	53	J2	J2	428	0	428	762	35.97	0	0	0
TOM1-053	4	53	J2	J2	319	0	319	810	28.26	0	0	0
TOM1-054	4	53	J2	J2	380	2	380	915	29.34	0	0	0
TOM2-001	4	-9	-9	J2	174	0	174	458	27.53	0	0	1
TOM2-002	6	-9	-9	J2	318	5	291	570	35.81	27	0	0
TOM2-003	4	-9	-9	K	468	14	467	514	47.66	1	0	1
TOM2-004	4	-9	-9	E1	464	10	464	622	42.73	0	0	0
TOM2-005	4	-9	-9	K	265	1	264	548	32.60	1	0	0
TOM2-006	4	-9	-9	E1	392	1	392	489	44.49	0	0	0
TOM2-007	4	-9	-9	K	435	14	435	567	43.41	0	0	0
TOM2-008	4	-9	-9	J2	375	5	375	661	36.20	0	0	0
TOM2-009	4	-9	-9	J2	295	1	294	533	35.63	1	0	0
TOM2-010	4	-9	-9	K	427	6	427	515	45.33	0	0	0
TOM2-011	4	-9	-9	J2	360	4	360	418	46.27	0	0	0
TOM2-012	4	-9	-9	K	343	0	343	408	45.67	0	0	0
TOM2-013	4	-9	-9	K	336	9	334	501	40.14	0	2	1
TOM2-014	4	-9	-9	K	373	0	362	445	45.60	0	11	0
TOM2-015	6	40	-9	K	295	2	293	513	36.51	1	1	0
TOM2-017	4	-9	-9	K	307	0	301	624	32.98	0	6	0
TOM2-019	4	1	J1	K	290	0	288	500	36.71	0	2	0
TOM2-020	4	1	-9	J2	254	0	254	620	29.06	0	0	0
TOM2-021	4	1	-9	J2	347	0	347	393	46.89	0	0	0
TOM2-022	4	1	J2	J2	314	0	314	483	39.40	0	0	0
TOM2-023	4	2	-9	K	378	1	376	320	54.15	1	1	0
TOM2-025	4	2	-9	E1	298	3	298	354	45.71	0	0	0
TOM2-026	4	2	-9	K	335	0	335	546	38.02	0	0	0
TOM2-027	4	2	-9	K	380	0	379	615	38.19	1	0	0
TOM2-028	4	2	-9	J2	364	2	362	435	45.56	1	1	1
TOM2-029	4	2	-9	K	406	5	406	545	42.69	0	0	0
TOM2-030	4	2	-9	K	418	0	416	522	44.47	1	1	1
TOM2-031	4	2	-9	K	285	0	284	583	32.83	0	1	0
TOM2-032	4	30	-9	K	480	2	480	867	35.63	0	0	0

Table K.17a. Continued.

Sample	TT	TSG	TSS[a]	Petrofacies[a]	Total	Total Foliated Rocks[b]	Total Sand Temper	Paste	Percent Temper	Grog	Clay Lumps	Unkn
TOM2-033	4	30	-9	K	672	2	671	813	45.25	0	1	0
TOM2-034	4	30	-9	K	460	0	460	713	39.22	0	0	0
TOM2-035	4	30	-9	K	585	6	585	892	39.61	0	0	0
TOM2-036	4	30	-9	K	627	4	626	835	42.89	1	0	0
TOM2-037	4	40	-9	J2	371	2	369	488	43.19	0	2	0
TOM2-038	6	40	-9	Unknown	412	54	358	449	47.85	0	0	0
TOM2-039	4	45	-9	K	390	0	388	563	40.92	2	0	0
TOM2-040	4	45	-9	J2	417	1	417	481	46.44	0	0	0
TOM2-041	9	2	-9	J2	280	0	278	605	31.64	0	2	0
TOM2-042	9	-9	-9	J2	287	1	287	533	35.00	0	0	0

[a]B = Catalina Petrofacies, Bv = Catalina Volcanic Petrofacies, E1 = Western Tortolita Petrofacies, E2 = Central Tortolita Petrofacies, E3 = Eastern Tortolita Petrofacies, J2 = Twin Hills Petrofacies, J3 = Wasson Petrofacies, K = Black Mountain Petrofacies, M = Rillito Petrofacies.

[b]Normally, LMA and LMM would not be included in the Total Foliated Rocks. However, in the Tucson Basin, the gneisses may have unfoliated zones which are from the same provenance as the foliated rocks. Thus, for this project, LMA and LMM are included in the Total Foliated Rocks, except where information recorded during counting specifies that the LMA and LMM indicate other metamorphic rock types such as quartzite or metavolcanics.

samples for the former and nine samples for the latter. Seven samples contained sand from the Black Mountain Petrofaciesand four samples had Eastern Tortolita Petrofacies sand, along with two samples having the Tortolita sand with volcanics composition. A single sample had Catalina Petrofacies sand. Surprisingly, while most of the samples derived from bowls, all the sand tempers were seen in bowls and jars, with the exception of the northern Tucson Mountains sand that was only noted in bowls.

The six Tucson Red-on-brown samples from the Late Rincon or Tanque Verde period also revealed the use of the "mixed" composition Wasson Petrofacies sand in one sample, while one had the typical Wasson sand. Other sand tempers in these samples derived from the Beehive, Eastern Tortolita, and Black Mountain petrofacies. A single sample had sand from the northern Tucson Mountains. The five Middle or Late Rincon or Tanque Verde Red-on-brown samples contained Wasson, Twin Hills, and Catalina petrofacies sands, along with one sample having the Tortolita with volcanics composition. Finally, one indeterminate Red-on-brown jar was made with the Wasson "mixed" composition sand.

The single Tortolita Red jar analyzed had sand temper from the Central Tortolita Petrofacies. An indeterminate Classic red ware bowl was made with a combination of Wasson Petrofacies sand and the addition of grog containing crushed schist. The indeterminate red ware bowl had sand from the Tortolita Mountains, with plentiful volcanic inclusions.

A Gila Polychrome bowl was shown to have been made locally and featured typical Wasson Petrofacies sand. An indeterminate polychrome bowl was made with sand that did not closely resemble known sands in the Tucson Basin. The sand is either atypical Eastern Tortolita Petrofacies sand, or it comes from outside the basin. Given that this vessel is a polychrome, there is some chance it is extrabasinal. Both the Clapboard and Flattened Corrugated jars contained sand derived from the Twin Hills Petrofacies. Finally, a sample of an indeterminate Mogollon Corrugated bowl proved to have sand that did not match any of the known Tucson Basin sands, as was expected.

Typically, the next step in such a ceramic study is to relate the petrographic results to the groups of sherds classified only through binocular analysis. However, as discussed above, the lack of correlation between the binocular identification and the final petrographic assignment means that any assignments given to those sherds not petrographically examined is fairly tentative. An additional reason for the difficulties in relating the petrographic results to the binocular analysis of the sherds is the fact that three different individuals conducted the temper examination of the sherds. In order to illustrate how applicable the petrographic results are to the ceramic corpus, each project will be discussed separately. One caveat to this discussion is that when the specific temper source is listed as indeterminate, the petrographic results will of course show that none were correctly assigned in the binocular analysis.

Within the MAR3 samples, fourteen different temper types and generic temper assignments were investigated petrographically. Of these groups, the

Table K.17. Point-count data for the analyzed samples, the Yuma Wash site. (Parameter definitions are given in Table K.15.)

B. Monocrystalline grains (only those present are included).

Sample	Qtz	Kspar	Micr	Plag	Plagal	Plaggn	Px	Amph	Opaq	Biot	Musc	Chlor	Oliv	Epid	Sphene	Gar	Caco
MAR3-001	50	2	0	46	11	0	1	4	5	0	1	1	0	2	0	0	0
MAR3-002	70	25	0	0	68	5	0	1	15	0	3	3	0	14	1	0	1
MAR3-003	37	3	0	50	14	0	0	0	5	0	0	4	0	0	0	0	0
MAR3-004	32	10	2	30	3	0	0	0	3	0	1	0	0	7	0	0	1
MAR3-005	79	27	0	0	83	1	0	6	17	0	0	3	0	2	0	0	5
MAR3-006	111	19	0	0	90	0	0	4	15	0	7	10	0	7	1	0	0
MAR3-007	213	105	4	0	101	1	1	6	5	0	0	5	0	3	1	0	0
MAR3-008	171	92	3	0	105	0	0	9	10	1	0	2	0	4	1	0	1
MAR3-009	172	68	2	0	83	3	0	1	20	0	0	2	0	5	0	0	0
MAR3-010	143	66	0	0	74	3	1	3	7	1	0	5	0	5	0	0	0
MAR3-011	179	69	1	0	98	0	0	2	11	0	0	1	0	0	0	0	1
MAR3-012	106	30	12	60	4	0	0	5	21	0	2	3	0	2	3	2	0
MAR3-013	108	33	0	0	110	0	1	6	9	0	1	3	0	5	0	0	0
MAR3-014	178	82	0	8	88	1	0	4	22	0	0	4	0	5	2	0	0
MAR3-015	166	53	0	0	88	3	0	3	14	0	3	4	0	3	1	0	0
MAR3-016	153	54	0	0	68	2	0	4	8	0	1	2	0	2	0	0	0
MAR3-017	74	10	0	0	67	3	2	4	9	0	1	4	0	12	0	0	0
MAR3-018	134	54	2	0	72	6	0	3	9	0	0	4	0	1	1	0	1
MAR3-019	84	23	0	0	82	0	1	4	15	1	0	2	0	1	0	0	0
MAR3-020	72	14	1	90	14	0	0	0	12	2	0	1	0	5	0	0	0
MAR3-021	99	14	6	70	14	0	0	5	13	0	0	1	0	1	0	0	0
MAR3-022	74	28	0	0	47	3	0	4	8	0	1	1	0	2	2	0	0
MAR3-023	74	26	11	72	8	0	0	6	12	4	4	2	0	2	1	0	1
MAR3-024	167	55	0	0	50	2	1	0	5	3	16	6	0	4	0	6	0
MAR3-025	129	11	4	38	0	0	0	1	25	2	56	10	0	0	0	0	0
TOM1-003	66	21	0	0	47	3	1	1	18	0	55	16	0	10	0	0	0
TOM1-004	213	55	15	0	84	1	1	1	13	0	0	4	0	1	0	0	22
TOM1-005	129	31	4	0	78	1	1	3	8	0	3	9	0	3	0	2	0
TOM1-007	67	29	0	0	110	2	1	6	21	0	6	14	0	10	0	0	24
TOM1-008	92	25	0	0	40	8	0	0	17	0	47	6	0	4	0	0	0

Table K.17b. Continued.

Sample	Qtz	Kspar	Micr	Plag	Plagal	Plaggn	Px	Amph	Opaq	Biot	Musc	Chlor	Oliv	Epid	Sphene	Gar	Caco
TOM1-014	73	10	0	0	66	0	1	0	10	0	0	5	0	2	0	0	3
TOM1-016	83	15	0	0	18	0	0	1	6	0	0	1	0	2	0	0	10
TOM1-017	191	49	3	2	137	1	0	11	15	0	1	6	0	6	4	0	11
TOM1-018	200	52	2	0	87	1	0	12	27	1	1	4	0	3	4	0	0
TOM1-019	184	41	0	10	96	0	0	0	6	1	6	7	0	1	0	2	3
TOM1-020	170	20	1	0	83	0	0	0	9	0	9	16	0	1	0	5	0
TOM1-021	182	94	2	0	169	0	1	14	11	0	0	0	0	5	5	1	5
TOM1-022	279	51	1	0	100	2	1	11	23	0	0	1	0	4	1	0	0
TOM1-023	164	56	3	2	81	1	0	6	6	0	0	2	0	4	1	1	1
TOM1-024	194	88	2	0	160	0	3	14	9	0	0	1	0	4	4	0	0
TOM1-025	160	94	2	0	120	0	0	2	10	0	10	6	0	6	5	2	0
TOM1-026	116	60	0	0	140	2	4	4	25	0	0	5	0	4	0	0	7
TOM1-027	225	104	6	1	106	3	1	6	10	0	0	1	0	0	1	0	0
TOM1-028	132	72	14	0	104	1	0	4	19	0	3	1	0	0	0	0	15
TOM1-029	202	32	1	5	49	3	1	10	8	0	0	4	0	1	0	0	0
TOM1-030	192	60	1	1	46	0	0	4	9	0	0	0	0	0	0	0	12
TOM1-031	303	161	2	0	145	1	4	8	13	0	1	2	1	5	1	0	0
TOM1-032	239	134	24	0	287	1	6	1	20	1	1	4	0	3	3	0	0
TOM1-034	178	28	0	0	65	1	0	5	9	0	1	3	0	2	1	0	0
TOM1-036	163	54	0	0	93	0	0	0	7	1	4	3	0	8	0	0	0
TOM1-038	197	54	0	0	110	0	1	9	7	0	0	5	0	5	4	1	1
TOM1-040	94	30	0	0	120	0	1	28	32	0	0	2	0	3	8	0	0
TOM1-041	211	58	2	14	138	0	0	10	21	1	1	4	0	8	3	0	10
TOM1-042	94	55	4	5	57	1	0	4	8	0	0	3	0	5	0	0	0
TOM1-043	88	65	4	0	99	2	0	0	34	23	3	44	0	4	0	0	0
TOM1-044	170	24	0	0	154	2	0	85	5	3	0	15	0	2	5	0	0
TOM1-045	77	27	2	0	73	4	3	1	8	0	0	2	0	4	0	0	0
TOM1-046	68	19	0	0	51	7	0	1	17	1	0	11	0	0	0	0	1
TOM1-047	104	0	6	104	1	1	5	2	18	2	1	5	0	7	0	0	3
TOM1-048	75	6	0	0	38	3	1	0	12	1	7	5	0	13	0	0	0
TOM1-049	78	13	0	0	64	2	0	2	39	1	1	5	0	5	0	0	0
TOM1-050	165	35	0	0	71	1	0	1	19	0	0	4	0	0	0	0	3

Table K.17b. Continued.

Sample	Qtz	Kspar	Micr	Plag	Plagal	Plaggn	Px	Amph	Opaq	Biot	Musc	Chlor	Oliv	Epid	Sphene	Gar	Caco
TOM1-051	71	13	0	0	81	2	1	1	26	0	0	6	0	8	0	0	2
TOM1-052	86	10	0	0	28	3	0	0	18	0	0	1	0	0	0	0	0
TOM1-053	65	0	0	14	52	1	1	2	11	0	1	2	0	4	0	0	1
TOM1-054	55	16	0	0	62	2	0	2	16	0	2	8	0	5	0	0	6
TOM2-001	42	15	0	0	33	0	0	4	12	1	0	5	0	1	1	0	0
TOM2-002	60	26	0	0	67	1	1	4	17	0	13	9	0	2	0	0	2
TOM2-003	192	93	10	2	92	0	0	6	10	0	1	5	0	6	1	0	6
TOM2-004	174	90	2	0	105	0	0	16	21	1	0	9	0	2	2	0	0
TOM2-005	99	43	2	0	60	2	1	4	7	0	0	7	0	0	0	0	0
TOM2-006	151	90	0	0	100	0	2	13	7	0	0	2	0	1	7	0	1
TOM2-007	167	85	4	2	86	0	0	1	7	0	0	3	0	2	0	1	5
TOM2-008	118	80	1	0	72	1	0	5	12	0	0	5	0	1	1	0	0
TOM2-009	104	26	5	0	35	1	0	3	8	0	0	2	0	4	0	0	4
TOM2-010	171	87	7	12	78	2	0	16	6	0	2	4	0	6	1	0	4
TOM2-011	140	76	1	0	75	0	1	1	4	0	0	7	0	2	2	1	1
TOM2-012	74	92	4	0	101	0	0	2	10	2	0	1	0	1	0	0	0
TOM2-013	101	72	0	2	44	2	0	2	11	0	2	12	0	0	0	0	17
TOM2-014	120	78	18	0	101	1	5	3	10	0	0	1	0	0	1	0	0
TOM2-015	73	65	0	0	41	0	0	3	22	0	3	3	0	1	0	0	22
TOM2-017	47	32	4	0	46	0	0	5	12	1	0	6	0	8	0	0	7
TOM2-019	79	51	0	0	82	0	1	2	8	0	0	0	0	0	0	0	0
TOM2-020	43	15	0	0	27	2	1	1	8	0	0	5	0	1	0	0	0
TOM2-021	55	16	0	0	41	1	4	4	11	0	0	4	0	4	0	0	0
TOM2-022	63	27	0	0	51	0	0	0	6	0	0	1	0	0	0	0	5
TOM2-023	129	71	0	0	97	1	1	0	5	0	6	2	0	2	0	0	0
TOM2-025	92	71	0	0	85	1	0	7	12	0	1	2	0	4	7	1	2
TOM2-026	80	35	22	0	105	3	1	1	4	3	0	12	0	1	2	0	7
TOM2-027	84	60	1	1	119	1	0	2	14	0	0	2	0	5	0	0	7
TOM2-028	134	81	5	0	67	1	0	2	15	5	0	5	0	2	0	0	3
TOM2-029	165	72	7	0	86	0	0	3	7	1	0	4	0	3	1	0	3
TOM2-030	98	63	3	0	166	5	0	3	27	0	2	7	0	0	0	0	6
TOM2-031	99	78	2	0	71	0	0	2	4	1	5	2	0	1	0	0	2

Table K.17b. Continued.

Sample	Qtz	Kspar	Micr	Plag	Plagal	Plaggn	Px	Amph	Opaq	Biot	Musc	Chlor	Oliv	Epid	Sphene	Gar	Caco
TOM2-032	192	109	3	0	119	0	2	1	7	0	1	2	0	1	1	0	0
TOM2-033	278	132	0	0	166	0	3	2	24	0	2	7	0	2	0	2	0
TOM2-034	130	82	4	0	121	0	0	3	14	4	1	5	0	1	0	1	8
TOM2-035	244	129	8	2	112	0	1	9	14	1	3	2	0	3	0	1	0
TOM2-036	323	97	2	1	93	1	3	10	17	0	1	12	0	3	1	0	0
TOM2-037	169	72	0	0	57	1	0	2	6	2	2	3	0	3	0	0	0
TOM2-038	160	20	0	0	45	0	0	0	30	0	85	14	0	0	0	0	0
TOM2-039	99	31	2	0	91	2	0	11	28	0	0	12	0	9	0	0	4
TOM2-040	154	83	0	0	95	0	2	4	9	0	1	0	0	4	2	0	1
TOM2-041	51	16	0	0	52	0	2	2	20	0	0	3	0	9	0	0	3
TOM2-042	69	36	0	37	0	0	0	3	4	2	1	2	0	0	0	0	0

Table K.17. Point-count data for the analyzed samples, the Yuma Wash site. (Parameter definitions are given in Table K.15.)

C. Lithic grains and monocrystalline grains within coarse-foliated rock fragments (only those present are included).

Sample	Lmm	Lmf	Lma	Lmt	Lmtp	Lmvf	Lmss	Lvfb	Lvf	Lvi	Lvm	Lvv	Lvh	Lss	Lsch	Lsca	Sopaq	Smusc	Schlor
MAR3-001	0	0	0	0	0	0	2	2	47	4	0	19	0	0	3	14	0	0	0
MAR3-002	0	0	0	2	0	3	7	7	60	75	0	15	55	0	0	2	0	0	0
MAR3-003	0	0	0	0	0	0	0	16	35	3	0	6	0	0	1	1	0	0	0
MAR3-004	0	0	0	0	0	0	0	6	41	7	0	2	1	0	5	2	0	0	0
MAR3-005	0	3	0	0	0	4	0	2	87	18	0	6	13	0	0	21	0	0	0
MAR3-006	0	1	0	0	0	2	3	1	39	18	0	8	30	0	0	0	0	3	0
MAR3-007	0	0	0	2	0	0	1	0	9	19	0	3	27	0	0	0	0	0	0
MAR3-008	0	1	0	4	0	2	3	0	9	19	0	4	13	0	0	1	0	0	0
MAR3-009	0	0	0	6	0	0	5	0	1	2	0	0	6	0	0	0	0	0	0
MAR3-010	0	0	0	5	0	1	1	2	17	17	0	8	19	4	0	8	0	0	0
MAR3-011	0	0	0	2	0	0	1	0	12	8	0	3	16	0	0	2	0	0	0
MAR3-012	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
MAR3-013	0	0	0	1	0	0	0	0	13	14	2	7	0	0	0	5	0	0	0
MAR3-014	0	0	0	3	0	2	1	0	10	19	0	7	17	0	0	0	0	0	0
MAR3-015	0	0	1	14	0	0	0	1	11	17	0	2	5	0	0	25	0	0	0
MAR3-016	0	0	0	2	0	0	0	0	13	9	0	8	17	0	0	10	0	0	0
MAR3-017	0	0	0	2	0	1	3	1	54	38	0	7	18	1	1	5	0	0	0
MAR3-018	0	0	0	17	0	1	0	0	5	15	0	4	16	0	0	7	0	0	0
MAR3-019	0	0	0	4	0	1	4	0	18	7	0	2	22	0	0	20	0	0	0
MAR3-020	0	0	0	4	0	0	1	0	19	3	0	2	0	0	8	6	0	0	0
MAR3-021	0	0	0	2	0	0	0	1	13	2	0	3	0	0	3	15	0	0	0
MAR3-022	0	0	0	3	0	5	2	2	23	22	0	4	9	0	0	0	0	0	0
MAR3-023	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
MAR3-024	0	0	0	5	0	1	4	2	11	24	0	2	13	0	0	2	0	0	0
MAR3-025	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	1	3	5	1
TOM1-003	0	1	0	2	0	3	1	1	30	25	0	5	21	1	1	0	0	0	0
TOM1-004	0	0	0	0	0	0	0	1	27	2	0	3	84	1	3	11	0	0	0
TOM1-005	1	0	0	4	0	0	0	3	11	6	0	2	14	0	0	7	0	0	0
TOM1-007	0	0	0	0	0	0	1	0	9	6	0	2	0	0	0	0	0	0	0
TOM1-008	1	0	0	7	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0

Table K.17c. Continued.

Sample	Lmm	Lmf	Lma	Lmt	Lmtp	Lmvf	Lmss	Lvfb	Lvf	Lvi	Lvm	Lvv	Lvh	Lss	Lsch	Lsca	Sopaq	Smusc	Schlor
TOM1-014	0	0	0	0	0	1	3	7	48	24	0	4	16	1	0	0	0	0	0
TOM1-016	0	0	0	1	0	0	2	3	90	25	0	7	45	0	2	17	0	0	0
TOM1-017	0	1	1	4	0	0	0	2	10	7	0	4	9	0	0	11	0	0	0
TOM1-018	0	0	0	4	0	0	1	0	0	0	0	0	1	0	0	12	0	0	0
TOM1-019	0	2	0	27	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
TOM1-020	0	2	0	10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
TOM1-021	0	0	0	1	0	0	0	0	22	15	0	4	11	1	3	3	0	0	0
TOM1-022	0	0	0	1	0	0	1	0	10	16	0	4	14	0	2	5	0	0	0
TOM1-023	1	2	0	6	0	0	0	0	11	10	0	6	10	0	1	1	0	0	0
TOM1-024	0	0	0	2	0	0	1	0	0	0	0	0	0	1	0	2	0	0	0
TOM1-025	0	0	0	2	0	1	0	0	4	7	0	5	20	1	4	18	0	0	0
TOM1-026	0	0	0	0	0	1	0	0	28	18	0	1	26	0	0	3	0	0	0
TOM1-027	0	0	0	1	0	0	0	0	14	16	0	3	19	0	4	0	0	0	0
TOM1-028	0	0	0	0	0	0	0	3	22	24	0	6	46	2	0	7	0	0	0
TOM1-029	0	0	0	4	0	0	0	1	13	19	0	3	21	0	0	1	0	0	0
TOM1-030	0	0	0	4	0	1	0	1	61	4	0	6	58	1	1	6	0	0	0
TOM1-031	0	0	0	4	0	0	0	0	13	18	0	4	28	2	3	4	0	0	0
TOM1-032	0	0	0	0	0	0	0	0	7	20	1	0	46	0	0	0	0	0	0
TOM1-034	0	2	0	11	0	0	1	0	5	6	0	0	4	0	1	0	0	0	0
TOM1-036	0	2	0	4	0	0	0	4	16	10	0	4	1	1	0	1	0	0	0
TOM1-038	0	0	0	6	0	0	0	0	0	2	0	2	0	0	0	4	0	0	0
TOM1-040	0	0	0	8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
TOM1-041	0	0	0	6	0	0	0	0	2	3	0	1	2	0	0	3	0	0	0
TOM1-042	0	0	0	5	0	0	0	0	3	12	0	4	12	0	0	9	0	0	0
TOM1-043	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOM1-044	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TOM1-045	0	0	0	0	0	0	0	15	74	30	1	22	25	0	3	11	0	0	0
TOM1-046	0	1	0	0	0	5	1	5	135	18	1	20	41	0	5	12	0	0	0
TOM1-047	0	3	0	1	0	1	1	12	77	47	0	7	51	1	3	11	0	0	0
TOM1-048	0	1	0	1	0	4	4	1	67	31	0	13	28	0	0	2	0	0	0
TOM1-049	0	3	0	3	0	1	4	9	80	40	0	5	27	0	1	1	0	0	0
TOM1-050	0	0	0	1	0	0	0	2	81	14	1	11	65	1	2	38	0	0	0

Table K.17c. Continued.

Sample	Lmm	Lmf	Lma	Lmt	Lmtp	Lmvf	Lmss	Lvfb	Lvf	Lvi	Lvm	Lvv	Lvh	Lss	Lsch	Lsca	Sopaq	Smusc	Schlor
TOM1-051	0	1	0	3	0	2	2	4	73	35	0	16	48	3	2	2	0	0	0
TOM1-052	0	0	0	0	0	1	1	4	114	28	0	15	95	0	1	23	0	0	0
TOM1-053	0	0	0	0	0	1	2	3	56	33	0	11	49	0	1	8	0	0	0
TOM1-054	0	1	0	1	0	1	1	5	90	30	0	10	50	1	1	15	0	0	0
TOM2-001	0	0	0	0	0	0	0	0	18	10	0	9	22	0	0	0	0	0	0
TOM2-002	0	0	0	3	1	0	2	0	27	17	0	9	26	0	0	3	0	1	0
TOM2-003	3	1	0	10	0	0	0	1	11	7	0	2	6	0	0	1	0	0	0
TOM2-004	0	2	0	8	0	0	1	1	4	11	0	3	7	0	0	5	0	0	0
TOM2-005	0	0	0	1	0	0	0	0	7	14	0	1	13	0	0	3	0	0	0
TOM2-006	0	0	0	1	0	0	2	0	3	3	0	0	1	0	0	8	0	0	0
TOM2-007	0	4	0	10	0	0	0	0	7	11	0	1	18	0	1	20	0	0	0
TOM2-008	0	0	0	5	0	0	1	0	11	21	0	2	34	0	0	5	0	0	0
TOM2-009	0	0	0	1	0	3	1	1	27	14	0	1	45	0	0	9	0	0	0
TOM2-010	1	0	0	5	0	1	0	0	4	5	0	0	7	0	0	8	0	0	0
TOM2-011	0	0	0	4	0	0	2	1	8	12	0	3	14	0	0	5	0	0	0
TOM2-012	0	0	0	0	0	0	0	0	6	22	0	0	24	0	0	4	0	0	0
TOM2-013	1	0	0	7	0	1	3	1	11	20	0	4	7	1	1	10	0	1	0
TOM2-014	0	0	0	0	0	0	0	0	1	6	0	0	9	0	0	8	0	0	0
TOM2-015	0	1	0	1	0	0	0	1	5	21	0	4	19	0	0	8	0	0	0
TOM2-017	0	0	0	0	0	0	1	1	28	38	0	7	54	0	0	4	0	0	0
TOM2-019	0	0	0	0	0	0	0	1	28	19	0	1	11	0	0	5	0	0	0
TOM2-020	0	0	0	0	0	1	0	8	109	4	0	10	16	0	0	3	0	0	0
TOM2-021	0	0	0	0	0	1	2	3	63	54	1	9	72	0	0	2	0	0	0
TOM2-022	0	0	0	0	0	1	0	0	46	11	0	4	59	0	0	40	0	0	0
TOM2-023	0	0	0	1	0	0	0	0	11	38	0	1	8	0	0	3	0	0	0
TOM2-025	0	0	0	3	0	0	0	0	1	1	0	0	0	1	0	7	0	0	0
TOM2-026	0	0	0	0	0	0	0	25	13	5	0	1	7	0	0	8	0	0	0
TOM2-027	0	0	0	0	0	1	0	2	42	14	0	9	10	0	0	5	0	0	0
TOM2-028	0	1	0	1	0	1	1	0	5	15	0	3	13	0	0	1	0	0	0
TOM2-029	0	0	0	5	0	0	0	0	7	15	0	4	15	1	2	5	0	0	0
TOM2-030	0	0	0	0	0	1	0	0	12	6	0	1	12	0	0	3	0	0	0
TOM2-031	0	0	0	0	0	0	0	0	7	4	0	1	5	0	0	0	0	0	0

Table K.17c. Continued.

Sample	Lmm	Lmf	Lma	Lmt	Lmtp	Lmvf	Lmss	Lvfb	Lvf	Lvi	Lvm	Lvv	Lvh	Lss	Lsch	Lsca	Sopaq	Smusc	Schlor
TOM2-032	0	0	0	2	0	0	0	0	3	18	0	2	14	0	1	2	0	0	0
TOM2-033	0	0	0	2	0	0	0	1	5	21	0	1	23	0	0	0	0	0	0
TOM2-034	0	0	0	0	0	0	0	5	28	25	0	11	10	0	0	7	0	0	0
TOM2-035	0	2	0	4	0	0	1	0	0	6	0	4	31	2	0	6	0	0	0
TOM2-036	0	0	0	4	0	0	2	0	6	19	0	4	12	5	0	10	0	0	0
TOM2-037	0	0	0	2	0	1	0	0	11	8	0	3	24	0	0	3	0	0	0
TOM2-038	0	1	0	12	0	0	0	0	0	0	0	0	0	0	0	0	6	25	10
TOM2-039	0	0	0	0	0	0	2	0	32	16	0	7	22	0	0	20	0	0	0
TOM2-040	0	0	0	1	0	2	0	0	5	14	0	6	24	0	0	10	0	0	0
TOM2-041	0	0	0	0	0	1	1	2	40	18	0	12	40	0	0	6	0	0	0
TOM2-042	1	0	0	0	0	0	0	1	32	7	0	1	53	0	0	36	0	0	0

Table K.18. Qualitative observations for analyzed samples, the Yuma Wash site. (Parameter definitions are given in Table K.16.)

A. Qualitative data for the less than sand-sized fraction.

	Matrix Attributes			Silt Fraction		Clay Fraction	
Sample	Opacity	Color	Heterogenity	Dominant	Secondary	Dominant	Secondary
MAR3-001	2	19	0	1	20	9	40
MAR3-002	3	25	1	1	20	9	40
MAR3-003	3	40	1	1	10	9	40
MAR3-004	3	23	1	1	10	9	40
MAR3-005	3	40	0	1	20	9	40
MAR3-006	3	25	1	1	20	9	40
MAR3-007	3	42	0	1	11	9	40
MAR3-008	3	23	0	1	20	9	40
MAR3-009	2	25	0	1	20	9	30
MAR3-010	3	25	1	1	20	9	40
MAR3-011	3	40	0	1	20	9	40
MAR3-012	3	23	0	1	20	9	54
MAR3-013	3	25	0	1	20	9	40
MAR3-014	3	25	1	1	20	9	40
MAR3-015	3	21	0	1	20	9	40
MAR3-016	3	20	1	1	20	9	40
MAR3-017	3	25	1	1	20	9	40
MAR3-018	3	25	1	1	20	9	40
MAR3-019	3	12	0	1	20	9	40
MAR3-020	3	23	0	1	20	9	40
MAR3-021	3	23	0	1	20	9	40
MAR3-022	3	25	0	1	20	9	40
MAR3-023	3	23	0	1	20	9	40
MAR3-024	3	40	1	1	20	9	40
MAR3-025	3	20	0	1	41	9	40
TOM1-003	3	25	0	1	41	9	40
TOM1-004	3	23	1	1	20	9	40
TOM1-005	3	42	1	1	20	9	40
TOM1-007	3	42	0	1	20	9	40
TOM1-008	3	41	0	1	41	9	40
TOM1-014	3	25	0	1	20	9	40
TOM1-016	3	20	1	1	10	9	40
TOM1-017	3	25	1	1	20	9	40
TOM1-018	3	42	0	1	20	9	40
TOM1-019	3	23	0	1	10	9	40
TOM1-020	3	21	0	1	20	9	40
TOM1-021	3	23	0	1	10	9	40
TOM1-022	3	12	0	1	20	9	54
TOM1-023	3	42	0	1	20	9	40
TOM1-024	3	23	0	1	20	9	20
TOM1-025	3	12	0	1	10	9	50
TOM1-026	3	23	0	1	20	9	40
TOM1-027	3	12	0	1	20	9	40
TOM1-028	3	12	0	1	10	9	40
TOM1-029	3	23	1	1	20	9	40
TOM1-030	3	25	0	1	10	9	50
TOM1-031	3	20	0	1	10	9	40

Table K.18a. Continued.

	Matrix Attributes			Silt Fraction		Clay Fraction	
Sample	Opacity	Color	Heterogenity	Dominant	Secondary	Dominant	Secondary
TOM1-032	3	23	0	1	10	9	30
TOM1-034	3	25	0	1	20	9	40
TOM1-036	3	25	0	1	20	9	40
TOM1-038	3	41	0	1	20	9	40
TOM1-040	3	23	0	1	20	9	53
TOM1-041	3	40	1	1	20	9	43
TOM1-042	3	42	0	1	20	9	40
TOM1-043	3	25	0	1	20	9	40
TOM1-044	3	25	0	1	20	9	40
TOM1-045	3	23	0	1	20	9	40
TOM1-046	3	20	0	1	20	9	40
TOM1-047	3	42	0	1	20	9	30
TOM1-048	3	41	0	1	20	9	40
TOM1-049	3	23	0	1	40	9	40
TOM1-050	3	23	0	1	10	9	40
TOM1-051	3	23	0	1	20	9	40
TOM1-052	3	20	0	1	10	9	40
TOM1-053	3	23	0	1	20	9	40
TOM1-054	3	23	0	1	20	9	40
TOM2-001	3	25	0	1	20	9	40
TOM2-002	3	40	0	1	20	9	40
TOM2-003	3	23	1	1	43	9	40
TOM2-004	3	20	1	1	20	9	40
TOM2-005	3	12	0	1	20	9	50
TOM2-006	3	25	0	1	20	9	40
TOM2-007	3	23	0	1	20	9	40
TOM2-008	3	40	0	1	11	9	40
TOM2-009	3	42	1	1	20	9	40
TOM2-010	3	23	0	1	10	9	40
TOM2-011	3	40	1	1	11	9	40
TOM2-012	3	20	0	1	20	9	40
TOM2-013	3	40	1	1	10	9	40
TOM2-014	3	12	3	1	20	9	40
TOM2-015	3	21	0	1	20	9	40
TOM2-017	3	42	1	1	20	9	40
TOM2-019	3	42	1	1	20	9	40
TOM2-020	3	23	0	1	20	9	40
TOM2-021	3	25	0	1	20	9	40
TOM2-022	3	20	0	1	20	9	40
TOM2-023	3	25	1	1	20	9	40
TOM2-025	3	25	0	1	20	9	40
TOM2-026	3	42	1	1	20	9	40
TOM2-027	3	42	0	1	20	9	40
TOM2-028	3	25	1	1	11	9	40
TOM2-029	3	42	0	1	20	9	40
TOM2-030	3	42	0	1	20	9	43
TOM2-031	3	25	0	1	11	9	40
TOM2-032	3	23	0	1	30	9	40
TOM2-033	3	20	1	1	10	9	40

Table K.18a. Continued.

	Matrix Attributes			Silt Fraction		Clay Fraction	
Sample	Opacity	Color	Heterogenity	Dominant	Secondary	Dominant	Secondary
TOM2-034	3	19	0	1	40	9	40
TOM2-035	3	20	0	1	10	9	50
TOM2-036	3	23	0	1	10	9	40
TOM2-037	3	42	1	1	20	9	40
TOM2-038	3	40	0	1	41	9	40
TOM2-039	3	40	0	1	20	9	43
TOM2-040	3	25	0	1	11	9	40
TOM2-041	3	20	1	1	43	9	40
TOM2-042	3	21	0	1	11	9	40

petrographic results supported the binocular assignment for three of the groups (Table K.20). The characteristic volcanic inclusions seen in temper from the Twin Hills or Wasson petrofacies was usually identified correctly. However, most of the samples contained the "mixed" composition sand temper from the Wasson Petrofacies or the northern Tucson Mountains sand. This was clearly difficult to categorize, as would be expected for sands not previously known.

For the TOM1 samples, sixteen temper groups were examined through the thin sections. The temper in six groups was mostly correctly identified during the binocular analysis. This applied particularly to sherds with typical sand compositions from the Twin Hills and Central Tortolita petrofacies. Catalina Petrofacies sand was correctly recognized in one sample. Once again, the Wasson "mixed" composition sand was difficult to assign to a specific temper source.

The comparison between the binocular and petrographic assignments for the twelve TOM2 temper groups was problematic, as many of the groups had not been assigned a specific temper source. The typical Twin Hills Petrofacies sand was correctly identified. However, this group in particular had many of the unusual sand compositions.

When the fabric groups are combined from all three projects, it becomes apparent that in certain cases the temper was correctly identified (Table K.21). Unsurprisingly, the groups with temper that was easily identified were those with typical sands from the Twin Hills, Wasson, and Central Tortolita petrofacies. Therefore, sherds assigned a temper group of 4/1/J2, 4/41/E2, 4/47/E2, 4/53/J2, 4/54/J3, 6/53/J2, and 9.1/54/J3 are correct. However, for some of the temper groups only one sample was petrographically examined, so the likelihood that all sherds with a similar temper code contain the identified sand is not as high as for those temper groups in which multiple examples were subjected to petrographic analysis. For other groups with an indeterminate specific source, they could still be assigned to one petrofacies and thus used to examine the corpus as a whole. Unfortunately, the presence of several unusual sand compositions, which caused problems in temper identification for all the analysts, precludes more of the ceramics with temper group assignments from being given a petrofacies designation.

For those samples that could be given a petrofacies assignment, some interesting results were attained (Table K.22). This was done only if the percentage of samples correctly identified during the binocular analysis was at or above 67 percent. Most of the plain ware sherds were tempered with sand from the Twin Hills Petrofacies to the south of the Yuma Wash site. This probably indicates a preference by the potters for a sand with unique, large inclusions that may have been technologically beneficial. Half of the Tucson Basin Red-on-brown ware sherds contained sand from the Wasson "mixed" composition source, while 35 percent had sand from the Twin Hills Petrofacies. This indicates substantial local production; however, there were vessels of this ware found at the site that had been produced in other parts of the Tucson Basin. The red ware sherds were derived from several petrofacies. Salado Polychrome sherds contained either the Wasson "mixed" composition or sand from the Twin Hills Petrofacies, indicating their local production and production just to the south of the site. The remaining wares were very rare, and only the dominance of Twin Hills sand in the Brown Corrugated types was notable, implying their production to the south of the Yuma Wash site.

DISCUSSION

A thorough examination of ethnographic literature has established that most potters will travel 3

Table K.18. Qualitative observations for analyzed samples, the Yuma Wash site. (Parameter definitions are given in Table K.16.)

B. Qualitative data for the sand-sized fraction.

Sample	Temper Type	Modal Schist Size	Modal Sand Size	Finest	Coarsest	Mode	Sorting	Grain Types: Dominant	Grain Types: Secondary	Grain Types: Tertiary
MAR3-001	1	0	9	1	7	9	5	5	20	100
MAR3-002	1	0	9	1	7	9	5	5	21	100
MAR3-003	2	0	9	1	7	9	4	20	5	100
MAR3-004	1	0	9	1	7	9	4	5	20	11
MAR3-005	1	0	9	1	7	9	5	5	21	101
MAR3-006	2	0	9	1	7	9	5	5	21	11
MAR3-007	1	0	9	1	7	9	5	5	21	11
MAR3-008	1	0	9	1	7	9	5	5	21	11
MAR3-009	1	0	9	1	7	9	5	5	21	11
MAR3-010	1	0	9	1	7	9	5	5	21	11
MAR3-011	2	0	9	1	7	9	5	5	21	11
MAR3-012	1	0	9	1	7	9	4	5	20	19
MAR3-013	1	0	9	1	7	9	5	5	21	11
MAR3-014	1	0	9	1	7	9	5	5	21	11
MAR3-015	1	0	9	1	7	9	5	5	21	11
MAR3-016	1	0	9	1	9	9	5	5	21	11
MAR3-017	1	0	9	1	7	9	5	5	21	11
MAR3-018	1	0	9	1	7	9	5	5	21	11
MAR3-019	1	0	9	1	6	9	5	5	21	11
MAR3-020	1	0	9	1	7	9	4	5	20	11
MAR3-021	1	0	9	1	7	9	4	5	20	11
MAR3-022	2	0	9	1	7	9	5	5	21	11
MAR3-023	1	0	9	1	7	9	4	5	20	11
MAR3-024	5.1	9	9	1	7	9	5	5	21	11
MAR3-025	7.1	9	9	1	7	9	4	5	41	20
TOM1-003	5.1	0	9	1	7	9	9	5	21	41
TOM1-004	1	0	9	1	7	9	4	1	21	11
TOM1-005	1	0	9	1	7	9	4	1	21	11
TOM1-007	1	0	9	1	7	9	9	5	21	30
TOM1-008	1	0	9	1	7	9	9	5	41	21
TOM1-014	1	0	9	1	7	9	5	5	21	40
TOM1-016	1	0	9	1	7	9	4	1	21	115.05
TOM1-017	1	0	9	1	7	9	5	1	21	11
TOM1-018	1	0	9	1	7	9	5	5	21	11
TOM1-019	1	9	9	1	7	9	4	1	21	11
TOM1-020	5.1	0	9	1	7	9	5	5	21	11
TOM1-021	1	0	9	1	7	9	5	5	21	11
TOM1-022	1	0	9	1	7	9	5	5	21	11
TOM1-023	1	0	9	1	7	9	4	1	21	11
TOM1-024	1	0	9	1	7	9	5	5	21	11
TOM1-025	1	0	9	1	7	9	5	5	21	11
TOM1-026	1	0	9	1	7	9	5	5	21	11
TOM1-027	1	0	9	1	7	9	5	5	11	21
TOM1-028	1	0	9	1	7	9	5	5	21	11
TOM1-029	1	0	9	1	7	9	4	1	21	11
TOM1-030	1	0	9	1	7	9	5	5	11	21

Table K.18b. Continued.

Sample	Temper Type	Modal Schist Size	Modal Sand Size	Finest	Coarsest	Mode	Sorting	Grain Types: Dominant	Grain Types: Secondary	Grain Types: Tertiary
TOM1-031	1	0	9	1	7	9	5	5	11	21
TOM1-032	1	0	9	1	7	9	5	5	21	11
TOM1-034	1	0	9	1	7	9	5	5	21	30
TOM1-036	1	0	9	1	7	9	5	5	21	11
TOM1-038	1	0	9	1	7	9	5	5	21	11
TOM1-040	1	0	9	1	6	9	5	5	21	11
TOM1-041	1	0	9	1	6	9	4	1	21	11
TOM1-042	1	0	9	1	7	9	9	5	21	11
TOM1-043	5.1	0	9	1	7	9	5	5	21	45
TOM1-044	1	0	9	1	7	9	5	5	21	51
TOM1-045	1	0	9	1	7	9	5	101.01	5	21
TOM1-046	1	0	9	1	7	9	5	100	115.05	5
TOM1-047	1	0	9	1	7	9	5	101.01	115.05	30
TOM1-048	5.1	0	9	1	7	9	5	5	21	100
TOM1-049	2	0	9	1	7	9	5	100	105	5
TOM1-050	1	0	9	1	7	9	5	100	115.05	105
TOM1-051	2	0	9	1	7	9	5	100	115.05	105
TOM1-052	1	0	9	1	7	9	5	100	115.05	5
TOM1-053	1	0	9	1	7	9	5	5	115.05	21
TOM1-054	1	0	9	1	7	9	9	5	21	100
TOM2-001	1	0	9	1	7	9	9	5	21	43
TOM2-002	2	0	9	1	7	9	5	5	21	43
TOM2-003	1	0	9	1	7	9	4	1	11	21
TOM2-004	1	0	9	1	7	9	9	5	11	21
TOM2-005	1	0	9	1	7	9	5	5	21	11
TOM2-006	1	0	9	1	7	9	5	5	21	11
TOM2-007	1	0	9	1	9	9	4	1	21	11
TOM2-008	1	0	9	1	7	9	5	5	11	21
TOM2-009	1	0	9	1	7	9	5	1	21	11
TOM2-010	1	0	9	1	7	9	5	1	11	21
TOM2-011	1	0	9	1	7	9	5	5	11	21
TOM2-012	1	0	9	1	7	9	5	5	11	21
TOM2-013	1	0	9	1	7	9	4	1	11	21
TOM2-014	1	0	9	1	7	9	5	5	21	11
TOM2-015	1	0	9	1	7	9	5	5	11	21
TOM2-017	1	0	0	1	7	9	5	5	21	11
TOM2-019	1	0	9	1	7	9	5	5	21	11
TOM2-020	1	0	9	1	7	9	5	5	101.02	21
TOM2-021	1	0	9	1	7	9	5	5	21	115.05
TOM2-022	1	0	9	1	7	9	5	5	21	115.05
TOM2-023	1	0	9	1	7	9	5	5	21	11
TOM2-025	1	0	9	1	7	9	5	5	21	11
TOM2-026	1	0	9	1	7	9	4	1	21	11
TOM2-027	1	0	9	1	7	9	4	1	21	11
TOM2-028	1	0	9	1	7	9	5	5	11	21
TOM2-029	1	0	9	1	7	9	4	1	11	21
TOM2-030	1	0	9	1	7	9	4	1	21	11
TOM2-031	1	0	9	1	7	9	5	5	11	21
TOM2-032	1	0	9	1	7	9	5	5	11	21

Table K.18b. Continued.

Sample	Temper Type	Modal Schist Size	Modal Sand Size	Finest	Coarsest	Mode	Sorting	Grain Types		
								Dominant	Secondary	Tertiary
TOM2-033	1	0	9	1	7	9	5	5	11	21
TOM2-034	2	0	9	1	7	9	5	5	11	21
TOM2-035	1	0	9	1	7	9	5	5	11	21
TOM2-036	1	0	9	1	7	9	5	5	11	21
TOM2-037	1	0	9	1	7	9	5	5	11	21
TOM2-038	5.1	9	5	1	7	9	5	5	41	21
TOM2-039	1	0	9	1	7	9	4	1	21	11
TOM2-040	1	0	9	1	7	9	5	1	21	11
TOM2-041	1	0	9	1	7	9	5	5	43	21
TOM2-042	1	0	9	1	7	9	5	5	11	40

km or less to collect sand temper (Heidke 2009:Table 4.10). Based on this, pottery tempered with sand resources found within 3 km of the Yuma Wash site are considered "local" productions. The site is located on the northeastern edge of the Wasson Petrofacies along the Santa Cruz River (Figure K.4). Within 3 km of the site is the Rillito Petrofacies to the north that would have provided "local" sand resources. In addition, across the Santa Cruz River, the edge of the Eastern Tortolita Petrofacies would also be considered "local." Pottery tempered with sand compositions found outside of these areas are considered "nonlocal" vessels.

The unusual "mixed" composition sand is believed to be local to the Yuma Wash site, which sits on an active alluvial terrace receiving slope wash from the Tucson Mountains. Volcanic rock fragments would be rounded and of medium size by the time they were deposited near the site. Furthermore, the Santa Cruz River, located next to the site, would have occasionally flooded, depositing sediments from other areas of the Tucson Basin. In fact, the most recent contribution to the Santa Cruz River would have been from the Cañada del Oro, which would have carried granites and gneiss fragments, along with prevalent mica and mafic minerals, from the Tortolita Mountains. Our working hypothesis is that the "mixed" composition represents a combination of the Tucson Mountain slope wash at the site and flood deposits from the Santa Cruz River. Such materials may have derived from natural cuts in the alluvial fan or possibly agricultural canals. As there is evidence for these canals crossing the eastern edge of the piedmont on which the Yuma Wash site sits, the latter suggestion is a distinct possibility (Huckleberry 2005; also, Chapter 2). Sediments in the excavated canals included silty clay and fine-sized sand ideal for pottery production. At the site of Las Colinas, a settling basin appears to have been filled with canal water, and after the water evaporated, the resulting clay was used to manufacture pottery (based on non-destructive XRF analyses of sediments and pottery; Crown et al. 1988). A pottery producing area was located near canals at the Sweetwater site, also in the Phoenix Basin, and may have provided raw materials (Woodson 2011:135-139). This raises the possibility that canal sediments were utilized to produce ceramics at prehistoric sites. Therefore, we purpose that the "mixed" composition seen in many of the sherds represents unique locally available sand, possibly deriving from agricultural canals.

In light of this, most of the petrographically analyzed samples were locally produced (Table K.23). The Wasson "mixed" composition sand was noted for 34 plain ware and Tanque Verde Red-on-brown bowls and jars (including one Late Rincon or Tanque Verde sample and one indeterminate red-on-brown jar). Unmixed Wasson Petrofacies sand was used for five plain ware jars, one plain ware of indeterminate form, one Tanque Verde Red-on-brown bowl, one Late Rincon or Tanque Verde jar, and one Middle Rincon, Late Rincon, or Tanque Verde jar. This sand was also used in a Gila Polychrome bowl and an indeterminate Classic red ware bowl. Two plain ware jars, two Tanque Verde Red-on-brown bowls and one jar, one Tanque Verde Red-on-brown of indeterminate form, and one Late Rincon or Tanque Verde Red-on-brown of indeterminate form were produced with sand from the Eastern Tortolita Petrofacies, across the Santa Cruz River from the site. One Tanque Verde Red-on-brown bowl and one jar, one Middle Rincon, Late Rincon, or Tanque Verde Red-on-brown jar, and an indeterminate red ware bowl also had sand from the Tortolita Petrofacies, but with many volcanic rock fragments. This sand could potentially have derived from within the 3 km area defined as local for the Yuma Wash site.

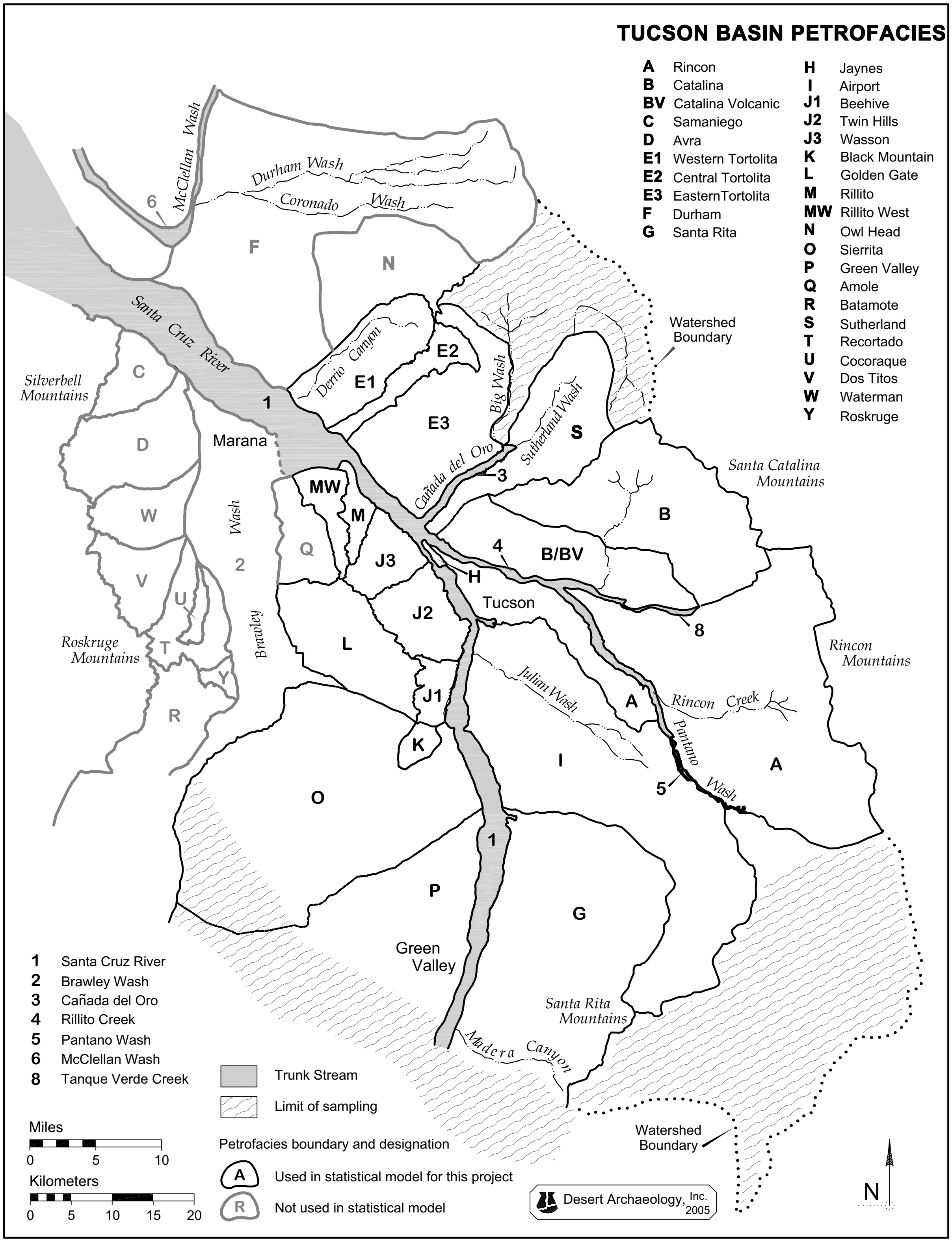

Figure K.2. Tucson Basin Petrofacies, 2010 model.

Unfortunately, modern disturbance makes acquiring a sample in this area to test this hypothesis virtually impossible.

Pottery not produced locally derived from several petrofacies. Sand from the Twin Hills Petrofacies to the south of the site was used to produce six

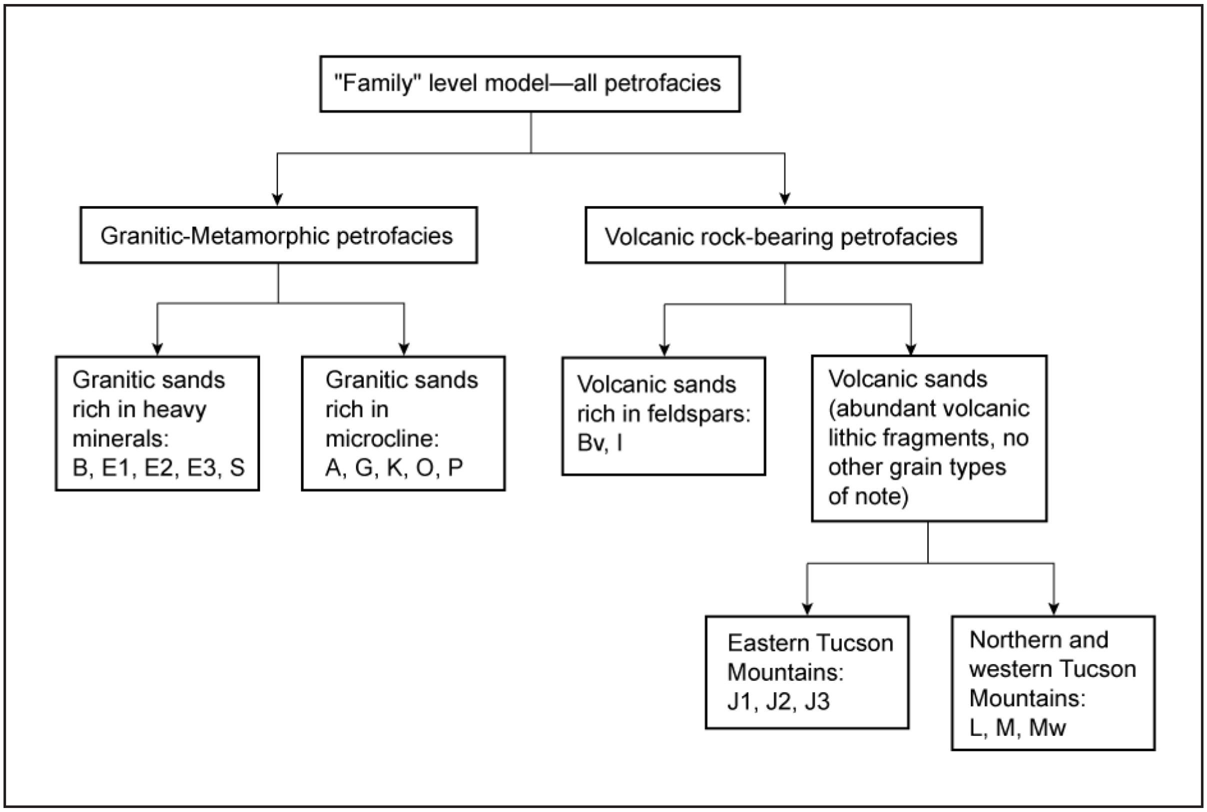

Figure K.3. Diagram of steps in discriminant model classification

plain ware jars and one bowl, ten Tanque Verde Red-on-brown bowls and jars (including two Middle Rincon, Late Rincon, or Tanque Verde jars), and the two Brown Corrugated jar samples. The Stucco Plain ware jar was also made with this sand. Nine Tanque Verde Red-on-brown bowls and one Late Rincon or Tanque Verde Red-on-brown of indeterminate form were produced from a volcanic sand that probably derives from an area in the northern Tucson Mountains, north of the Yuma Wash site. A single Late Rincon or Tanque Verde Red-on-brown sherd of indeterminate vessel form was tempered with sand from the Beehive Petrofacies. Samples with Black Mountain Petrofacies sand were more common and included seven Tanque Verde Red-on-brown bowls and jars, and one Late Rincon or Tanque Verde Red-on-brown bowl. One plain ware jar was produced with sand from the Big Wash Petrofacies adjacent to the Eastern Tortolita Petrofacies. One plain ware jar and one Tortolita Red ware jar were made with Central Tortolita Petrofacies sand. Sand from the Catalina Petrofacies was found in one Tanque Verde Red-on-brown sherd and one Middle Rincon, Late Rincon, or Tanque Verde Red-on-brown sherd, both of indeterminate form.

A Mogollon Brown ware bowl sample was produced with sand that did not match any in the Tucson Basin, suggesting its likely import to the Yuma Wash site from outside the basin. An indeterminate polychrome bowl was also made with an unusual sand that could derive from a location beyond the Tucson Basin.

Three plain ware jars were tempered with crushed schist and thus a petrofacies could not be assigned. Sherds with grog temper containing crushed schist appear to have been uniformly tempered with Wasson Petrofacies sand.

The results of the petrographic analysis of ceramics from several other Classic period sites are worth mentioning in comparison to those from the current study of Yuma Wash site pottery (Figure K.5). Analysis of pottery from the Rillito Fan site, AZ AA:12:788 (ASM), has been conducted on two occasions, with material deriving from Desert Archaeology excavations and from those recently conducted by Northland Research, Inc. During the latter study, it was discovered that most of the pottery was not produced from the local Jaynes (H) Petrofacies sand (Ownby et al. 2010). On the contrary, sand from the Twin Hills Petrofacies was used to manufacture the majority of the plain and decorated wares. Although the northeastern section of this petrofacies is within 3 km of the Rillito Fan site, it is not certain whether potters from the Rillito Fan site would have crossed the Santa Cruz River to exploit this resource or if pottery made at a site within the Twin Hills Petro-

Table K.19. Final results after petrographic and discriminant model analysis, the Yuma Wash site.

Sample	Ware	Temper Composition Assigned during Binocular Analysis			Petrofacies Assigned by Petrographer[a]	Petrofacies Assigned by Discriminant Model[a]	Final Petrofacies Assignment[a]
		TT	TSG	TSS[a]			
MAR3-001	Tanque Verde Red-on-brown	4	53	-9	J3	J1	J3
MAR3-002	Plain ware	4	53	J2	J2	J2	J2
MAR3-003	Late Rincon or Tanque Verde red-on-brown	9.1	54	-9	M	J1	J1
MAR3-004	Plain ware	9.1	54	J3	J3	L	J3
MAR3-005	Middle or Late Rincon or Tanque Verde red-on-brown	4	54	J3	J3	J3	J3
MAR3-006	Plain ware	4	2	-9	J2	M	J2
MAR3-007	Indeterminate red-on-brown	4	2	-9	J2	M	J3, mix
MAR3-008	Tanque Verde Red-on-brown	4	2	O	J3	M	J3, mix
MAR3-009	Indeterminate Mogollon Corrugated	4	2	O	Unknown	E3	Extrabasinal
MAR3-010	Plain ware	6	2	O	J3	M	J3, mix
MAR3-011	Tanque Verde Red-on-brown	4	2	O	J2	M	J3, mix
MAR3-012	Plain ware	4	42	E3	E1	E3	Z
MAR3-013	Tanque Verde Red-on-brown	4	42	E3	Unknown	M	North Tucson Mountains
MAR3-014	Tanque Verde Red-on-brown	4	42	E3	M	M	J3, mix
MAR3-015	Tanque Verde Red-on-brown	4	42	E3	Unknown	J1	J3, mix
MAR3-016	Tanque Verde Red-on-brown	4	7	-9	J2	J2	J3, mix
MAR3-017	Late Rincon or Tanque Verde red-on-brown	4	7	-9	J3	J3	J3
MAR3-018	Tanque Verde Red-on-brown	4	30	-9	J3	M	J3, mix
MAR3-019	Late Rincon or Tanque Verde red-on-brown	4	30	-9	K	J2	North Tucson Mountains
MAR3-020	Tanque Verde Red-on-brown	4	30	-9	J3	L	North Tucson Mountains
MAR3-021	Tanque Verde Red-on-brown	4	30	K	Bv	K	North Tucson Mountains
MAR3-022	Plain ware	6	3	-9	J3	M	J3
MAR3-023	Plain ware	6	3	-9	E3	E2	E3
MAR3-024	Plain ware	7	5	-9	K	M	J3, mix
MAR3-025	Plain ware	7	5	-9	Unknown	B	Crushed schist
TOM1-003	Plain ware	5	-9	-9	J2	M	J3 plus grog with crushed schist
TOM1-004	Tanque Verde Red-on-brown	4	-9	-9	J2	G	J3, mix
TOM1-005	Tanque Verde Red-on-brown	4	-9	-9	Unknown	J2	J3, mix
TOM1-007	Tanque Verde Red-on-brown	4	-9	-9	E3	J1	North Tucson Mountains
TOM1-008	Plain ware	5	-9	-9	Unknown	A	Crushed schist

Table K.19. Continued.

Sample	Ware	Temper Composition Assigned during Binocular Analysis			Petrofacies Assigned by Petrographer[a]	Petrofacies Assigned by Discriminant Model[a]	Final Petrofacies Assignment[a]
		TT	TSG	TSS[a]			
TOM1-014	Stucco Plain ware	4	1	-9	J2	J2	J2
TOM1-016	Middle or Late Rincon or Tanque Verde red-on-brown	4	1	J2	J2	J2	J2
TOM1-017	Tanque Verde Red-on-brown	4	2	-9	E1	J3	E with volcanics
TOM1-018	Plain ware	4	2	-9	E1	E3	E3
TOM1-019	Tanque Verde Red-on-brown	4	3	-9	B	B	B
TOM1-020	Middle or Late Rincon or Tanque Verde red-on-brown	4	3	B	B	B	B
TOM1-021	Tanque Verde Red-on-brown	4	30	-9	K	G	J3, mix
TOM1-022	Late Rincon or Tanque Verde red-on-brown	4	30	-9	K	M	J3, mix
TOM1-023	Tanque Verde Red-on-brown	4	30	-9	K	M	J3, mix
TOM1-024	Tanque Verde Red-on-brown	4	30	K	E1	E3	E3
TOM1-025	Tanque Verde Red-on-brown	4	30	K	K	G	J3, mix
TOM1-026	Tanque Verde Red-on-brown	4	30	K	K	J3	North Tucson Mountains
TOM1-027	Tanque Verde Red-on-brown	4	30	K	K	K	J3, mix
TOM1-028	Tanque Verde Red-on-brown	4	30	K	K	J2	K
TOM1-029	Tanque Verde Red-on-brown	4	30	K	K	M	J3, mix
TOM1-030	Tanque Verde Red-on-brown	4	30	K	K	J2	J2
TOM1-031	Tanque Verde Red-on-brown	4	30	K	K	G	J3, mix
TOM1-032	Late Rincon or Tanque Verde red-on-brown	4	30	K	K	K	K
TOM1-034	Plain ware	4	40	-9	Bv	M	J3, mix
TOM1-036	Plain ware	4	40	-9	B	M	J3, mix
TOM1-038	Late Rincon or Tanque Verde red-on-brown	4	40	-9	E1	E3	E3
TOM1-040	Tortolita Red	4	41	E2	E2	E3	E2
TOM1-041	Tanque Verde Red-on-brown	4	45	-9	E1	E3	E3
TOM1-042	Tanque Verde Red-on-brown	4	45	-9	J2	G	J3, mix
TOM1-043	Indeterminate polychrome	4	40	S	E3	S	Unknown
TOM1-044	Plain ware	4	47	E2	E2	E2	E2
TOM1-045	Tanque Verde Red-on-brown	4	53	J2	J2	J3	J2
TOM1-046	Tanque Verde Red-on-brown	4	53	J2	J2	J2	J2
TOM1-047	Plain ware	4	53	J2	J2	J2	J2
TOM1-048	Plain ware	6	53	J2	J2	J2	J2

Table K.19. Continued.

Sample	Ware	Temper Composition Assigned during Binocular Analysis			Petrofacies Assigned by Petrographer[a]	Petrofacies Assigned by Discriminant Model[a]	Final Petrofacies Assignment[a]
		TT	TSG	TSS[a]			
TOM1-049	Plain ware	4	53	J2	J2	J2	J3
TOM1-050	Tanque Verde Red-on-brown	4	53	J2	J2	J2	J2
TOM1-051	Plain ware	4	53	J2	J2	J2	J2
TOM1-052	Middle or Late Rincon or Tanque Verde red-on-brown	4	53	J2	J2	J2	J2
TOM1-053	Flattened Brown Corrugated	4	53	J2	J2	J2	J2
TOM1-054	Clapboard Brown Corrugated	4	53	J2	J2	J2	J2
TOM2-001	Gila Polychrome	4	-9	-9	J2	J2	J3
TOM2-002	Indeterminate Classic red	6	-9	-9	J2	J2	J3 plus grog with crushed schist
TOM2-003	Middle or Late Rincon or Tanque Verde red-on-brown	4	-9	-9	K	E3	E with volcanics
TOM2-004	Tanque Verde Red-on-brown	4	-9	-9	E1	E3	E with volcanics
TOM2-005	Tanque Verde Red-on-brown	4	-9	-9	K	M	K
TOM2-006	Tanque Verde Red-on-brown	4	-9	-9	E1	E3	E3
TOM2-007	Tanque Verde Red-on-brown	4	-9	-9	K	Bv	J3, mix
TOM2-008	Tanque Verde Red-on-brown	4	-9	-9	J2	M	J3, mix
TOM2-009	Tanque Verde Red-on-brown	4	-9	-9	J2	J2	J2
TOM2-010	Tanque Verde Red-on-brown	4	-9	-9	K	E3	J3, mix
TOM2-011	Tanque Verde Red-on-brown	4	-9	-9	J2	M	J3, mix
TOM2-012	Tanque Verde Red-on-brown	4	-9	-9	K	K	K
TOM2-013	Tanque Verde Red-on-brown	4	-9	-9	K	J1	K
TOM2-014	Tanque Verde Red-on-brown	4	-9	-9	K	O	K
TOM2-015	Plain ware	6	40	-9	K	J2	J2
TOM2-017	Plain ware	4	-9	-9	K	J2	J3
TOM2-019	Tanque Verde Red-on-brown	4	1	J1	K	M	North Tucson Mountains
TOM2-020	Tanque Verde Red-on-brown	4	1	-9	J2	J2	J2
TOM2-021	Plain ware	4	1	-9	J2	J2	J3
TOM2-022	Tanque Verde Red-on-brown	4	1	J2	J2	J2	J2
TOM2-023	Plain ware	4	2	-9	K	M	J3, mix
TOM2-025	Tanque Verde Red-on-brown	4	2	-9	E1	E3	E3
TOM2-026	Tanque Verde Red-on-brown	4	2	-9	K	J3	K
TOM2-027	Tanque Verde Red-on-brown	4	2	-9	K	J3	North Tucson Mountains

Table K.19. Continued.

Sample	Ware	Temper Composition Assigned during Binocular Analysis			Petrofacies Assigned by Petrographer[a]	Petrofacies Assigned by Discriminant Model[a]	Final Petrofacies Assignment[a]
		TT	TSG	TSS[a]			
TOM2-028	Tanque Verde Red-on-brown	4	2	-9	J2	M	J3, mix
TOM2-029	Tanque Verde Red-on-brown	4	2	-9	K	M	J3, mix
TOM2-030	Tanque Verde Red-on-brown	4	2	-9	K	K	North Tucson Mountains
TOM2-031	Indeterminate red ware	4	2	-9	K	BW	E with volcs
TOM2-032	Tanque Verde Red-on-brown	4	30	-9	K	K	J3, mix
TOM2-033	Tanque Verde Red-on-brown	4	30	-9	K	G	J3, mix
TOM2-034	Tanque Verde Red-on-brown	4	30	-9	K	J2	K
TOM2-035	Tanque Verde Red-on-brown	4	30	-9	K	K	J3, mix
TOM2-036	Tanque Verde Red-on-brown	4	30	-9	K	M	J3, mix
TOM2-037	Tanque Verde Red-on-brown	4	40	-9	J2	M	J3, mix
TOM2-038	Plain ware	6	40	-9	Unknown	B	Crushed schist
TOM2-039	Tanque Verde Red-on-brown	4	45	-9	K	J2	North Tucson Mountains
TOM2-040	Tanque Verde Red-on-brown	4	45	-9	J2	M	J3, mix
TOM2-041	Plain ware	9	2	-9	J2	J2	J2
TOM2-042	Tanque Verde Red-on-brown	9	-9	-9	J2	J2	J2

[a]A = Rincon Petrofacies, B = Catalina Petrofacies, Bv = Catalina Volcanic Petrofacies, E1 = Western Tortolita Petrofacies, E2 = Central Tortolita Petrofacies, E3 = Eastern Tortolita Petrofacies, G = Santa Rita Petrofacies, J1 = Beehive Petrofacies, J2 = Twin Hills Petrofacies, J3 = Wasson Petrofacies, K = Black Mountain Petrofacies, L = Golden Gate Petrofacies, M = Rillito Petrofacies, O = Sierrita Petrofacies, S = Sutherland Petrofacies, Z = Big Wash Petrofacies.

Table K.20. Comparison of binocular and petrographic assignments, by project, the Yuma Wash site.

Project	Temper Group	Total No. of Samples	Total No. Correct	Petrographic Assignment[a]
MAR3	4/2/-9	2	–	One J2 sand, the other local mixed composition
	4/2/O	3	0	Local mixed composition, plus one extrabasinal sample
	4/7/-9	2	–	One J3 sand, the other local mixed composition
	4/30/-9	3	–	Two with north Tucson Mountains, one with local mixed composition
	4/30/K	1	0	Sand from north Tucson Mountains
	4/42/E3	4	0	Two with local mixed composition, one with north Tucson Mountains, and one with Z sand
	4/53/-9	1	–	Local unmixed composition (J3)
	4/53/J2	1	1	J2 sand
	4/54/J3	1	1	Local unmixed composition (J3)
	6/2/O	1	0	Local mixed composition
	6/3/-9	2	–	One with J3 sand, the other with E3 sand
	7/5/-9	2	1	One with added crushed rock, the other local mixed composition
	9.1/54/-9	1	–	J1 sand
	9.1/54/J3	1	1	Local unmixed composition (J3)
TOM1	4/-9/-9	3	–	Two with local mixed composition, one with north Tucson Mountains
	4/1/-9	1	–	J2 sand
	4/1/J2	1	1	J2 sand
	4/2/-9	2	–	One with E3 sand, one with E sand with volcanics
	4/3/-9	1	–	B sand
	4/3/B	1	1	B sand
	4/30/-9	3	–	Local mixed composition
	4/30/K	9	2	Sands from K, J2, E3, local mixed composition and north Tucson Mountains
	4/40/-9	3	-	Two local mixed composition, one E3 sand
	4/40/S	1	0	Unknown, possibly extrabasinal
	4/41/E2	1	1	E2 sand
	4/45/-9	2	–	One with local mixed composition, one with E3 sand
	4/47/E2	1	1	E2 sand
	4/53/J2	9	8	J2 sand, one is a local unmixed composition (J3)
	5/-9/-9	2	–	One with crushed schist, one with grog containing crushed schist
	6/53/J2	1	1	J2 sand
TOM2	4/-9/-9	14	–	Sands from K, E3, E with volcanics, J2, local unmixed composition (J3) and local mixed composition
	4/1/-9	2	–	One J2 sand, one J3 sand
	4/1/J1	1	0	Sand from north Tucson Mountains
	4/1/J2	1	1	J2 sand
	4/2/-9	8	–	Sands from K, E3, E with volcanics, local mixed composition, and north Tucson Mountains
	4/30/-9	5	–	Local mixed composition, plus one K sand
	4/40/-9	1	–	Local mixed composition
	4/45/-9	2	–	Local mixed composition and north Tucson Mountains
	6/-9/-9	1	–	Grog with crushed schist
	6/40/-9	2	–	One crushed schist, one J2 sand
	9/2/-9	1	–	J2 sand
	9/-9/-9	1	–	J2 sand

[a]B = Catalina Petrofacies, E2 = Central Tortolita Petrofacies, E3 = Eastern Tortolita Petrofacies, J1 = Beehive Petrofacies, J2 = Twin Hills Petrofacies, J3 = Wasson Petrofacies, K = Black Mountain Petrofacies, Z = Big Wash Petrofacies.

Table K.21. Comparison of binocular and petrographic assignments, by temper group, the Yuma Wash site.

Temper Group	Total No. of Samples	Total No. Correct	Petrographic Assignment[a]
4/-9/-9	17	–	Sands from K, E3, E with volcanics, J2, local unmixed composition (J3), local mixed composition, and north Tucson Mountains
4/1/-9	3	–	J2 sand, one is J3 sand
4/1/J1	1	0	Sand from north Tucson Mountains
4/1/J2	2	2	J2 sand
4/2/-9	12	–	Sands from K, E3, E with volcanics, J2, local mixed composition, and north Tucson Mountains
4/2/O	3	0	Local mixed composition, plus one extrabasinal sample
4/3/-9	1	–	B sand
4/3/B	1	1	B sand
4/7/-9	2	–	One J3 sand, the other local mixed composition
4/30/-9	11	–	Eight local mixed composition, two north Tucson Mountains, and one K sand
4/30/K	10	3	Sands from K, J2, E3, local mixed composition, and north Tucson Mountains
4/40/-9	4	–	Local mixed composition, one E3 sand
4/40/S	1	0	unknown, possibly extrabasinal
4/41/E2	1	1	E2 sand
4/42/E3	4	0	Two with local mixed composition, one with north Tucson Mountains, and one with Z sand
4/45/-9	4	–	Two with local mixed composition, one with north Tucson Mountains, and one with E3 sand
4/47/E2	1	1	E2 sand
4/53/-9	1	–	Local unmixed composition (J3)
4/53/J2	10	9	J2 sand, one is a local unmixed composition (J3)
4/54/J3	1	1	Local unmixed composition (J3)
5/-9/-9	2	–	One with crushed schist, one with grog containing crushed schist
6/-9/-9	1	–	Grog with crushed schist
6/2/O	1	0	Local mixed composition
6/3/-9	2	–	One with J3 sand, the other with E3 sand
6/40/-9	2	–	One crushed schist, one J2 sand
6/53/J2	1	1	J2 sand
7/5/-9	2	–	One with added crushed rock, the other a local mixed composition
9.1/54/-9	1	–	J1 sand
9.1/54/J3	1	1	Local unmixed composition (J3)
9/2/-9	1	–	J2 sand
9/-9/-9	1	–	J2 sand

[a]B = Catalina Petrofacies, E2 = Central Tortolita Petrofacies, E3 = Eastern Tortolita Petrofacies, J1 = Beehive Petrofacies, J2 = Twin Hills Petrofacies, J3 = Wasson Petrofacies, K = Black Mountain Petrofacies, Z = Big Wash Petrofacies.

facies was imported. Pottery undoubtedly imported to the Rillito Fan site comprised a few plain and red ware samples with sand from the Central Tortolita Petrofacies, located 10 km to the north of the site. Thus, unlike the Yuma Wash site, the Rillito Fan site, also situated on an active alluvial fan, occupants appear to have either used sand derived at some distance from the site or imported a majority of the pottery. This may indicate that the locally available sand was not suitable for pottery production, possibly due to the fine size of the grains, and along with the paucity of clay resources, suggests a different pattern of ceramic manufacture.

However, these results are not in direct accordance with those from an earlier study of pottery from the Rillito Fan site that only examined samples

Table K.22. Temper characterization data for those sherds with established sand sources, the Yuma Wash site.

		Sherds Examined Under Binocular Microscope, by Ware								
Petrofacies	Thin Sections Interpreted Accuracy	Plain Ware	Tucson Basin Red-on-brown	Red Ware	Salado Polychrome	Brown Corrugated	Plain or Red Ware	Plain or Red-on-brown Ware	Mogollon Brown Ware	Total
Beehive										
9.1/54/-9	1/1 (100%)	1	2	1	–	–	–	–	–	4
Twin Hills										
4/1/J2	2/2 (100%)	8	12	–	–	–	–	1	–	21
4/1/-9	2/3 (67%)	14	40	1	2	–	–	–	–	57
4/53/J2	9/10 (90%)	110	108	3	7	20	3	–	–	251
6/53/J2	1/1 (100%)	13	5	–	–	3	–	–	–	21
9/2/-9	1/1 (100%)	3	6	–	–	–	–	–	–	9
9/-9/-9	1/1 (100%)	3	5	–	–	–	–	–	–	8
Wasson										
4/53/-9	1/1 (100%)	6	9	–	–	–	–	–	–	15
4/54/J3	1/1 (100%)	3	4	–	–	–	–	–	–	7
9.1/54/J3	1/1 (100%)	3	–	–	–	–	–	–	–	3
Wasson mix										
4/2/O	2/3 (67%)	14	69	3	1	–	–	–	1	88
4/30/-9	8/11 (73%)	22	163	1	2	–	1	1	–	190
4/40/-9	¾ (75%)	7	18	–	–	–	–	–	–	25
6/2/O	1/1 (100%)	5	–	–	1	–	–	–	–	6
North Tucson Mountains										
4/1/J1	1/1 (100%)	15	26	2	–	–	–	–	–	43
Central Tortolita										
4/41/E2	1/1 (100%)	2	–	1	–	–	–	–	–	3
4/47/E2	1/1 (100%)	5	–	1	–	–	–	–	–	6
Catalina										
4/3/B	1/1 (100%)	4	4	1	–	1	–	–	–	10
4/3/-9	1/1 (100%)	16	23	2	–	4	1	–	–	46
Grog with Crushed Schist										
6/-9/-9	1/1 (100%)	7	2	2	–	1	–	2	–	14
Total		261	496	18	13	29	5	4	1	827

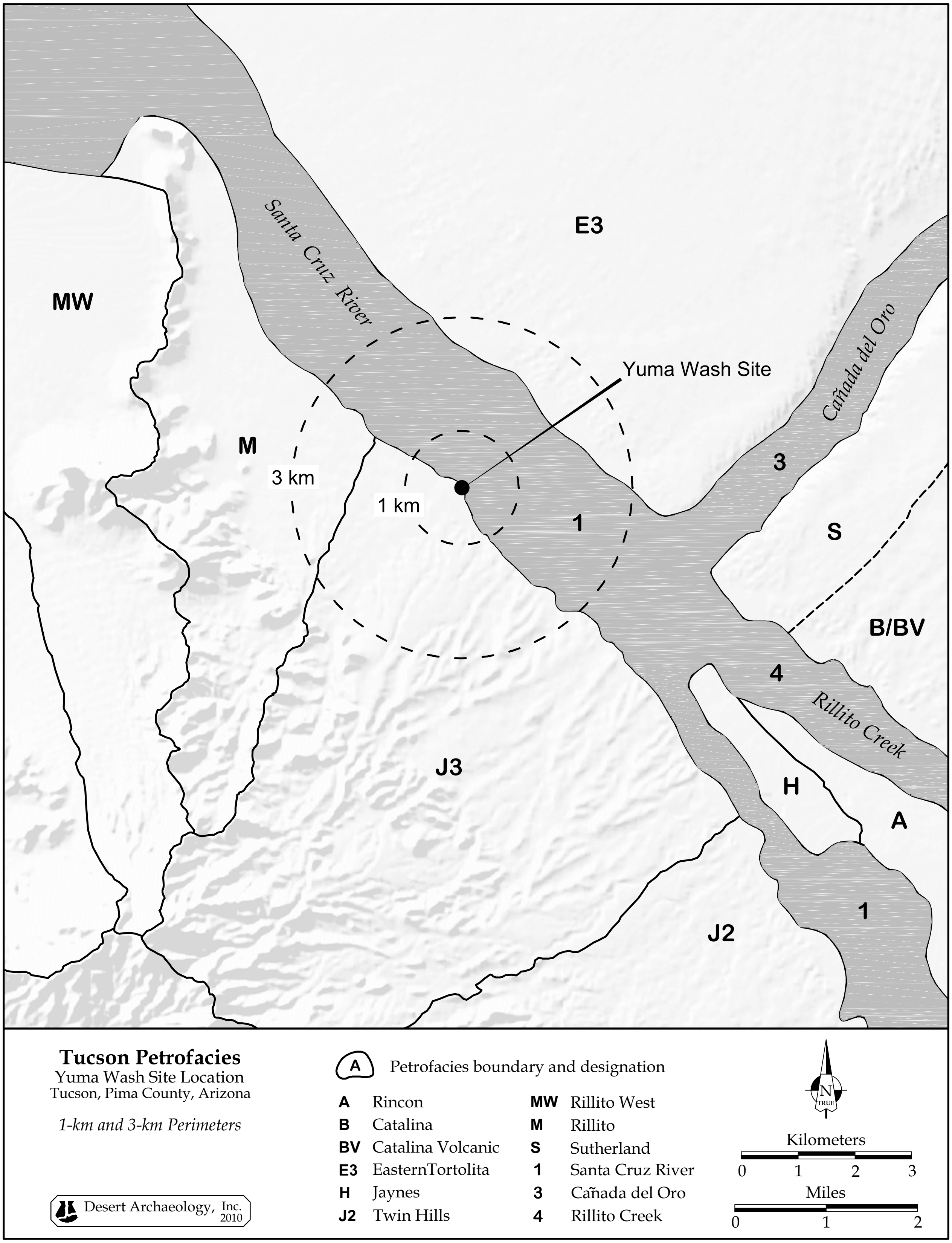

Figure K.4. Location of Yuma Wash site in relation to petrofacies within 1 and 3 km.

through binocular microscopy (Stinson and Heidke 2007)[4]. The results suggested that most of the plain ware samples contained Catalina or Beehive petrofacies sand, with a minor amount made with sand from either the Tortolita[5] or Twin Hills petrofacies. The same pattern was noted for the red wares, although more were made with Twin Hills Petrofacies sand and none had sand from the Tortolita Petrofacies. Decorated wares were also made with sand from these four petrofacies, with the Salado Polychromes mostly having Beehive Petrofacies sand and the Tucson Basin Red-on-brown being dominated by sherds with sand from the Catalina Petrofacies.

Surprisingly, the Tanque Verde Red-on-brown sherds had a temper that could not be assigned to a petrofacies. Based on the results of the current study, it is now suggested that these Rillito Fan vessels may have derived from the Yuma Wash site or been manufactured locally with sand having an unusual composition. Overall, this study also suggested pottery found at the Rillito Fan site was not produced with local sands, but rather, potters may have traveled 5 km to the Catalina and Beehive Petrofacies to collect sand, or pottery was acquired through short-distance exchange from those areas. The vessels with Twin Hills and Tortolita petrofacies sand are more likely imported to the Rillito Fan site, and this comprises mostly the Salado Polychrome and Tucson Basin Red-on-brown sherds. However, these results need to be petrographically verified, as the analyzed samples in the first study did not identify any sherds tempered with sand from the Catalina and Beehive petrofacies.

Pottery from the Zanardelli site, AZ BB:13:1 (ASM), was investigated petrographically (Heidke and Miksa 2009). While the site is located in the Airport (I) Petrofacies, most of the pottery was found to contain either Black Mountain or Beehive petrofacies sand. Because the Black Mountain Petrofacies is 9.4 km and the Beehive Petrofacies is 14.5 km from the Zanardelli site, both on the other side of the Santa Cruz River, it appears most of the pottery was imported. This may have been due to the local sand resources being unsuitable for pottery production.

The Classic period sites of Rillito Fan and Zanardelli therefore differ from the Yuma Wash site in having pottery that does not contain local sands, which was either produced from resources acquired at some distance, or the vessels came to the sites through short-distance exchange. Interestingly, Beehive Petrofacies sand-tempered pottery was found at all three sites, although in this case, the distance of the sites to that area suggests the pottery was imported. This is surprising, as currently there are no known Classic sites in this area. Pottery with sand from the Twin Hills Petrofacies was found at the Yuma Wash and Rillito Fan sites; this sand is approximately 7 km south of the former and only a short distance from the latter[6]. Further, the site of Rabid Ruin, AZ AA:12:46 (ASM), is located in this petrofacies (see Figure K.3) (Harry 1997). Likewise, pottery made in the Central Tortolita Petrofacies was also present at the Yuma Wash and Rillito Fan sites, but in this case, it suggests importation as the area is located at some distance from both. Finally, sand from the Black Mountain Petrofacies was found in pottery from the Yuma Wash and Zanardelli sites. For both of these sites, the petrofacies is located at some distance and may suggest exchange of pottery manufactured in this area. The San Xavier Bridge site, AZ BB:13:14 (ASM), is located in this petrofacies, and Tanque Verde Red-on-brown pottery from the site was produced with Black Mountain Petrofacies sand (Lombard 1987b). Further, Martinez Hill, AZ BB:13:3 (ASM), is located across the river in the Airport (I) Petrofacies, and the site's potters may have exploited sand resources in the Black Mountain Petrofacies. Overall, there is a pattern of unique production of ceramics and complicated exchange networks for these three Classic period sites.

Uniquely, the Yuma Wash site has pottery produced with sand from many more petrofacies than the other two sites. This may indicate the site was a location for trading pottery from areas producing it, such as those near the Tortolita Mountains and those further south. This would explain the presence at the Yuma Wash site of pottery made in many locations.

CONCLUSIONS

The current study has made a considerable advance in our understanding of pottery production and distribution during the Classic period. The identification of an unusual local "mixed" composition sand used to produce pottery at the Yuma Wash site enabled the identification of a local ceramic industry, one that may have been involved in exchange networks in the Tucson Basin. Furthermore, pottery

[4]This work utilized the 2003 petrofacies map for the Tucson Basin.

[5]At this point, the Tortolita Petrofacies had not been subdivided.

[6]The use of sand resources across the Santa Cruz River from an archaeological site has been documented for the Julian Wash site (Sedentary period), located on the eastern side of the Santa Cruz River, which was shown to have used Beehive and Twin Hills petrofacies sand for producing most of the pottery found there (Miksa 2011).

Table K.23. Petrographic results, by ware, the Yuma Wash site.

Petrofacies	Plain	Plain Stucco	Flattened Brown	Clapboard Brown	Tucson Basin Tanque Verde Red-on-brown	Late Rincon or Tanque Verde Red-on-brown	Middle Rincon, Late Rincon, or Tanque Verde Red-on-brown	Tucson Basin Red-on-brown Indeterminate	Tortolita Red	Indeterminate Classic Red	Indeterminate Red	Salado Polychrome, Gila	Salado Polychrome, Indeterminate	Indeterminate Mogollon Corrugated	Total
Beehive	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Twin Hills	7	1	1	1	8	–	2	–	–	–	–	–	–	–	20
Wasson	6	–	–	–	1	1	1	–	–	1	–	1	–	–	11
Wasson mix	5	–	–	–	27	1	–	1	–	–	–	–	–	–	34
North Tucson Mountains	–	–	–	–	9	1	–	–	–	–	–	–	–	–	10
Black Mountain	–	–	–	–	7	1	–	–	–	–	–	–	–	–	8
Central Tortolita	1	–	–	–	–	–	–	–	1	–	–	–	–	–	2
Eastern Tortolita	2	–	–	–	4	1	–	–	–	–	–	–	–	–	7
Tortolita with volcanics	–	–	–	–	2	–	1	–	–	–	1	–	–	–	4
Big Wash	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Catalina	–	–	–	–	1	–	1	–	–	–	–	–	–	–	2
Crushed Schist	3	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Extrabasinal	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Unknown (Extrabasinal?)	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Total	25	1	1	1	59	6	5	1	1	1	1	1	1	1	105

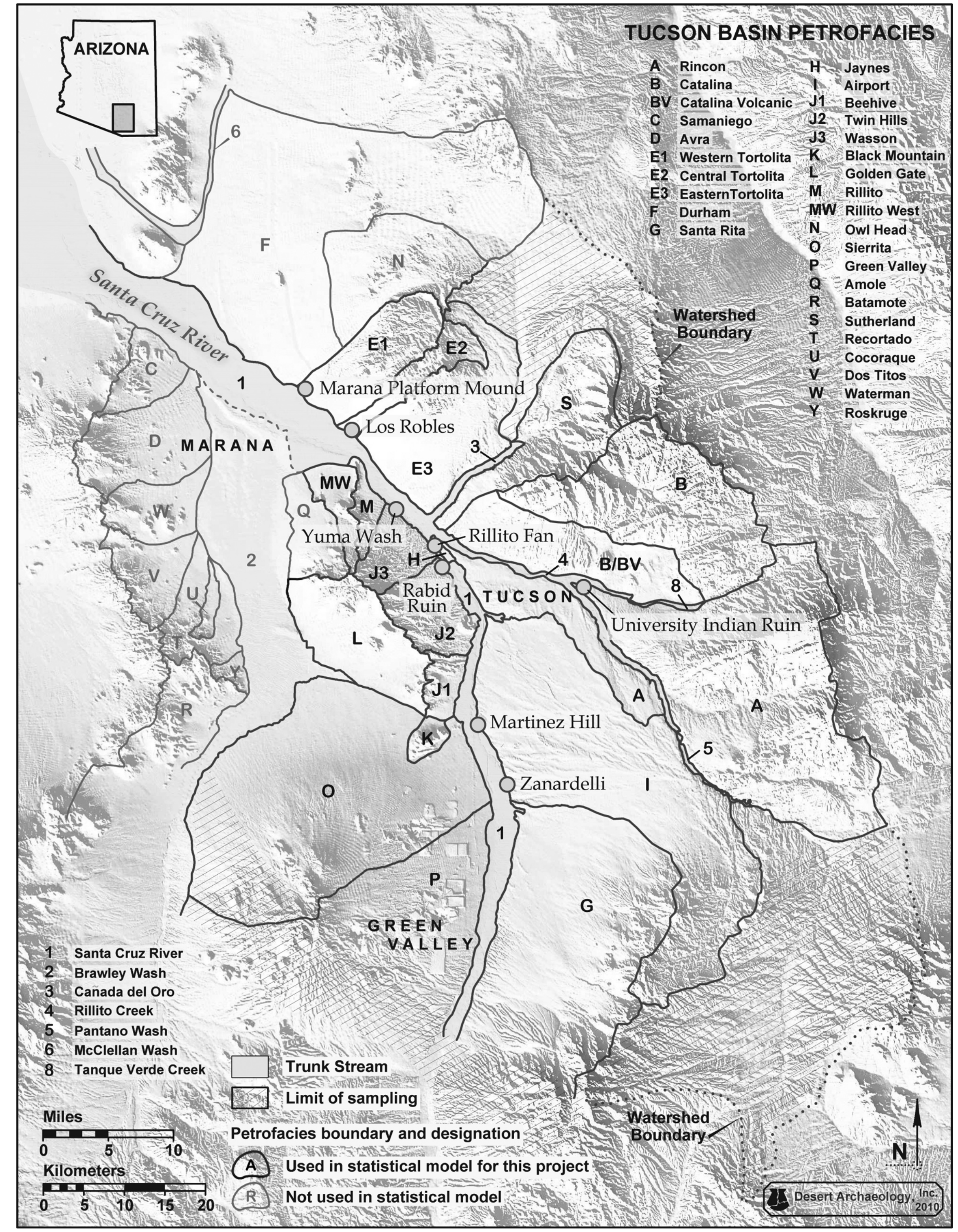

Figure K.5. Large late Classic period sites in the Tucson Basin.

from this period at other sites whose provenance was difficult to establish may benefit from the realization that a unique, fine-grained sand was used for pottery production. This may explain why Tanque Verde Red-on-brown vessels from the Marana Mound sites were problematic to provenance through petrographic and geochemical methods, a hypothesis that will hopefully be tested through reexamination of this material (Harry 1997). Thus, future analyses of pottery from these sites must now consider that local ceramic manufacture continued throughout the Classic period, but the sand resources used changed due to a movement of sites closer to the rivers and washes. The late Holocene aggradations of alluvial fans on the Santa Cruz River floodplain, particularly along the Tucson and Tortolita mountains lower piedmonts, may be one reason for the change in settlement location, one which would have provided a diverse range of irrigation strategies. These new locations would have had different sands available for pottery manufacture. The correlation between site location and raw materials is significant and bears on our understanding of pottery production and distribution during a time when site location was changing throughout the Tucson Basin.

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