A PRELIMINARY ANALYSIS OF SHOOFLY PLAIN WARE CERAMICS

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INTRODUCTION

In the summer of 1984 Arizona State University held its Field School at Shoofly Village, AZ O:11:6 (ASU), a large compound-walled site located near Payson, Arizona. There have not yet been many archaeological investigations in the Payson Basin. Shoofly Village appears to be the largest site in the region, and it is hoped that excavations there will provide a better understanding of the prehistoric manifestations in the region.

The majority of the ceramics found at the site and other sites in the area belong to the Tonto/Verde Series of the Alameda Brown Ware. These types were originally defined in the 1930s and 40s (Caywood and Spicer 1935; Colton 1941, 1958; Colton and Hargrave 1937).

The Tonto/Verde types are either plain/brown or slipped red and occur in smudged and unsmudged varieties. They are manufactured by the paddle-and-anvil method. Clay is usually residual, although occasionally alluvial clay is used (Colton 1958). Non-plastic inclusions are crushed quartz, quartzite and other minerals of granitic origin such as feldspar, hornblende, and mica.

During the 1984 field season a number of attributes were monitored on a small sample of sherds. There appeared to be variation in some paste attributes such as percentage of temper, temper size, and paste color. It was also found that the published type descriptions (see figures 1-4) were difficult to use since they mainly distinguish between the Verde and Tonto types as having either medium or coarse angular quartz inclusions. The difference is in degree

rather than in kind. Also, according to Colton (1958), Tonto Red is not slipped red but fired red, whereas Verde Red is slipped. This distinction, however, seems questionable. As can be seen, the Tonto/Verde types are not very well understood, and there seems to be no good criterion by which one can distinguish between Tonto and Verde Red or Plain.

The analysis described in the following pages was designed to determine the range of variability within the ceramic assemblage at Shoofly. In addition, preliminary tests were done to examine the relationship of the variables studied. First, however, factors that can introduce variability into an artifact assemblage are briefly summarized:

1) idiosyncratic behavior; it is expected that within any technology or style there is a certain amount of variation due to differential skills or personal choices of the producers. The less the industry in question is specialized, the more variation contributed by this factor is expected.

2) temporal differences; if a site was occupied for a prolonged period of time, shifts, if only minor, in style or technology can occur. The same can be expected if the site was occupied more than once.

3) social interaction; variability can also be introduced by interaction with other sites, that is, if vessels and/or raw materials were exchanged with other villages. On the other hand, these interactions will be difficult to detect if the sites under investigation used the same sources for their raw materials.

4) functional differences; it is known from many ethno-

graphic accounts that potters often use different clays and/or temper for different kinds of vessels. This has to do with the desired qualities of a ceramic vessel, for example, cooking pots should be resistent to thermal shock, and water jars should be permeable for evaporative cooling.

Ware 14 - Type 25 April 1, 1958

VERDE BROWN

SYNONYM: Verde Brown Ware, Caywood and Spicer, 1935, p. 42.

DESCRIBED BY: Caywood and Spicer, 1935. Revised by Colton and Hargrave, 1937, p. 137.

NAMED BY: Caywood and Spicer, 1935.

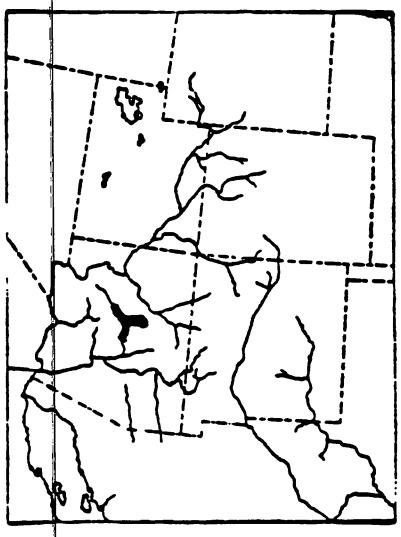
ILLUSTRATION: Caywood and Spicer, 1935, Pl. VIII.

EXAMPLES: Sherds Nos. AT 8952-8957, 6231, 10,486-10,494, 7930-7934, at the Museum of Northern Arizona.

TYPE SITE: Tuzigoot Pueblo (NA 1261), Verde Valley, Yavapai County, Arizona.

STAGES: Pueblo II (?)-III.

TIME: Possibly between 1000 and 1300 A.D.



DESCRIPTION:

CORE: Constructed: by paddling. Color: black to gray, red-brown to dark brown (usually), sometimes glowing red-brown or metallic copper color. Fired: in oxidizing atmosphere.

TEMPER: "Consists of 30 to 50% of medium particles of angular quartz and feldspar, sometimes round sand grains;" occasionally some micaceous particles; "temper varies from fine to extremely coarse;" "temper does not show on surface except for an occasional flake of mica."

WALLS: Medium weak to medium strong; porous. Thickness: jars, average about 13 mm; bowls, average about 5 mm. Fracture: crumbling.

SURFACE: Color: red-brown. Finish: both surfaces bowls, exterior surfaces jars, "smoothed but not polished; irregular but not lumpy;" scraping marks generally apparent on exteriors, particularly near rim where generally rough and unsmoothed; irregular depressions, frequent; interiors, scraped; exterior surface compacted.

FORMS: Jars (predominate), bowls. Rims: IA1I, IB3, rounded, direct, or outflared, out-bevelled, flaring, flat, and direct (rare). Handles: lugs on either side jars (rare).

DECORATION: None.

COMPARISON: Verde Brown is similar in many ways to Rio de Flag Brown except for temper.

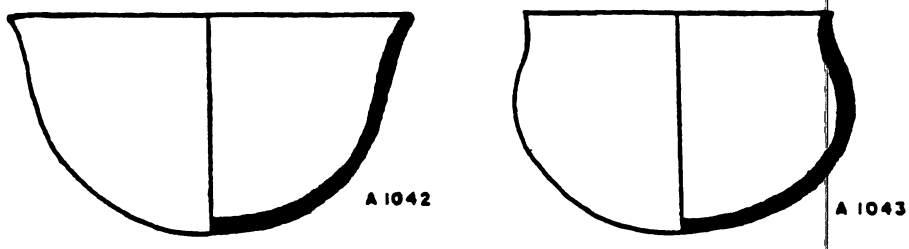
RANGE: Recorded from Tuzigoot Pueblo and other sites in the Verde Valley, Yavapai County, Arizona.

REMARKS: For further details see Caywood and Spicer, 1935. Descriptive characters of types in the Verde Series probably were included by Gila Pueblo in "An Archaeological Survey of Verde Valley" (Gladwin, W. and H. S., 1930), but individual types were not clearly distinguished.

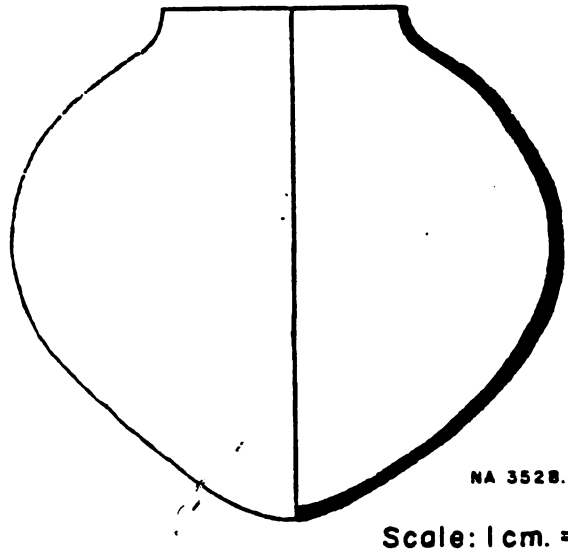
CULTURAL ASSOCIATION: Probably the utility ware of the Hohokam in the Verde Valley or southern Sinagua. Not enough excavation has been undertaken to settle the cultural association.

VARIETIES: Verde Red, Verde Smudged, Hardscrabble Brown, Polles Brown, Pine Brown.

Figure 1a



Scale: 1cm. = 5cm.



Scale: 1cm. = 9cm.

VERDE BROWN

Figure 1b

Ware 14 - Type 26 April 1, 1958

VERDE RED, N.T.

SYNONYM: Has been confused with Tonto Red, Colton and Hargrave, 1937.

DESCRIBED BY: Colton, see below.

EXAMPLES: Sherds Nos. AT 500, 505, 506, 8918, 8919 at the Museum of Northern Arizona.

TYPE SITE: Clear Creek Ruin (NA 2806), Middle Verde.

STAGE: Pueblo III.

TIME: 1200 to 1300 A.D.

DESCRIPTION:
CORE: Constructed: by paddling. Color: orange to gray. Fired: in an oxidizing atmosphere at end of firing.
TEMPER: Medium angular quartz and feldspar fragments 30-50%, sometimes sand grains, little mica.
WALLS: Weak to medium strong. Thickness: jars, 4.5 to 7 mm; bowls, 5 to 7 mm.
SURFACE: Color: red. Finish: smooth, sometimes polished, red slip.
FORMS: Jars and bowls, bowls predominate. Rims: IBIII.

RANGE: Middle Verde to Tonto Basin and perhaps to Roosevelt Basin.

REMARKS: Has been confused with Tonto Red. Tonto Red as re-described has no slip.

CULTURAL ASSOCIATION: Clear Creek Focus, Southern Sinagua Branch.

Figure 2

Ware 14 - Type 27 April 1, 1958

VERDE SMUDGED

A Variety of Verde Red

SYNONYM: Tonto Red, in part, Colton and Hargrave, 1937, p. 66. Tonto Smudged, Colton, 1941, p. 42.

DESCRIBED BY: Colton, see below.

EXAMPLES: Sherds Nos. AT 5791-5794 at the Museum of Northern Arizona.

TYPE SITE: NA 1268.

STAGE: Pueblo III.

TIME: 1100 to 1300 A.D.

DESCRIPTION:

CORE: Constructed: by paddle and anvil. Color: brown or black. Fired: oxidizing atmosphere; smudged. Carbon streak: penetrating from smudged interior.

TEMPER: Sand from arroyo, angular quartz feldspar, and sometimes crushed basalt in varying amounts. Texture: medium to coarse.

WALLS: Thickness: bowls, 4.0 to 7.6 mm; jars, 4.0 to 7.6 mm. Fracture: crumbling.

SURFACE: Color: outside, brown to red. Finish: crudely polished, shows marks of the polishing pebble, sometimes bumpy. Fire clouds: frequent.

FORMS: Bowls and jars.

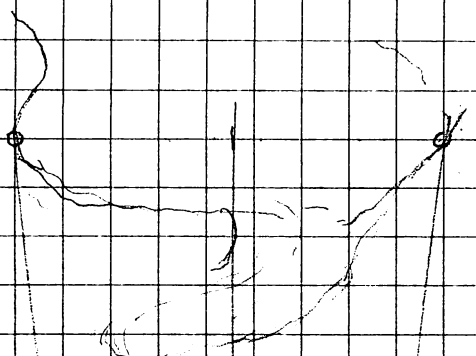
DECORATION: None.

COMPARISON: Sunset Red has basalt ash temper; Rio de Flag Smudged has fine to medium water worn volcanic sand; Winona Smudged has fine water worn sand; Salado Red has medium to coarse water worn sand.

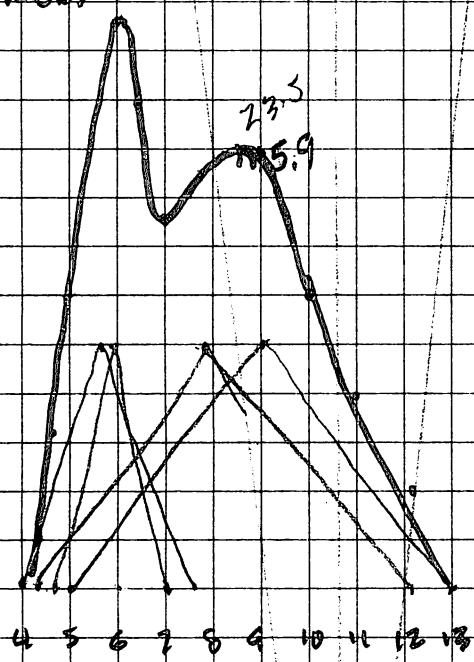
RANGE: Verde Valley, the East Verde, Tonto Basin and Roosevelt Basin.

CULTURAL ASSOCIATION: Southern Sinagua.

Figure 3

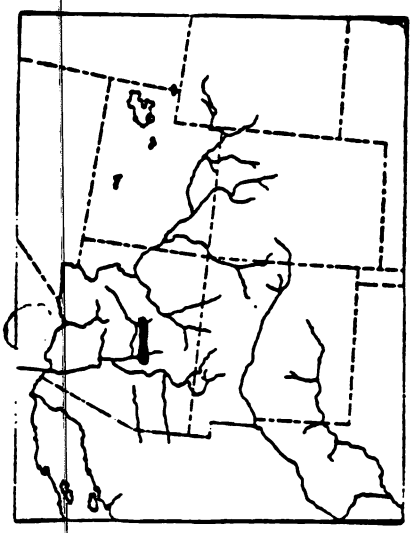


	THICKNESS VARS		THICKNESS BOWLS
VERDE BROWN	E3	(9)	5
&			
VERDE RED	4.5 – 7	(5.9)	5 – 7
VERDE SMUDG	4.0 – 7.6	(5.8)	4.0 – 7.6
TONTO RED (VARS PRED)		4.2 – 7.8 – 12.1	



Ware 14 - Type 31 April 1, 1958

TONTO RED



SYNONYMS: (a) Plain Ware, Schmidt, 1928, p. 298; (b) Gila Redware, in part, Gladwin, W. and H. S., 1930 b, Pl. 12.

DESCRIBED BY: Colton and Hargrave, 1937, p. 166.

EXAMPLES: Sherds Nos.AT 449-503, 2949-2970 at the Museum of Northern Arizona.

TYPE SITE: NA 779, Reiser Ranch near Payson, East Verde River, Gila County, Arizona.

STAGE: Pueblo III.

TIME: Probably between 1150 and 1275 A.D.

DESCRIPTION:

CORE: Constructed: by paddling. Color: gray, dark brown to brick red. Fired: in oxidizing atmosphere.

TEMPER: Shape, Color, and Material: very abundant; predominantly large grains quartz sand and crushed feldspar (?), with smaller amounts opaque angular fragments, gray, reddish, black or whitish; temper always conspicuous on worn surfaces; frequently on unworn surfaces. Texture: coarse to very coarse.

WALLS: Weak to medium strong. Thickness: 4.2 to 12.1 mm; average (160 sherds) 7.8 mm. Fracture: crumbling.

SURFACE: Color: exteriors -- usually dull brick-red; interiors -- black, brown, gray, or buff; color core and surfaces do not contrast except smudged interiors. Finish: exteriors, bumpy; sometimes moderately polished; usually gritty; sometimes lightly coated with thin red wash, often fugitive; no slip; occasionally lightly polished; interior surfaces of bowls often lightly polished, sometimes smudged; anvil marks usually conspicuous. Fire clouds: uncommon.

FORMS: Bowls, jars (predominate); often difficult to distinguish form from individual sherds. Rims: jars, IB3; bowls, IIIA3.

DECORATION: None.

COMPARISONS: Turkey Hill Red, usually more evenly finished, often highly polished especially on bowl interiors; temper somewhat less abundant, less coarse, with larger proportion opaque angular fragments; anvil marks somewhat less conspicuous. Tuzigoot Red, temper about equal amounts medium fine quartz or feldspar (?) sand and opaque angular fragments, with micaceous particles occasionally present; texture core usually medium to fine; anvil marks less noticeable; vessel walls average somewhat thinner. Flagstaff Red and Sunset Red, temper mostly black volcanic sand. Verde Red has a slip; Tonto Red, no slip.

RANGE: East Verde drainage; extends from southern end of Verde Valley south to the Gila River. It is an intrusive type in the Flagstaff area.

CULTURAL ASSOCIATION: Utility type of the southern Sinagua and Salado (?).

Figure 4

ANALYSIS OF SAMPLE 1

To obtain data on attributes of vessel form, it was decided to use only rim sherds for this study. Furthermore, using the same vessel part throughout reduces 'intra-vessel' variability, for example, body sherds (especially from the bottom) can be considerably thicker than the rims of the same vessel. Also, only rims from the Phase II excavations were selected, that is,they represent all areas of the site yet come only from room contexts. This resulted in a sample of 901 sherds.

During the first phase of the analysis, attrubutes for 4 variables were recorded: slip, smudge, vessel form, and thickness of vessel wall. The criteria used for this analysis are outlined below.

Slip: Every sherd that had remains of red pigments (that is which differed markedly in color from the background paste) was coded as slipped, although they did not always conform with a good slipped surface.

Smudge: The important criterion was whether the carbon penetrated the vessel wall to a certain degree and whether there was a marked color contrast between the 'smudge zone' and the paste.

Vessel form: This was the most difficult variable and resulted in the largest number of 'indeterminates'.
The distinction between bowls and jars was based on the nature of the orifice of the vessel.
Unrestricted vessels were coded as bowls and restricted vessels as jars. Therefore, some of the jars may functionally

be bowls. For example, 'deep bowls' may function as bowls but are coded as jars because of their restricted orifice.

Thickness: Measurements were taken 1cm below the rim (more was often not available). An average for three point (both ends and the middle) was recorded. Measurements were rounded to the nearest 0.5mm.

Results

Frequencies for these 4 variables are presented in Tables 1 and 2. As can be seen, the distribution of the variable 'thickness' shows 2 peaks. Therefore, the distribution of this variable was examined for bowls and jars separately. The bowls now have only one peak, but the jars still have 2. It is my feeling that there are actually 2 types of jars in the sample (see figure 5) and that the 2 peaks could represent these 2 types. It is intended to recode the jars to test this hypothesis.

Next, 2-way tables for the discrete variables were computed (tables 5-7). The statistics have to be used with caution, since tables with more than 40 cases often result in higher Chi-squares. Nevertheless, an examination of the cell frequencies shows that co-variation is generally not very good with the possible exception of vessel form and slip. Bowls tend to be slipped more often and jars not, but there is still an awful lot of unslipped bowls and slipped jars. It is possible that the recoding of the jar category will result in stronger correlations.

It is possible that the correlation of these discrete

variables becomes more consistent through time (Dittert, personal communication), yet at the present time there are insufficient data to test this hypothesis.

Next, t-tests for the variable 'thickness' were computed (table 8). Although the results are statistically significant in all cases, only the differences for bowls and jars (and possibly for slipped and unslipped vessels) are actually meaningful. The differences in means for smudged and unsmudged vessels are less than 1 increment on the scale used to measure thickness!

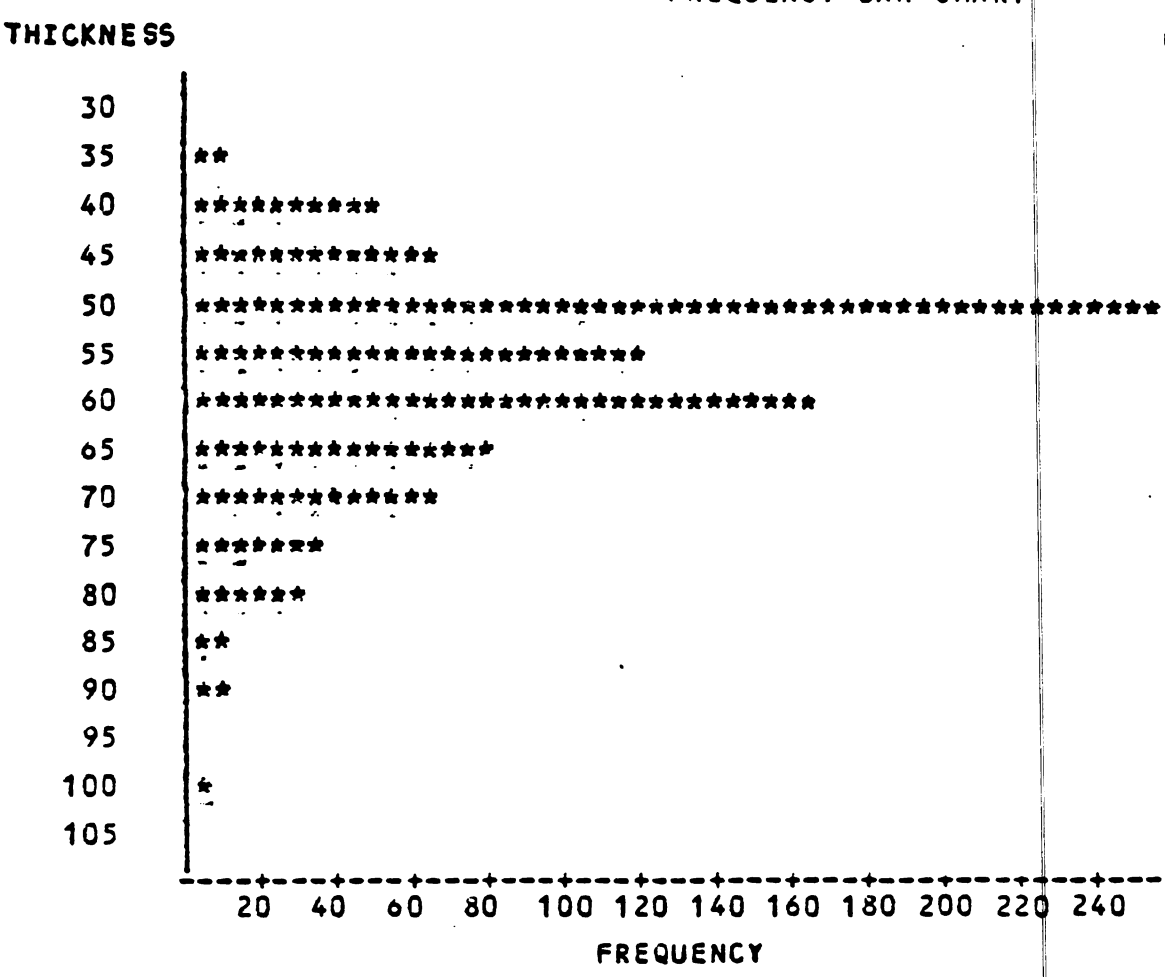
Further evaluation of these variables depends on the results of the analysis of sample 2.

FREQUENCIES FOR SAMPLE OF 901 SHERDS

Slip		
Absent	425	47.2%
Present	465	51.5%
Indeterminate	12	1.3%
Smudge		
Absent	470	52.2%
Present	426	47.3%
Indeterminate	5	0.5%
Vessel Form		
Bowl	420	46.6%
Jar	315	35.0%
Indeterminate	166	18.4%

Table 1

FREQUENCY BAR CHART

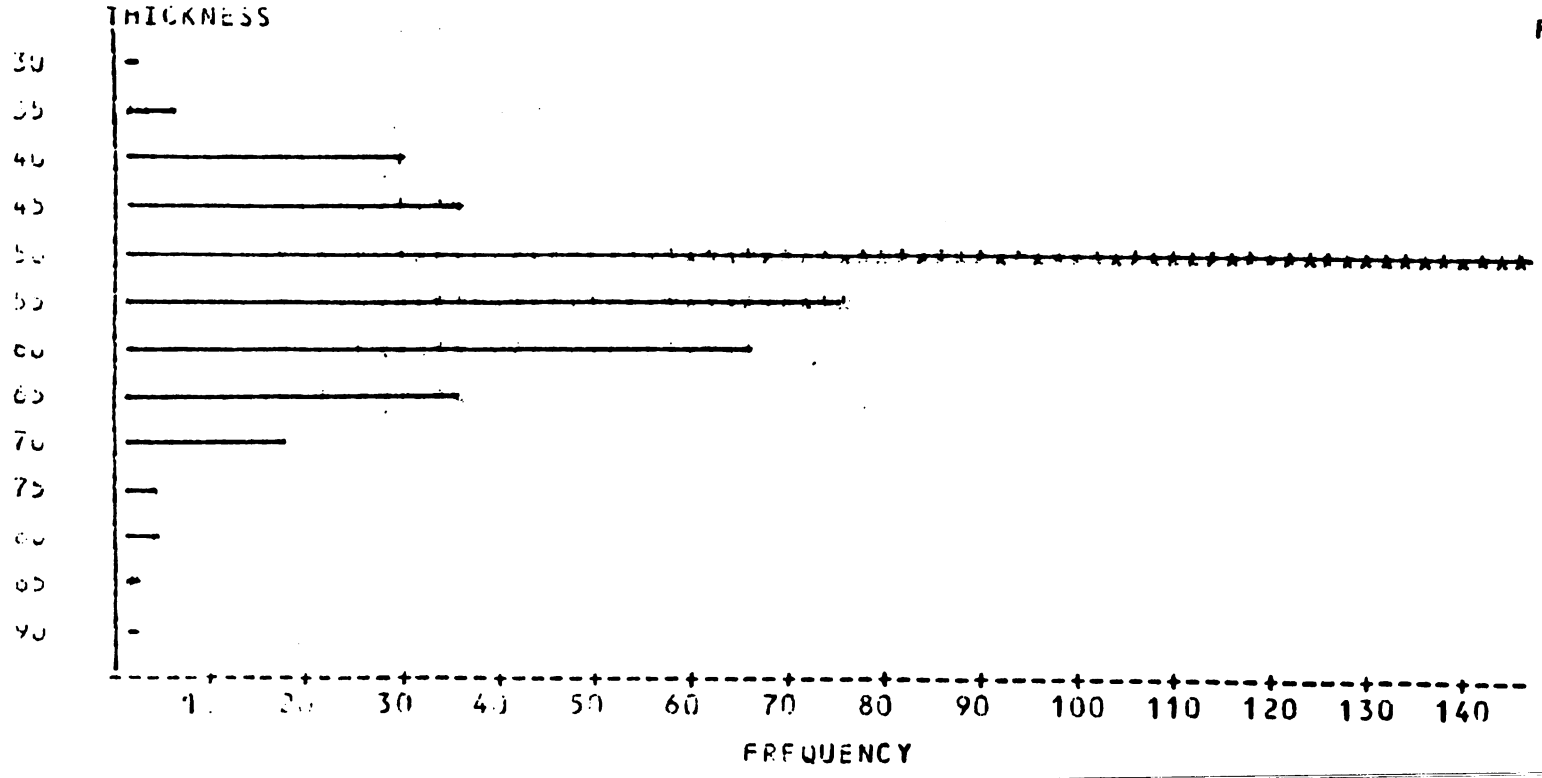


Mean: 57.17 Std.Dev.: 11.26 Std. Error of Mean: 0.37

Table 2

VESSEL FORM=BOWL

FREQUENCY BAR CHART

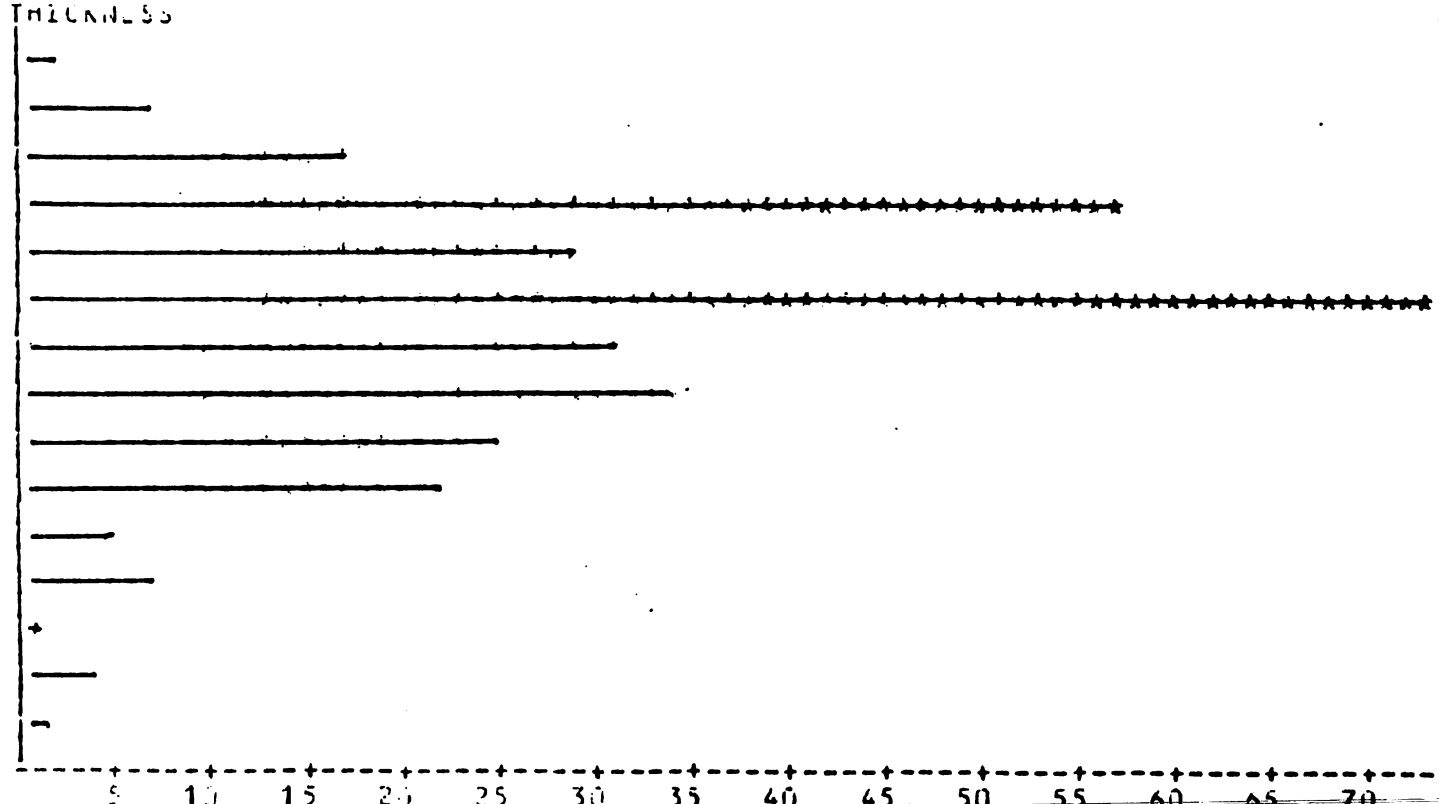


	FREQ	PERCENT
30	1	0.24
35	6	1.43
40	30	7.14
45	35	8.33
50	146	34.76
55	75	17.86
60	65	15.48
65	35	8.33
70	17	4.05
75	3	0.71
80	4	0.95
85	1	0.24
90	2	0.48

Table 3

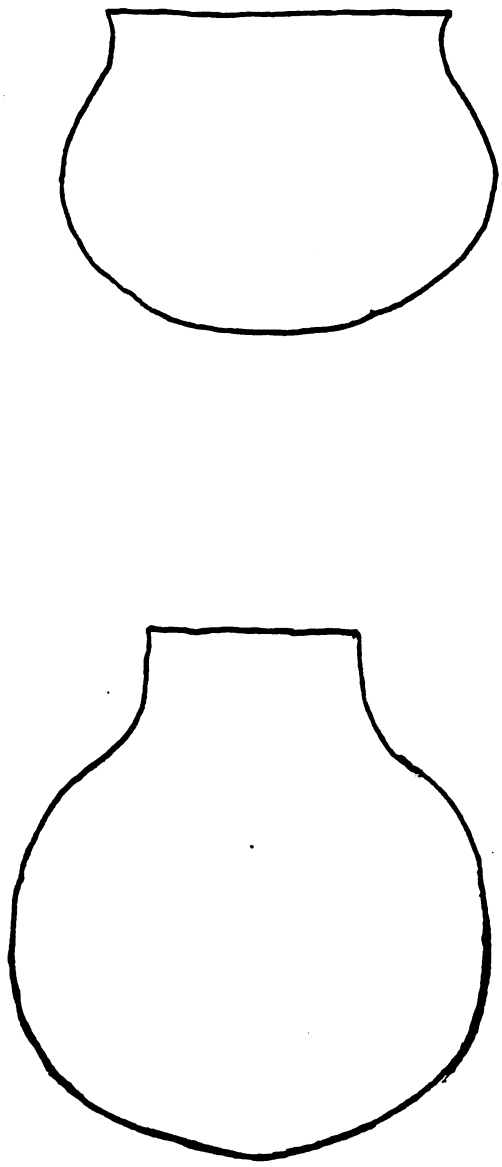
VESSEL FORM=JAR

FREQUENCY BAR CHART



	FREQ	PERCENT
35	2	0.63
40	7	2.22
45	17	5.40
50	57	18.10
55	29	9.21
60	73	23.17
65	31	9.84
70	34	10.79
75	25	7.94
80	22	6.98
85	5	1.59
90	7	2.22
95	1	0.32
100	4	1.27
105	1	0.32

Table 4



hypothetical jar forms

Figure 5

TABLE OF SLIP BY SMUDGE

SLIP SMUDGE

FREQUENCY / PERCENT / ROW PCT / COL PCT	ABSENT	PRESENT	TOTAL
ABSENT	196 27.18 56.98 53.41	148 20.53 43.02 41.81	344 47.71
PRESENT	171 23.72 45.36 46.59	206 28.57 54.64 58.19	377 52.29
TOTAL	367 50.90	354 49.10	721 100.00

STATISTICS FOR 2-WAY TABLES

CHI-SQUARE	9.716	DF= 1	PROB=0.0018
PHI	0.116		
CONTINGENCY COEFFICIENT	0.115		
CRAMER'S V	0.116		
LIKELIHOOD RATIO CHISQUARE	9.739	DF= 1	PROB=0.0018
CONTINUITY ADJ. CHI-SQUARE	9.256	DF= 1	PROB=0.0023
FISHER'S EXACT TEST (1-TAIL)			PROB=0.0012
(2-TAIL)			PROB=0.0022

Table 5

TABLE OF VFORM BY SLIP

VFORM SLIP

FREQUENCY / PERCENT / ROW PCT / COL PCT	ABSENT	PRESENT	TOTAL
BOWL	165 22.88 40.05 47.97	247 34.26 59.95 65.52	412 57.14
JAR	179 24.83 57.93 52.03	130 18.03 42.07 34.48	309 42.86
TOTAL	344 47.71	377 52.29	721 100.00

STATISTICS FOR 2-WAY TABLES

CHI-SQUARE	22.628	DF= 1	PROB=0.0001
PHI	-0.177		
CONTINGENCY COEFFICIENT	0.174		
CRAMER'S V	-0.177		
LIKELIHOOD RATIO CHISQUARE	22.722	DF= 1	PROB=0.0001
CONTINUITY ADJ. CHI-SQUARE	21.917	DF= 1	PROB=0.0001
FISHER'S EXACT TEST (1-TAIL)			PROB=0.0000
(2-TAIL)			PROB=0.0000

TABLE OF VFORM BY SMUDGE

VFORM SMUDGE

FREQUENCY / PERCENT / ROW PCT / COL PCT	ABSENT	PRESENT	TOTAL
BOWL	192 26.63 46.60 52.32	220 30.51 53.40 62.15	412 57.14
JAR	175 24.27 56.63 47.68	134 18.59 43.37 37.85	309 42.86
TOTAL	367 50.90	354 49.10	721 100.00

STATISTICS FOR 2-WAY TABLES

CHI-SQUARE	7.111	DF= 1	PROB=0.0077
PHI	-0.099		
CONTINGENCY COEFFICIENT	0.099		
CRAMER'S V	-0.099		
LIKELIHOOD RATIO CHISQUARE	7.126	DF= 1	PROB=0.0076
CONTINUITY ADJ. CHI-SQUARE	6.715	DF= 1	PROB=0.0096
FISHER'S EXACT TEST (1-TAIL)			PROB=0.0047
(2-TAIL)			PROB=0.0084

Tables 6-7

T-TESTS FOR THICKNESS

1) Slip

	N	Mean	Std. Dev.
Absent	344	61.10	13.24
Present	377	54.24	8.33

T = 8.2365
DF = 568.1
PROB > |T| = 0.0001

2) Smudge

	N	Mean	Std. Dev.
Absent	367	59.14	11.87
Present	354	55.83	10.80

T = 3.9104
DF = 719.0
PROB > |T| = 0.0001

3) Vessel form

	N	Mean	Std. Dev.
Bowl	412	53.91	8.84
Jar	309	62.33	12.75

T = 9.9553
DF = 519.5
PROB > |T| = 0.0001

Table 8

ANALYSIS OF SAMPLE 2

For this sample, a stratified random sample of the previous sample was taken. Ten percent of the 8 possible combinations of variables 'slip', 'smudge', and 'vessel form' were selected according to their representation in the larger sample. The variables recorded during this analysis are: Temper size, temper distribution, and temper precentage. In addition, data provided by Arleyn Simon for hardness as tested by the Rockwell Hardness Tester were also included. Criteria for attribute selection are as follows:

- Temper size: The largest particle present on a cut surface was measured. These measurements were grouped into increments of 0.5mm.

Temper distribution: Only two possible states of particle size distribution were recorded: bimodal and graded.

Temper percentage: This was determined by a point-count-analysis. A grid of 39 points was laid over the cut surface and the number of points that cross-cut an inclusion was counted. From this count the ratio of clay/temper was calculated.

Hardness: These data were collected by Arleyn Simon using the Rockwell Hardness Tester with a Brale point.

Results

Frequencies for these variables are presented in tables 9-11. Next, 2-way tables were computed for temper size and the variables slip, smudge, and vessel form.(tables 12-14). The statistics for these tables are probably invalid due to the low cell frequencies in some cases, but a look at

the actual cell counts gives a good indication of the situation. The counts for temper size are almost exactly the same across the three other variables with one exception: there are 3 times as many bowls as jars in the smallest size category.

Next, t-tests were computed for the variables temper percentage and hardness. The results are presented in tables 15 and 16. There appear to be no statistically significant differences with the possible exception of the means for temper percentage for bowls and jars.

DISCUSSION

The above analysis is only an initial step in the evaluation of the Shoofly ceramic assemblage. So far, the most consistent difference across the variables seems to be functional, that is for vessel form. It is hoped that a cluster analysis of these variables will shed more light into the situation. Preliminary results are already in, but the evaluation of these is not yet complete. Furthermore, a re-evaluation of the jar category should also give a more detailed picture for some of the tests presented above.

P.S. Refiring analysis showed no color variability in refired sherds.

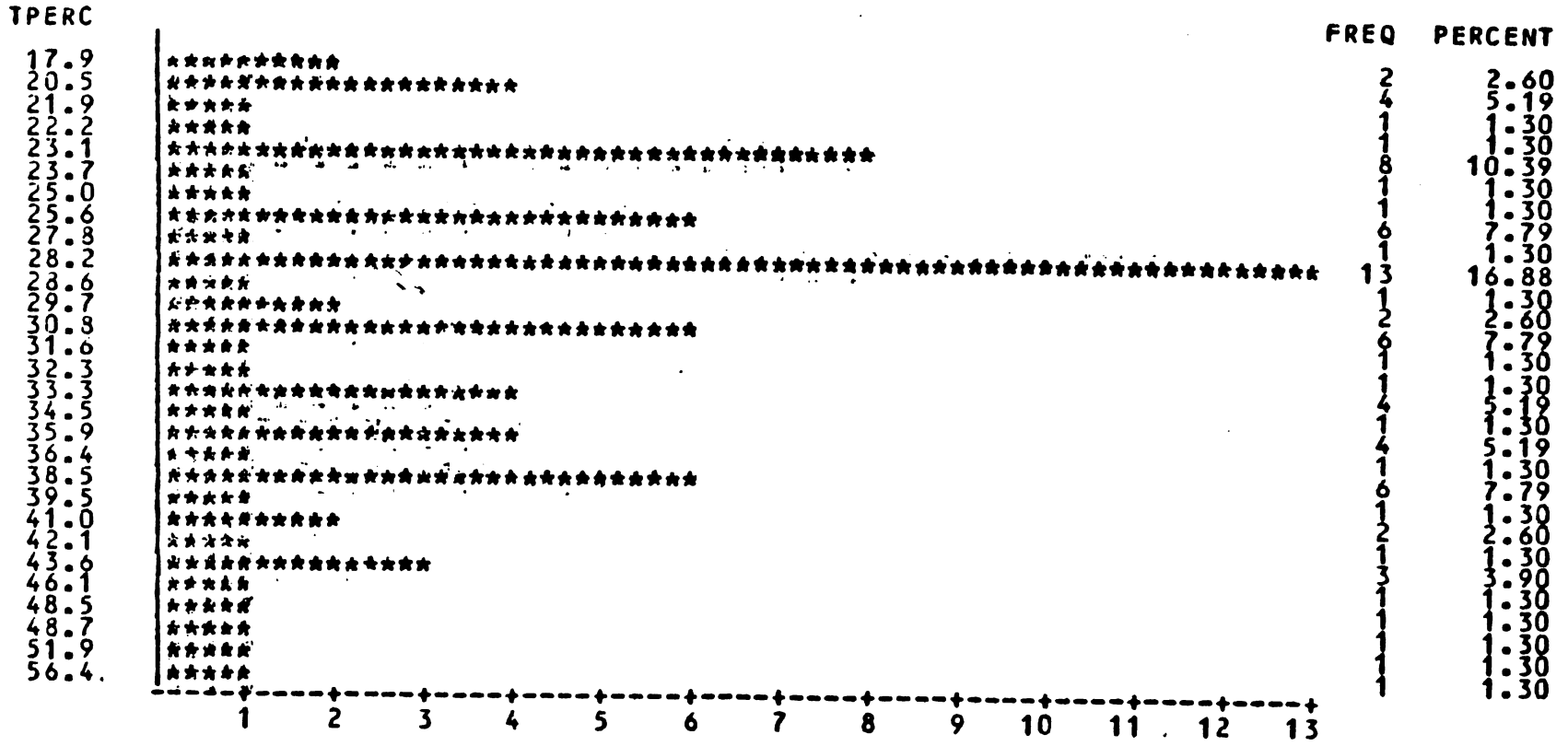
FREQUENCIES FOR SAMPLE OF 77 SHERDS

Slip		
Absent	38	49.4%
Present	39	50.6%
Smudge		
Absent	41	53.2%
Present	36	46.7%
Vessel form		
Bowl	42	54.5%
Jar	77	45.4%
Temper size		
0-0.5mm	0	0.0%
0.5-1.0mm	20	26.0%
1.0-1.5mm	28	36.4%
1.5-2.0mm	24	31.2%
2.0+ mm	5	6.5%
Temper distribution		
Graded	63	81.8%
Bimodal	14	18.2%

Table 9

Table 10

FREQUENCY BAR CHART



N=77 Mean=31.23 Std.Dev.=8.21

RHBMEAN	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
-14.22	1	1	1.299	1.299
26.44	1	2	1.299	2.597
31	1	3	1.299	3.896
31.22	1	4	1.299	5.195
32.22	1	5	1.299	6.494
33.44	1	6	1.299	7.792
34.33	1	7	1.299	9.091
34.44	1	8	1.299	10.390
35.11	1	9	1.299	11.688
36.89	1	10	1.299	12.987
40.44	1	11	1.299	14.286
40.67	1	12	1.299	15.584
41.67	1	13	1.299	16.883
42.89	1	14	1.299	18.182
43.56	1	15	1.299	19.481
43.89	1	16	1.299	20.779
44	1	17	1.299	22.078
45.78	1	18	1.299	23.377
46.78	1	19	1.299	24.675
47	1	20	1.299	25.974
48.44	1	21	1.299	27.273
49.89	1	22	1.299	28.571
51.33	1	23	1.299	29.870
53.44	2	25	2.597	32.468
53.56	1	26	1.299	33.766
54.44	1	27	1.299	35.065
55	1	28	1.299	36.364
55.44	1	29	1.299	37.662
55.78	1	30	1.299	38.961
56.89	1	31	1.299	40.260
57.44	1	32	1.299	41.558
58	1	33	1.299	42.857
58.11	1	34	1.299	44.156
59	1	35	1.299	45.455
59.67	1	36	1.299	46.753
61.33	1	37	1.299	48.052
62	1	38	1.299	49.351
62.22	1	39	1.299	50.649
63.33	1	40	1.299	51.948
64.11	1	41	1.299	53.247
64.33	1	42	1.299	54.545
64.44	1	43	1.299	55.844
64.89	1	44	1.299	57.143
65.78	1	45	1.299	58.442
68.78	1	46	1.299	59.740
70.67	1	47	1.299	61.039
71.44	1	48	1.299	62.338
72.11	1	49	1.299	63.636
72.22	1	50	1.299	64.935
72.44	2	52	2.597	67.532
72.56	1	53	1.299	68.831
73.11	1	54	1.299	70.130
73.78	1	55	1.299	71.429
73.89	1	56	1.299	72.727
74.44	1	57	1.299	74.026
75.11	1	58	1.299	75.325
76.33	1	59	1.299	76.623
79.89	1	60	1.299	77.922
80.56	2	62	2.597	80.519
83.33	1	63	1.299	81.818
85.78	2	65	2.597	84.416
86.11	1	66	1.299	85.714
88	1	67	1.299	87.013
88.89	1	68	1.299	88.312
89	1	69	1.299	89.610
89.44	1	70	1.299	90.909
91.67	1	71	1.299	92.208
92.44	1	72	1.299	93.506
92.56	1	73	1.299	94.805
92.89	1	74	1.299	96.104
94	1	75	1.299	97.403
97.67	1	76	1.299	98.701
98.56	1	77	1.299	100.000

N=77 Mean=62.16 Std.Dev.=20.84

Table 11

TABLE OF SLIP BY TSIZE

SLIP TSIZE

FREQUENCY / PERCENT / ROW PCT / COL PCT	2	3	4	5	TOTAL
0 Absent	10 12.99 26.32 50.00	14 18.18 36.84 50.00	12 15.58 31.58 50.00	2 2.60 5.26 40.00	38 49.35
1 Present	10 12.99 25.64 50.00	14 18.18 35.90 50.00	12 15.58 30.77 50.00	3 3.90 7.69 60.00	39 50.65
TOTAL	20 25.97	28 36.36	24 31.17	5 6.49	77 100.00

STATISTICS FOR 2-WAY TABLES

CHI-SQUARE	0.187	DF= 3	PROB=0.9797
PHI	0.049		
CONTINGENCY COEFFICIENT	0.049		
CRAMER'S V	0.049		
LIKELIHOOD RATIO CHISQUARE	0.188	DF= 3	PROB=0.9794

WARNING: OVER 20% OF THE CELLS HAVE EXPECTED COUNTS LESS THAN 5. TABLE IS SO SPARSE THAT CHI-SQUARE MAY NOT BE A VALID TEST.

TABLE OF SMUDGE BY TSIZE

SMUDGE TSIZE

FREQUENCY / PERCENT / ROW PCT / COL PCT	2	3	4	5	TOTAL
0 Absent	10 12.99 24.39 50.00	14 18.18 34.15 50.00	13 16.88 31.71 54.17	4 5.19 9.76 80.00	41 53.25
1 Present	10 12.99 27.78 50.00	14 18.18 38.89 50.00	11 14.29 30.56 45.83	1 1.30 2.78 20.00	36 46.75
TOTAL	20 25.97	28 36.36	24 31.17	5 6.49	77 100.00

STATISTICS FOR 2-WAY TABLES

CHI-SQUARE	1.649	DF= 3	PROB=0.6483
PHI	0.146		
CONTINGENCY COEFFICIENT	0.145		
CRAMER'S V	0.146		
LIKELIHOOD RATIO CHISQUARE	1.769	DF= 3	PROB=0.6216

WARNING: OVER 20% OF THE CELLS HAVE EXPECTED COUNTS LESS THAN 5. TABLE IS SO SPARSE THAT CHI-SQUARE MAY NOT BE A VALID TEST.

Tables 12-13

TABLE OF VFORM BY TSIZE

VFORM / TSIZE	2	3	4	5	TOTAL
BOWL	15	13	12	2	42
	19.48	16.88	15.58	2.60	54.55
	35.71	30.95	28.57	4.76	
	75.00	46.43	50.00	40.00	
JAR	5	15	12	3	35
	6.49	19.48	15.58	3.90	45.45
	14.29	42.86	34.29	8.57	
	25.00	53.57	50.00	60.00	
TOTAL	20	28	24	5	77
	25.97	36.36	31.17	6.49	100.00

FREQUENCY
PERCENT
ROW PCT
COL PCT

STATISTICS FOR 2-WAY TABLES

CHI-SQUARE	4.746	DF= 3	PROB=0.1914
PHI	0.248		
CONTINGENCY COEFFICIENT	0.241		
CRAMER'S V	0.248		
LIKELIHOOD RATIO CHISQUARE	4.940	DF= 3	PROB=0.1763

WARNING: OVER 20% OF THE CELLS HAVE EXPECTED COUNTS LESS THAN 5.
TABLE IS SO SPARSE THAT CHI-SQUARE MAY NOT BE A VALID TEST.

Table 14

T-TESTS FOR TEMPER PERCENTAGE

1) Slip

	N	Mean	Std. Dev.
Absent	38	31.71	8.64
Present	39	30.76	7.85

T = 0.5102
DF = 75.0
PROB > |T| = 0.6114

2) Smudge

	N	Mean	Std. Dev.
Absent	41	30.36	7.81
Present	36	32.21	8.65

T = −0.9855
DF = 75.0
PROB > |T| = 0.3276

3) Vessel form

	N	Mean	Std. Dev.
Bowl	42	28.51	6.12
Jar	35	34.49	9.24

T = −3.3961
DF = 75.0
PROB > |T| = 0.0011

Table 15

T-TESTS FOR HARDNESS (RHBMEAN)

1) Slip

	N	Mean	Std. Dev.
Absent	38	61.01	19.50
Present	39	63.28	22.27

T = -0.4750
DF = 75.0
PROB > |T| = 0.6362

2) Smudge

	N	Mean	Std. Dev.
Absent	41	63.97	20.68
Present	36	60.10	21.13

T = 0.8101
DF = 75.0
PROB > |T| = 0.4204

3) Vessel form

	N	Mean	Std. Dev.
Bowl	42	61.12	21.02
Jar	35	63.40	20.87

T = -0.4762
DF = 75.0
PROB > |T| = 0.6353

Table 16