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NOTES ON THE POTTERY OF PECOS

BY M. A. AND A. V. KIDDER

THE pueblo of Pecos in San Miguel county, New Mexico, was abandoned in 1838; after a presumably continuous occupation from an early period in prehistoric times. Its rubbish heaps, therefore, contain the accumulations of several centuries, and some of them are so stratified that by a careful study of their contents one is enabled to trace the development of the arts and industries of the community from beginning to end. Of the various objects found in these stratified heaps, pottery fragments are by far the commonest and most easily classifiable, and it is with them that the present paper is concerned.

That there have been changes in the pottery of the Rio Grande pueblos in prehistoric and historic times, has been recognized by archaeologists for a number of years, but no sure evidence as to the sequential order of the several recognizable styles was forthcoming until Mr. Nelson found at San Cristobal a stratified rubbish heap containing wares of three of the principal earlier types. Similar material from other sites enabled him to place chronologically two later types that brought the sequence unbroken down to a comparatively recent date (*ca.* 1700).¹ These investigations served, in the words of Dr. Kroeber, to convert "the archaeological problem of the Southwest from an essentially exploratory and descriptive

¹ N. C. Nelson, "Chronology of the Tano Ruins, New Mexico," *American Anthropologist* (N.S.), vol. 18, pp. 159-180. Here referred to as "N."

one, with interpretation based chiefly on Spanish documentary and native legendary sources, into a self-contained historic one." Mr. Nelson's discovery, and his discriminating analysis of his material constitute, therefore, one of the most important contributions that has yet been made to North American archaeology.

As Pecos was inhabited for a longer time than any other historic Southwestern site available for excavation;¹ and as its compact form, imposed by its position on a small mesa, tended to confine its rubbish heaps to a small area, an almost complete ceramic series can there be recovered in exact order. Thus we are able to cross-reference and, in some respects, to supplement the data secured by Mr. Nelson. We publish our results at this time, some years before the final report on the complete investigation can be brought out, and in their present fragmentary form, in order that they may become available for the constantly increasing number of archaeologists working in the Southwest.

The paper is in three parts: first, a classification of the wares found at Pecos, with condensed descriptions of the different types; second, the presentation and analysis of the stratigraphical evidence which has served to place them in their proper chronological order; third, a discussion of the sequence of the types.

CLASSIFICATION AND DESCRIPTION

In making this study we have used only sherds, the complete vessels found in the excavations not yet having been restored; hence we are unable to give any data on the shapes of whole pieces, or to include more than the most general notes on decoration. As it is difficult to describe in words such subtle qualities as the differences between nearly related groups of pottery, we have picked out a short series of sherds illustrating all the types. This series will be sent (on application to the Department of Archaeology, Phillips Academy, Andover, Mass.) to any one who cares to use it, either for a clearer understanding of the present paper, or for comparison with collections from other parts of the Southwest.

¹ Acoma is the only pueblo which has not changed its location at least once since 1540, and as to the length of its prehistoric occupation we are ignorant; it is possible, therefore, that Pecos was absolutely the longest inhabited village in Arizona or New Mexico.

The classification follows:

- I. DULL-PAINT WARE.
 1. Black-on-white.
 2. Biscuit.
 - A. Rough exterior.
 - B. Smooth exterior.
 3. Modern.
- II. GLAZE-PAINT WARE.
 1. Two-color.
 - A. Black-on-red.
 - B. Black-on-yellow.
 2. Transitional.
 3. Early three-color.
 4. Pajaritan three-color.
 5. Late three-color.
 6. Degenerate.
- III. UNDECORATED SMOOTH WARE.
 1. Polished black.
 2. Plain red.
- IV. BLACKWARE.
 1. Corrugated.
 2. Strong blind-corrugated.
 3. Medium blind-corrugated.
 4. Faint blind-corrugated.
 5. Featureless.
 6. Striated.

I. DULL-PAINT WARES

1. *Black-on-white*

Rim-shape.—Bowls; sides rise rather straight with no thickening at rim. Lip usually flat, but with rounded corners (pl. 1, fig. 1). Rounded and thin rims (figs. 2 and 3) present but uncommon. About 10 per cent. of bowl-sherds show outcurved rims with rounded lips (fig. 4). Ollas; insufficient data.

Surface-finish.—Slip-color ranges from light to dark gray, very rarely pure white; it is applied to the interior of bowls in a relatively heavy coat; to the exterior usually as a thin wash, occasionally as a heavy coat, rarely omitted altogether. Slip often cracked, particularly when it is applied heavily on the exterior.

Finish of interior even but never glossy; of exterior much rougher. No specimen with corrugated or basket-marked exterior observed.

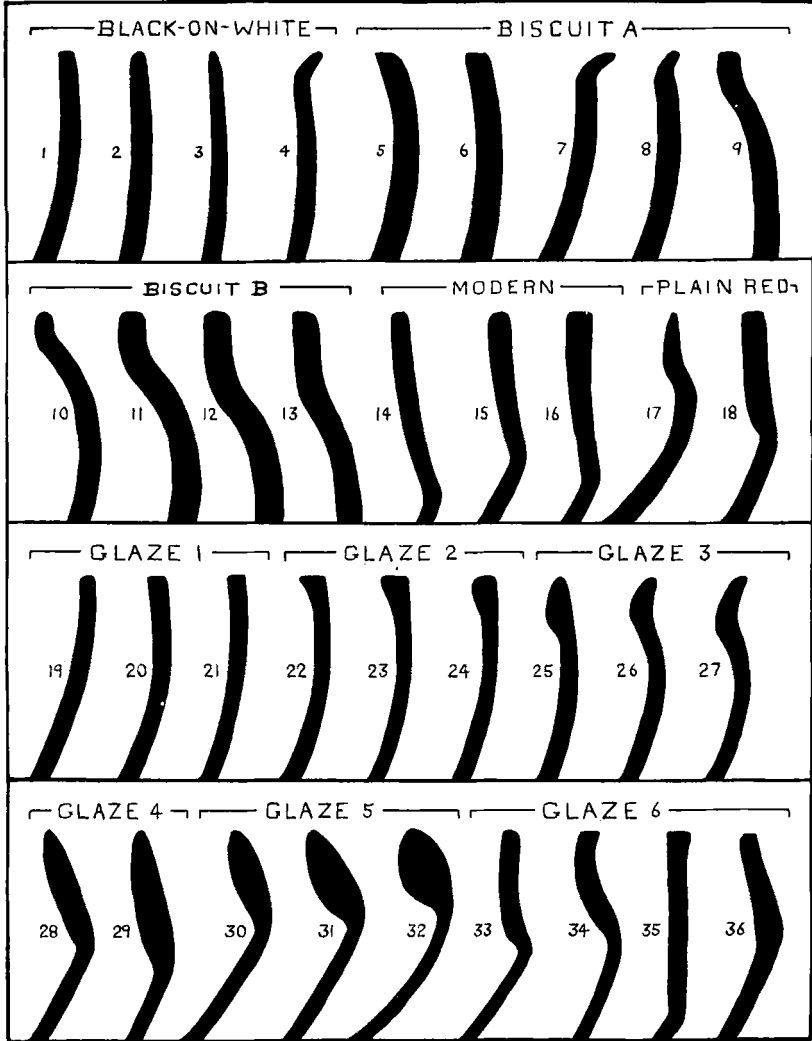
Ornamentation.—Pigment dull black, usually of a slaty cast. Zones: interiors of bowls, exteriors of ollas; exterior decoration of bowls exceedingly rare. Straight bowl-rims usually plain, occasionally dotted; outcurved rims bear ticks or, more commonly, a single heavy zigzag line. The main ornament appears to have been in the form of a broad band encircling the interior of the bowl and leaving only a small blank space in the bottom. Bands framed above and below by single heavy lines ("N," pl. VII, fig. 7); less commonly by one heavy line with a series of lighter ones between it and the band ("N," pl. VII, fig. 8). Line-break in framers rare. "All-over" decorations apparently fairly common, particularly on small bowls. Design preponderatingly geometric and rectilinear, life and curvilinear forms practically absent. Elements of design most commonly observed: coarse hatching and cross-hatching; plain and dotted checkerboard; series of plain triangular figures; dotted lines and edges; large stepped figures in opposed pairs. Brushwork normally crude and uncertain, lines coarse.

Paste Composition.—Paste fine, very hard and homogeneous; color ranges from pure white (rare) through light gray to dark gray (rare). Many sherds are of even color from surface to surface, but in the majority the center is darker than the edges. Gross tempering (sand or pounded rock) apparently absent; most sherds show a sparse sprinkling of light and dark flecks (nature undetermined). Average thickness of ware for bowls slightly over $\frac{3}{16}$ inch; for ollas about $\frac{3}{16}$ inch.

2. *Biscuit-ware*

Biscuit-ware is a soft, thick, and porous pottery with light colored slip and dull black paint. It is confined pretty strictly to the Rio Grande drainage, where it is most common in the northern districts: Taos, Abiquiu, the Chama, the Oso basin, etc. In the Pajarito country its abundance relative to other wares varies at different sites;¹ at Pecos and in the Galisteo basin it is less frequent than in the Pajarito and Keres regions ("N," p. 169); in the Manzanos and along the Rio Grande in southern New Mexico it is apparently rare. Its chronological position and morphological relationships will be discussed below. The division of the ware into two groups (*A* and *B*) is based on technological and decorative features which are believed to represent more than mere variation within a single group. Type *A* comprises all pieces which have

¹ See Kidder, "Pottery of the Pajarito Plateau and of some Adjacent Regions in New Mexico," *Memoirs American Anthropological Association*, vol. II, part 6, p. 459. Here referred to as "K."



BOWL-RIM SECTIONS

unslipped rough exteriors; Type *B* those with slipped and decorated exteriors. Further differences between the two will be brought out in the following descriptions:

Biscuit A

This particular variety has hitherto been reported from only one site, the Agua Fria "Schoolhouse" ruin ("K," p. 449); its presence in the Galisteo basin is to be inferred from Nelson's description of biscuit-ware with "decoration on one side" (p. 169).

Rim-shape.—Bowls (ollas not identified): there are three types; the plain (pl. 1, figs. 5, 6), the outcurved (figs. 7, 8), and the standing (fig. 9); the outcurved is much the most common. In all three the bowl-sides are more strongly curved than in black-on-white bowls (*cf.* figs. 1 to 4). Plain type: the lip is essentially flat and horizontal; the exterior edge of the flat top is rounded, the interior sharp (fig. 5). Outcurved type: the lip is somewhat thinner than the side of the vessel and has a rounded termination; the width of the flare, its angle, and the extent of its thinning, vary considerably (figs. 7, 8). Standing type: the rim proper is vertical; the lip is flat-topped with rounded edges.

Surface-finish.—Slip a very even, dull light-gray (very seldom if ever yellowish); well smoothed but seldom "slick" and never polished; rarely crackled; is applied to interior only. The unslipped exterior has a very characteristic texture, showing the close-set and irregularly horizontal striations of a scraping tool; the contours, however, are even and true, much more so than the rather irregular exteriors of black-on-white bowls; color dark gray.

Ornamentation.—On interior only. Pigment a dull, deep black, lacking the bluish cast of black-on-white. The lips of some of the straight-rimmed and most of the standing pieces are dotted; the inner surfaces of the standing examples and the flaring part of the outcurved ones are decorated with: a single zigzag line; or a series of dextrally oblique dashes; or with small, elongated rectangles containing one, two, or three parallel horizontal lines. The main design is apparently almost always of band type, leaving a rather large clear space in the bowl-bottom. The bands are usually framed above and below by single very heavy lines, less commonly by narrower single lines with interior sets of minor framers. Line-break not noted. Elements of design (such as key-figure, hatching, cross-hatching, and checkerboard) seem to be closer to the black-on-white system than to biscuit *B*, though a few motifs characteristic of the latter (awanyu and standard triangle—see "K," pl. XVIII, and fig. 13) seem to be present in an undeveloped form. Brushwork averages coarser and more irregular than in black-on-white.

Paste Composition.—Less compact, softer and more porous than black-on-white; fractures more irregularly; has a characteristic "woodeny" feel, and lack of ring when struck. Where the color is not uniform from surface to surface

the pieces always become progressively darker toward the exterior. No gross tempering at all; a few white flecks through the paste. Average thickness of bowl $\frac{5}{16}$ inch.

Biscuit B

This ware is characterized by the presence of slip and decoration on both interior and exterior of bowls, and by high, square-lipped rims; also by variability of slip-color, which ranges from almost white to almost yellow. Nelson (p. 169) divides the ware into two classes: white and yellow, but we believe these to be merely variants (due to the presence of oxides in the paste, and to differences in firing) from a light gray normal. Biscuit *B* from the Pajarito, which seems much like that of Pecos, is described at some length in "*K*" *passim*.

Rim-shape.—Bowls (ollas not yet distinguishable from biscuit *A*, so are here disregarded): standing rim practically the only type, flaring or unmodified examples being rare. The upper wall of the bowl curves inward and the rim rises more or less vertically without any thickening. Lip flat and horizontal with rounded corners. The rim cross-sections given (pl. I, figs. 10, 11, 12, 13) are believed to represent a development from early to late.

Surface-finish.—Slip applied to exteriors as well as interiors; usually dull light gray, some pieces fired (or smoked in use?) to dark gray, others of a yellowish cast. Surface smooth, but seldom "slick" and never polished. Slip rarely crackled.

Ornamentation.—In dull black pigment like that of type *A*. The lips of bowls regularly are ticked at about $\frac{1}{2}$ -inch intervals with large dots of paint. Inner surfaces of rims bear zigzags, festooned lines, vertical or oblique dashes. The body designs are generally of band type both interior and exterior; framed above and below by single heavy lines with series of thinner framers between them and the decoration proper. The design system is comparable to that of Pajaritan biscuit (see "*K*" *passim*) the triangle, awanyu, double flag, cut-down rectangle, and hatched triangle, all appear. Zigzag decorations seem rare, nor have we noticed the cross-bird. The line break is uncommon or perhaps absent.

Paste Composition.—Not distinguishable from biscuit *A* in consistency, tempering or thickness; but pieces of yellowish shade are commoner and average brighter yellow.

3. *Modern Painted*

This ware bears so strong a family resemblance to the present-day decorated pottery of certain of the eastern pueblos, *viz.*, Santo Domingo, Cochiti, San Ildefonso and Tesuque, that did stratigraphical evidence not show it to be of late date its modernity

could safely be inferred on comparative grounds. The question of the ancestry of modern ware is discussed in the concluding section.

Rim-shape.—Bowls: very characteristic, high (from $\frac{1}{2}$ to 3 inches, average about $1\frac{1}{2}$ inches), and gently curved (see pl. I, figs. 14, 15, 16): lip flat with rounded edges. Small, shallow bowls with plain rims present but rare. Ollas: little data, but apparently always flaring with round lip (*cf.* pl. II, fig. 6).

Surface-finish.—Slip in two colors: red and yellowish-buff.¹ The former is a heavy soft coat, susceptible to wear and to chipping; it is very commonly crackled; usually well finished, often "slick," rarely glossy. The red slip is brighter than the reds of glazed ware, is softer and is brought to a *well-polished* surface. For range of the slips see under ornamentation.

Ornamentation.—In dull black pigment not distinguishable from that of biscuit, red paint used for fillings in a few cases. Zones: on bowls usually only the exterior of the rim, that surface being covered (from outer edge of lip down to the shoulder) with light slip to receive the design; in these cases the light slip is underlaid by the red slip which extends from 1 or 2 inches below the shoulder over the lip to (but seldom beyond) its inner edge. The whole interior of the bowl and its exterior bottom are left in the paste, which is only fairly well smoothed. A few bowls are decorated in the interior (as well as on the exterior) in which cases the light slip also extends over that surface. Ollas: little data as to zones; some apparently decorated in black over light slip from shoulder to lip; others in a narrow band about, or just above, shoulder. In all cases the polished red slip extends from well below the shoulder to well inside the rim, underlying whatever application there may be of the light slip. Design of exterior of bowl rims (insufficient data for ollas and bowl interiors) consists of a band, always framed below, and usually also above, by a single narrow line. Panelling and the repetition of a single element are characteristic. Terraced figures, cloud-festoons, birds (?) and what appear to be vegetal forms are common. Lines are thin and brushwork is somewhat more confident than in biscuit B.

Paste Composition.—Harder and less porous than biscuit but, like biscuit, light and "woodeny." Color occasionally dull orange throughout but most commonly very dark gray (almost black) in a central streak which changes to yellow and finally to orange toward the two surfaces. The yellow-orange surface streaks vary in thickness according, apparently, to the intensity of the firing. In most sherds they occur under both surfaces, but are usually stronger under the outer; in some cases they are present only below the outer one. Tempering of sand or broken rock so rare as to seem accidental where present; most pieces show a few small, pure-white flecks which are more striking in this ware than are the corresponding light flecks in the biscuit and black-on-white because of the

¹ Occasionally, though very rarely, pinkish as in the Tano specimens; "N," p. 177.

darker shades of the paste. Thickness of ware for bowls just less than $\frac{1}{4}$ inch; for ollas about $\frac{3}{16}$ inch.

II. GLAZE-PAINT WARES¹

I. *Two-color*

This class is identical with Agua Fria "Schoolhouse" pottery² and with Mr. Nelson's chronological Type II.³ It is characterized by decoration in thin black glaze applied over red or light colored slips. The red and the light varieties are considered as color phases of a single type because they are found together, are practically identical in vessel-forms, and are very similar in decoration. Mr. Nelson has shown that the red began to be made somewhat earlier than did the light-colored, and our own stratigraphical studies tend to confirm this.

Rim-shape.—Bowls: the general trend of the sides indicates a somewhat more open vessel than in black-on-white or biscuit. The rim is invariably unthickened and plain, the lip tending to squareness, particularly in the yellow examples (pl. I, figs. 19, 20). The modeling of pieces is very precise and even, the least asymmetry in thickness or in line being unusual. Ollas: rim always straight, with no thickening or flare at the lip (the outline given in plate 2, fig. 1, is characteristic).

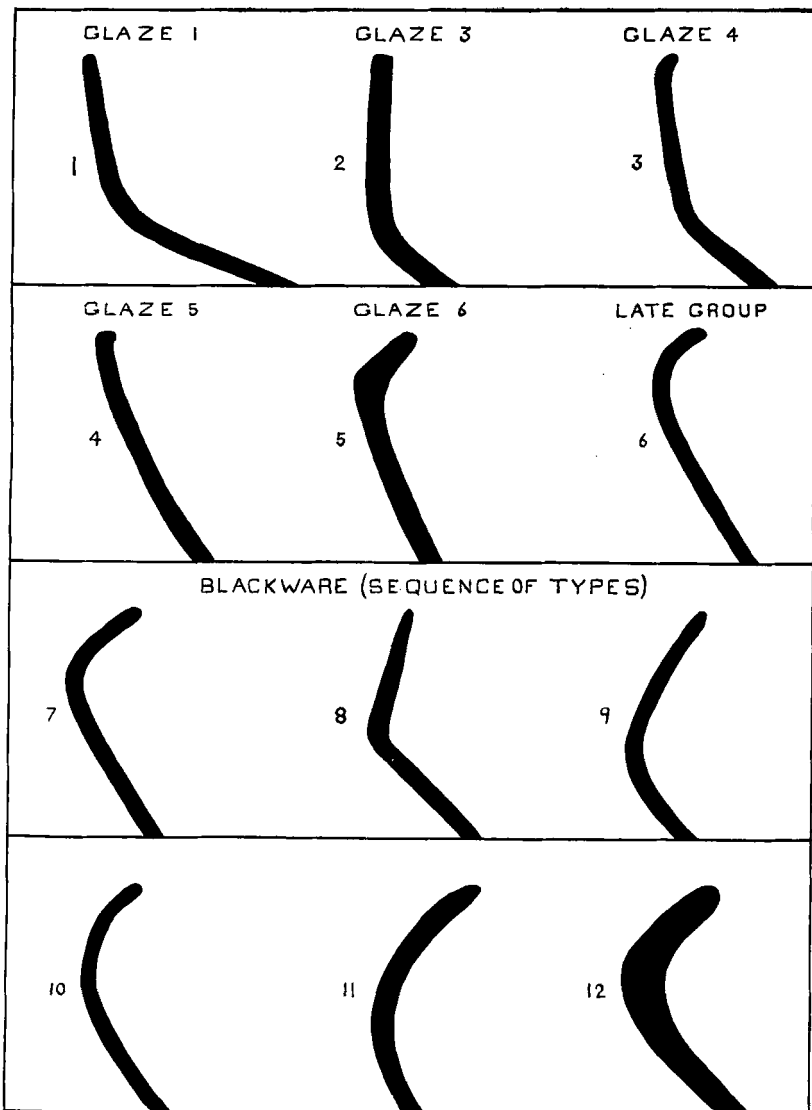
Surface Finish.—Slip; a relatively heavy coat; either a deep rich red; or a light color, varying from light gray to clear lemon-yellow. It seems to cover all surfaces of bowls and whole exterior of ollas. Excellently smoothed, but not polished; no crackling.

Ornamentation.—Glaze-paint. On light colored pieces the glaze is usually thin and "varnishy"; holds well to its lines with little or no running. The most brilliant, lustrous, and blackest glaze occurs on light gray or whitish pieces; on yellower surfaces it is browner, less lustrous and more "varnishy." The glaze, when applied over the red slip, is black, except where thin (then brownish); when extra thick it tends to draw together in little flat "beads," which are very characteristic. Zones of decoration: bowls, interior only (a few oblique dashes or crosses are the sole form of exterior ornament); ollas, upper body from shoulder to base of rim, latter undecorated. Arrangement: a single broad, horizontal band for ollas; the same for all (?) red and some light bowls; many light bowls have designs in the form of long, thin, intensively ornamented triangles which are set horizontally just below the rim (for a good illustration see "N," pl. VII, fig. 5). Elements: geometric and strictly rectilinear; opposed key figures,

¹ For discussions of the distribution of these wares see "N," p. 160; "K," pp. 453 ff.

² "K," p. 447.

³ "N," p. 172.



OLLA-RIM SECTIONS

hatching, stepped lines, dotted checkerboard, series of small right triangles depending from lines (*cf.* Nelson's description, p. 173). Brushwork even and confident; lines narrow and true.

Paste Composition.—Hard and ringing when struck. Color very variable: gray, yellowish-gray, yellow or even orange; some pieces have a gray central streak with yellow-orange layers under one or both surfaces. No gross tempering, fine white flecks sown thicker than in black-on-white or biscuit. Thickness of ware: bowls $\frac{3}{8}$ inch on the average; ollas a trifle less.

2. *Transitional*

In our preliminary classification, this type was set up as a sort of catch-all for pieces that did not accord well with the standards which were being used for the separation of Types 1 and 3. When these pieces were examined together it was seen that, with some exceptions, they formed not merely a collection of unclassifiable examples or chance variants from the normal of the two types, but a true class technically intermediate between them. In many ways the ware is very similar to "Frijolito" pottery ("K," p. 451).

Rim-shape.—Bowls (ollas not as yet surely recognized): even sides, that is with only one curve for each surface, but with more or less strongly thickened rims. The thickening is always on the inside and is always greatest at the edge of the lip; hence the lip itself is flat; it is also horizontal (see pl. I, figs. 22, 23, 24).

Surface-finish.—Slip usually yellowish or pinkish-gray; red slip rare. Is of poorer quality than Type 1, tending to rub and wear off, showing the reddish paste. The light slip covers whole interior of bowls, and exterior except for the bottom, which is red. Surfaces less smooth than in Type 1.

Ornamentation.—Glaze thin, black, and not often "runny." Is seldom highly lustrous, and has often failed to "take" at all, being merely dull black. Zones: the interior and exterior of bowls. Interior decoration always apparently of band type, framed above and below by single broad lines; elements somewhat simplified in comparison to Type 1 (see illustrations of pottery of a very similar nature in "K," pl. xxviii, fig. 4). Exterior decoration in the form of crosses, oblique marks, or red-filled double-ended key figures.

Paste Composition.—Not noticeably different from that of Type 1, except in greater thickness of the ware.

Summary.—Type 2 resembles Type 1 and differs from 3 in: shape (even sides); yellower average color of slip; quality of glaze. It differs from 1 and resembles 3 in: outside decoration; red-filled designs. It resembles neither in: thickened but flat-topped bowl rims. Its transitional nature is most clearly seen in the interior decoration, which lies midway between 1 and 3; in the simplification of design and in the coarsening of the brushwork.

3. *Early Three-color*

Although many pieces of the preceding type show three-color decoration, the practice of using red fillings between glaze lines over a light slip does not become firmly established until we reach the present type. This ware, with our Types 4 and 5, makes up Mr. Nelson's Type III ("Three-color glazed ware;" "N," p. 173); those pieces of our Type 2 which have three-color decoration he places in his Type III; those without three colors he assigns to his Type II (see fourth bowl-rim from the left under Type II in his fig. 21).¹

Rim-shape.—Bowls: almost infinitely variable in minor details of curve and proportion, but always thickened *on the interior a little below the lip*, and almost always having on the exterior opposite the thickening a more or less pronounced outcurve (pl. I, figs. 26, 27). A very few pieces have evenly curved exteriors (fig. 25). Ollas: the rim rises almost vertically (pl. II, fig. 2) or with a very slight inward trend; there is seldom any thickening or modification of the lip.

Surface-finish.—Slip of yellowish or pinkish-gray but of more pallid shades than in Type 2. Many pieces are of a bluish or slaty gray-white; this is evidently due to overfiring and is most commonly seen on exteriors of bowls near their rims; fire clouds common. Slip does not crackle, but wears and chips rather badly. Slip covers whole of bowls except exterior bottom and whole exterior of ollas from the inside of the spring of the neck to just below shoulder; the bottom being red. Finish markedly inferior to Type I, almost never "slick."

Ornamentation.—Glaze averages brown in color (green and black variants) is heavy and shows some tendency to run. It is usually highly lustrous, but the luster is uneven, being finest where the glaze is heaviest and dying down to a "varnishy" appearance where it is thin. Little blow-holes (due to gas bubbles probably) appear in some heavily glazed lines and are yellow or greeny brown. Lines of decoration heavy and no fine-line work occurs. Ollas have red-filled ornaments about the neck; plain ornament on body from base of neck to shoulder. Bowls: red-filled exterior decoration, plain ornament in interior; the inner surface of the flare of the rim is very often marked with a single heavy zigzag line, less commonly with oblique dashes or parts of zigzags. The interior decorations of bowls and the body designs of ollas are usually horizontal bands, framed above and below with pairs of heavy lines (not red-filled). The bands are panelled by upright lines, and the resultant spaces filled with oblique elements of simple nature.

¹ Reliance upon a single classificational criterion has led Mr. Nelson to misplace one of the ollas in his chronological series (pl. VII). The piece in question is two-color, and he has accordingly grouped it with Type II; its rim-shape and decoration, however, show that it really belongs in his Type III and our Type 4. It is, as a matter of fact, a later piece even than his Type III example.

The "Pajaritan bird" is absent. The exteriors of bowls are always decorated with some form of red-filled key or bird figure.

Paste Composition.—The body of the ware is compact and hard. There is a central gray streak becoming brown or reddish-yellow toward the two surfaces. Most sherds show considerable gross tempering in the form of crushed basaltic (?) rock. Thickness of bowl-walls averages $\frac{3}{8}$ inch, ollas a trifle less.

4. Pajaritan Three-color

As its name implies, this ware is similar to the commonest glazed pottery of the Pajarito plateau (that found at Tyuonyi, Tschirege, Otowi, Tsankawi, Puyé).¹ At Pecos it is not very abundant, and its exact place in the ceramic series is not yet clear. It evidently occurs in the Galisteo basin, a typical olla being figured by Mr. Nelson (pl. VII, fig. 6).

Rim-shape.—Bowls: very high, thickened, and with rounded lip; exterior of rim generally flattish (pl. I, figs. 28, 29), rarely a trifle concave; inner side always has a long, even, convex curve. Ollas: rim straight but inclines a little inwards, lip usually recurved outwards (pl. II, fig. 3).

Surface-finish.—Slip in varying shades of light red (very rarely pinkish white), covers all surfaces of bowls, and exteriors of ollas from bottom of interior of rim to well below shoulder, perhaps also bottom. Is carefully smoothed, but seldom "slick" and never glossy.

Ornamentation.—Pigment is black to brown glaze with a high average lustre and fair tractability (not much running). Fillings of many designs are in a red paint much darker in color than the slip. Zones of decoration: interiors of bowls, from base of standing rim downwards; exteriors, from just below rim-edge to about one inch below the under-curve of the bowl-body. Ollas: the exterior of the neck and the upper-body, the two usually being treated as distinct zones. Interior of bowl-rim generally plain, sometimes bears a zigzag line as in Type 3. Bowl-design: interiors have bands or, less commonly, "all-over" patterns. The former are framed with two lines above and two below, each set red-filled. The figures in the bands and in the "all-over" decorations are also often red-filled. Bands are regularly panelled by sets of vertical bars, the panels bearing alternating elements, usually birds and oblique figures (see "K," pls. XXII-XXIV). Exterior decoration generally in the form of a double line filled with red drawn about bowl below standing rim; from it rise at intervals, birds or other elements, often red-filled. Independent repeated units (*i. e.*, not attached to a line), such as double-ended keys and three-finger designs ("K," pl. XXV and fig. 19) are only fairly common. Olla-design: as a rule the neck decoration follows that of the bowl-exterior; body decoration that of the bowl-interior.

¹ Described with illustrations in "K," pp. 417-447.

Paste Composition.—Not distinguishable from that of Type 3 in color, but some examples have considerable gross tempering in the form of smooth-edged bits of quartz (water-worn?). Average thickness of bowl-walls $\frac{3}{16}$ inch, of ollas a very little less.

5. *Late Three-color*

This is by far the commonest single type found at Pecos; it never occurs, as far as we know, in the Pajarito ruins; the heavy bowl-rim illustrated by Mr. Nelson among his Type III examples (third from the left, fig. 21) seems to show that it is present in the Galisteo basin.

Rim-shape.—Bowls: low, very thick, and strongly incurved; interior of rim more or less convex, according to amount of thickening; lip rounded (see figs. 30, 31, 32). Ollas: the rim continues the curve of the vessel-body without abrupt change of angle, the lip is flat-topped, with a slight flare (fig. 4, pl. 2). Ollabowls: these are bowls with such restricted apertures as to approach the olla form (see "K," pl. XVII, fig. 3; and "N," fig. 21, second from the right, top row). At Pecos this form seems to be present only in the Type 5 glazes. In shape of rim the examples are closely similar to the one figured by Mr. Nelson.

Surface-finish.—Slip-color dirty white (commonest), through cream to yellow; rarely red. Slip covers the whole interior of bowls, and exterior nearly to bottom (which is either unslipped, or painted with a thin red wash); ollas, light slip from inside of lip to just below shoulder; bottom, and inside of rim, red. The light slip is a heavy coat, the thickness of writing paper; it is soft, and wears badly; crackles only in heavily overfired pieces. Finish averages poor.

Ornamentation.—The pigment is a very heavy glaze, which varies from dull and "crusty," to a fine lustrous brown with iridescent lights; where it runs out thin it is light-green to canary-yellow. The drips and runs of the glaze are always toward the rim. Red fillings are in a thick, soft pigment which frequently flakes off. Decorative zones: bowls; interior, and upper part of exterior; ollas, neck and upper body. Bowl-design on exterior consists of a red-filled double line encircling the vessel a little below the rim, with crudely drawn red-filled figures, usually birds, perched upon it; a variant of the three-finger decoration ("K," fig. 19), made to imitate the human face, is common; double-ended keys are apparently absent. The inner decoration of bowls is seldom more than a pair of red-filled lines running about the pot just below the rim-swelling. Ollas: data insufficient, consists apparently of simple red-filled bands and very crude bird figures. All lines are heavy and carelessly drawn, the potters evidently having realized that the glaze would run in firing and spoil any attempt at fine work.

Paste Composition.—Color: those pieces which have the clearest yellow slip and the most lustrous glaze, are light gray clear through; those with poor glaze and slip are brownish-gray in the center and reddish toward the edges. The paste is granular and "sandy," rather thickly tempered with small, dull-white masses

(ground-up sherds?); there are sometimes a few grains of quartz. Average thickness for both bowl- and olla-walls, a little less than $\frac{1}{4}$ inch.

6. *Degenerate Glaze*

This type corresponds to Mr. Nelson's Type IV. As he points out (p. 175), it is of historic date, and is characterized by diversity of form and by execrable decoration. The ware has so far proved to be much less common at Pecos than at San Cristobal and San Marcos, and to be represented by a smaller range of forms, nothing but bowls and ollas having been found. Our excavations, however, have not yet penetrated to those parts of the site which contain the largest amounts of degenerate glaze.

Rim-shape.—Bowls: extremely varied, but in general there is little thickening (as compared to Type 5), the rims are high, usually nearly vertical, and have a tendency toward reverse curves. A series of four rim-sections is given (pl. I, figs. 33-36); these represent the commonest forms, but no two bowl-rims are ever quite identical. Ollas: the neck continues the slope of the body without abrupt change of angle, the rim is thickened, and the lip is strongly outcurved (pl. II, fig. 5).

Surface-finish.—Slip usually light colored, less commonly red. The light slip is very variable in shade: gray, greeny-gray, pinkish, cream, yellow; it covers the whole interior of bowls, and the exterior nearly to the bottom, which is painted red. Ollas: light-slipped from just within the rim to a little below the point of greatest diameter, bottoms red. Finish generally poor, irregular and "scrapy."

Ornamentation.—The glaze is thick, heavy, and extremely "runny." In color it is usually dark green or dark brown, but where thin is often light green or even yellow. Many examples are dull and poor; where the glaze has "taken" well, however, it is beautifully lustrous. All attempt at precise design is abandoned, the decoration consisting of crude zigzags, blobs, dashes, etc., applied to the exteriors and interiors of bowls and the upper parts of ollas (see "N," pl. VII, figs. 1 and 2). There are no red fillings.

Paste Composition.—Variable. Color generally dark gray throughout. Some pieces are very heavily tempered with bits of crushed quartz, others have no tempering beyond a few light-colored flecks. Vessel-walls average thinner than in Type 5.

III. UNDECORATED SMOOTH WARE

I. *Polished Black*

Pottery with high-polished, lustrous black surfaces is found, in the Southwest, on the lower Gila (Arizona), in the Casas Grandes district (Chihuahua), in the Socorro region of New Mexico, and at

Pecos; it is also made today at the pueblo of Santa Clara. The significance of this peculiar and seemingly patchy distribution has yet to be worked out. At Pecos the ware is surely late and is probably all of historic date.

Rim-shape.—Ollas: (bowls very rare) the rim flares out strongly and has a rounded lip (pl. 2, fig. 6).

Surface-finish.—Slip deep black in most cases, occasionally slate-gray; covers whole exterior and runs down about an inch inside the rim. The characteristic polishing of the surface extends from within the rim to well below the shoulder (possibly also over under-body and bottom); the average pieces are only fairly well polished, the best have a perfectly even texture and high sheen.

Paste Composition.—Color deep chocolate brown to almost jet black; thickly tempered with very fine particles of what seems to be pounded quartz; this gives the paste a granular or sandy appearance. The ware is a little harder than biscuit, but like biscuit has a "wooden" feel. Average thickness $\frac{1}{8}$ inch.

2. Plain Red

This ware may be distinguished, even in small sherds, from undecorated red fragments of other classes (such as the bottoms of Types 3, 5, and 6 glaze ollas, bits of Type I red bowls, etc.) by its highly polished surfaces and by the color and "feel" of its paste.

Rim-shape.—Bowls: much like modern (see pl. I, fig. 18) for larger specimens; the smaller bowls (fig. 17) have lower rims with sharp or rounded lips. Ollas do not differ in rim-shape from polished black (*cf.* fig. 6, pl. II).

Surface-finish.—Slip bright red; covers whole interior of bowls, and often the whole exterior as well, the bottoms of some examples are left unslipped. Ollas: the slip runs from within the rim nearly or quite to the bottom. The finish ranges from indifferent to very highly polished, the finest specimens are always ollas.

Paste Composition.—Apparently exactly the same as modern (*q. v.*).

IV. BLACKWARE

The black cooking pottery, as well as the finer, colored ware underwent changes during the occupation of Pecos. These changes, however, were very much less radical than those in the other classes, and took place so slowly that, while there are quite obvious differences between the earliest and the latest sherds, the intermediate stages can only be made out by placing a number of pieces from each stratigraphical layer side by side and considering them, so to

speak, in the mass. By doing this several successive styles may be recognized. There are, however, so many unclassifiable fragments (presumably from the bottoms and lower sides of the ollas) that we have not attempted statistical treatment of the blackware types, but give instead a sort of running account of the development of the ware, beginning with the earliest known style.

Indented Corrugated—This is not found at Pecos proper, but is present at other nearby sites. It is the local representative of the very widespread archaic cooking pottery of the Southwest; pottery made by laying up on itself coil by coil a continuous thin strand of clay, all traces of the coil being obliterated on the interiors of the vessels, but no smoothing at all being done on their exteriors. Thus, in well-made pieces (and the proportion of these is remarkably high) the coil on the exterior is sharp and definite, each turn being clearly distinguishable. Further, the coil was notched or indented at short, regular intervals during its application to the growing vessel, producing a curious, almost textile, appearance.¹ Such is the earliest cooking pottery of which we now have knowledge in the Pecos valley; it does not occur at the main ruin. There, in the lowest levels of the rubbish heaps, we find a coiled ware which lacks the indented marks and is called, accordingly, *plain corrugated*. This is obviously a simplified form of the preceding one; in fact the whole earlier development of blackware at Pecos is a progressive simplification, the visible signs of the structural coil being steadily eliminated. The next stage we have called *blind corrugated*; the vessels of this class still show the horizontal coil-ridges, but the latter have been so smoothed over in finishing that the sharp cracks between them have been obliterated. Three successive subtypes are recognizable: the *strong*, *medium*, and *faint*. In the latter the coil-ridges have been so nearly destroyed that the surface of the ware shows merely a faint rippling, so slight as to be perceptible only when the light falls across it at a very low angle. In *featureless black*, the next type, all trace of corrugation has disappeared, the vessel exteriors having an even though rough texture. The latest blackware so far identified is the *striated*; there is, of course, no sign of the coil, but the surface is scored with series of fine and more or less parallel scratchings, crisscrossing over each other in all directions. These were produced, evidently, by some finishing tool used while the clay was moist. Experiment shows that a corncob with the kernels removed most nearly duplicates these marks.

Blackware may also be classified on the basis of rim-shape; but, as was the case with surface-texture, the principal types merge into each other very slowly. Type *A* (pl. II, fig. 7): sharply flaring, but with a well-rounded curve between body and rim. Type *B* (fig. 8): very straight rim with sharp break in

¹ For a fuller description of the process, with excellent illustrations see Holmes, "Pottery of the Ancient Pueblos," *Fourth Annual Report Bureau of American Ethnology*.

angle from body, less flare than in any other type. Type *C* (fig. 9): rim still straight, but higher, with more flare, and with less abrupt (though still noticeable) break in angle. Type *D* (fig. 10): high rim, evenly curved flare. Type *E* (fig. 11): heavy ware, even curve, wider flare. Type *F* (fig. 12): *thickened* rim, very sharp flare, solid construction.

These six rim-types seem to correspond stratigraphically in a general way to the six surface-texture types (striated with *F*, featureless with *E*, faint blind-corrugated with *D*, etc.). Both series of types, however, are vague at best, so that single black sherds cannot be relied upon as sure evidence for the dating of strata or deposits; but masses of them sufficiently large to enable one to discount minor variations and to judge of their average character, would undoubtedly be of value.

STRATIGRAPHICAL

Having classified the wares, we must turn to stratigraphy for our determination of their chronological order. Material for this study was gathered by means of test sections similar to those made by Mr. Nelson; columns of rubbish running from surface to hardpan were isolated, and from them was taken their entire pottery content, the fragments from the different levels or cuts being kept separate. The Pecos tests were not divided into exactly equal cuts, as was done by Mr. Nelson, but were laid out in nearly equal divisions based on sand, ash, or other strata which indicated actual levels of deposition during the formation of the mound. This was necessitated by the fact that the Pecos deposits were for the most part laid down on sloping or irregular surfaces, and cuts made on arbitrarily chosen plane levels would have resulted in the splitting or cross-cutting of strata. This method derogates from the absolute statistical value of the material, as the cuts, not being of exactly equal thickness, are not strictly comparable statistically. The cultural results, for which these tests were taken, are, however, satisfactory; and even the statistical outcome seems fairly significant. Columns of debris have been saved intact in all parts of the heap, so that more exactly subdivided sections can be taken if desired.

Of the four tests here considered, three (whole series nos. x, xi, xii) are from the great rubbish heap on the east slope of the Pecos mesa. The earth-column of test x was 20 feet long, 5 feet wide, and 18 feet high; its eight cuts (numbered as in all the others

from top to bottom) averaged 2 feet 3 inches in thickness. Tests XI and XII were each 25 feet long, 5 feet wide, and 12 feet high, XI had seven cuts of about 1 foot 8 inches in thickness; XII, eight cuts of 1 foot 6 inches. These tests were made very large in area in order that we might get a great amount of sherds for the preliminary study, and also to neutralize as far as possible the disturbing effect of graves, from which no part of the eastern heap is entirely free. The fourth test (XIII) was made in a midden below the northwest corner of the main pueblo; it was approximately 3 feet square, by 4 feet high, and had seven 7-inch cuts. This section was gone through with greater care than the other three, even the tiniest sherds being saved.¹

The material was handled as follows: the sherds from each cut were classified according to ware and to vessel-forms, and the numerical results entered under the headings given in the accompanying tables (nos. I, III, V, VII). Further, the glazed bowl-rim sherds were subjected to closer study (for a purpose which will be made clear below); they were classified, counted, and the results entered in tables II, IV, VI, and VIII. Finally one set of charts was prepared to illustrate graphically the distribution in percentages of the principal wares (*i. e.*, all black, all glaze, all biscuit, etc.); and another set to show in the same way the range of the types of glaze.

Looking at the four ware-charts, we see that each one of them contains two approximately normal frequency curves: (1) for glaze; (2) for biscuit. All show black-on-white very strong at the beginning and declining rapidly as glazed ware rises. Furthermore, each one exhibits the start of three other curves: those for modern painted; plain red; and polished black. The line representing rough black runs more or less irregularly across each chart.

Blackware as a class obviously has no chronological significance. It was evidently a somewhat variable, but nevertheless constantly important factor in the total ceramic output of the pueblo during its whole occupation.² As to the meaning of the tendency of the

¹ In X, XI, and XII no fragment less than $\frac{3}{4}$ -inch across was kept; pieces smaller than this can seldom be accurately classified.

² We leave out of consideration the sub-types of blackware; these are without doubt chronologically significant, but our data are not yet sufficiently full to allow us to recognize them with certainty.

TABLE I
TEST X

Cut No.....	Number of Sherds								Approximate Percentages							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Black olla rim ¹	44	28	36	28	26	10	38	4	9	5	6	3	4	2	6	3
Black olla body.....	237	236	173	269	151	109	164	29	46	46	29	34	25	25	26	22
Polished black ²	51	19	2						10	4	× ⁶					
Late plain red ³	87	51							17	10						
Modern painted ³	14	11	3						3	2	×					
Glaze bowl rim.....	19	32	93	85	82	42	32	1	4	6	15	11	13	10	5	1
Glaze bowl body.....	28	56	139	169	129	102	95	2	5	11	23	22	21	23	15	2
Olla-bowl ⁴	1	4	2						×	1	×					
Glaze olla rim.....	2	3	7	12	10	5	6		×	1	1	1	2	1	1	
Glaze olla body.....	20	62	105	152	126	113	53		4	12	17	18	21	26	8	
Biscuit B bowl rim..		4	6	10	12	6	5		1	1	1	1	2	1	1	
Biscuit B bowl body.	1	4	24	37	34	10	4	1	×	1	4	5	6	2	1	1
Biscuit A bowl rim..			2	5	9	10	16				×	1	1	2	3	
Biscuit A bowl body.	4		4	22	24	33	61		1		1	3	4	7	10	
Biscuit olla ⁵			8	9	3						1	1	×			
B.-on-W. bowl rim...	1		6	4	1	1	47	28	×		1	×	×	×	7	21
B.-on-W. bowl body.	6	1	4	4	4	6	104	60	1	×	1	×	1	1	16	46
B.-on-W. olla.....					2		9	6					×		1	4
Totals.....	515	511	614	806	613	447	634	131	100	100	100	100	100	100	100	100

¹ Only ollas occur.² Only ollas occur; body and rim sherds listed together.³ Bowls and ollas; body and rim sherds listed together.⁴ Glazed ware; body sherds of olla-bowls are not certainly distinguishable from those of undecorated bowl body sherds, hence only rims are listed.⁵ We cannot yet distinguish Biscuit A ollas from Biscuit B ollas.⁶ Present, but less than one half of one per cent.TABLE II
OCCURRENCE OF GLAZED WARE TYPES AS SHOWN BY BOWL-RIMS. TEST X.

Cut No.....	Number of Sherds								Percentages							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Type 6.....	4	1	1						.7	.1	.2					
Type 5.....	10	15	15						1.9	2.9	2.4					
Type 4.....		6	22							1.1	3.5					
Type 3.....	2	5	44	32	5	2			.3	.9	7.1	3.9	.8	.4		
Type 2.....	1	3	8	35	57	2			.1	.5	1.3	4.3	9.5	.4		
Type I (yellow)....	2	2	2	10	14	28	15		.3	.3	.3	1.2	2.2	6.2	2.3	
Type I (red).....			1	8	6	10	17	1			.2	.9	.9	2.2	2.6	.7
Totals.....	19	32	93	85	82	42	32	1	3.3	5.8	15.0	10.3	13.4	9.2	4.9	.7
Type I (both phases)	2	2	3	18	20	38	32	1	.3	.3	.5	2.1	3.1	8.4	4.9	.7

TABLE III

TEST XI

Cut No.....	Number of Sherds							Approximate Percentages						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Black olla rim.....	59	38	23	16	27	15	4	10	8	6	7	6	4	6
Black olla body.....	165	116	56	64	92	75	17	29	23	16	30	20	21	27
Polished black.....	41	15	1					7	3	×				
Late plain red.....	54	32	1					9	7	×				
Modern painted.....	21	18	1					4	3	×				
Glaze bowl rim.....	105	116	92	42	79	61	1	18	23	25	20	17	17	2
Glaze bowl body.....	68	73	76	50	115	82	2	12	15	21	23	25	23	3
Alla-bowl.....	7	12	12	4				1	2	4	2			
Glaze olla rim.....	12	19	19	2	8	9		2	4	5	1	2	3	
Glaze olla body.....	44	62	83	28	53	50		8	12	23	13	12	14	
Biscuit B bowl rim.....	1		1	5	16	4		×		×	2	3	1	
Biscuit B bowl body.....	1	1		3	46	9		×	×		2	10	2	
Biscuit A bowl rim.....				1	3	13	1				×	1	4	2
Biscuit A bowl body.....					8	27	3					2	8	5
Biscuit olla.....					6							1		
B.-on-W. bowl rim.....				1	2	4	7				×	×	1	11
B.-on-W. bowl body.....				1	6	8	23				×	1	2	37
B.-on-W. olla.....	1				1	1	4	×				×	×	7
Totals.....	579	502	365	217	462	358	62	100	100	100	100	100	100	100

TABLE IV

OCCURRENCE OF GLAZED WARE TYPES AS SHOWN BY BOWL-RIMS. TEST XI

Cut No.....	Number of Sherds							Percentages						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Type 6.....	16	11	1					2.7	2.1	.2				
Type 5.....	83	101	74	15	3			14.3	20.1	19.1	6.8	.6		
Type 4.....	2	3	12	17				.3	.6	3.2	7.8			
Type 3.....	2	1	2	8	58	5		.3	.1	.4	3.6	12.5	1.5	
Type 2.....			1	1	10	20				.2	.4	2.1	5.5	
Type 1 (yellow).....			1		4	21				.2		.8	5.8	
Type 1 (red).....	2		1	1	4	15	1	.3		.2	.4	.8	4.1	1.6
Totals.....	105	116	92	42	79	61	1	17.9	22.9	23.5	19.0	16.8	16.9	1.6
Type 1 (both phases).....	2		2	1	8	36	2	.3		.4	.4	1.6	9.9	1.6

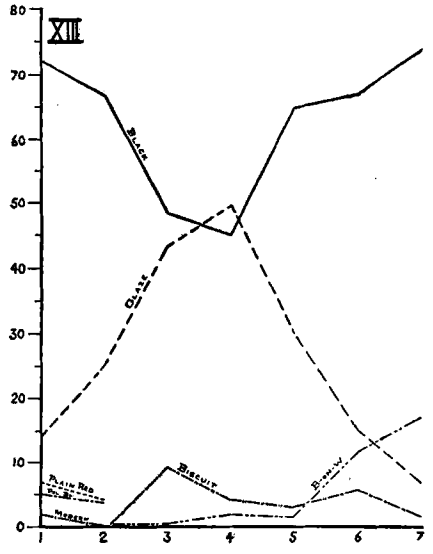
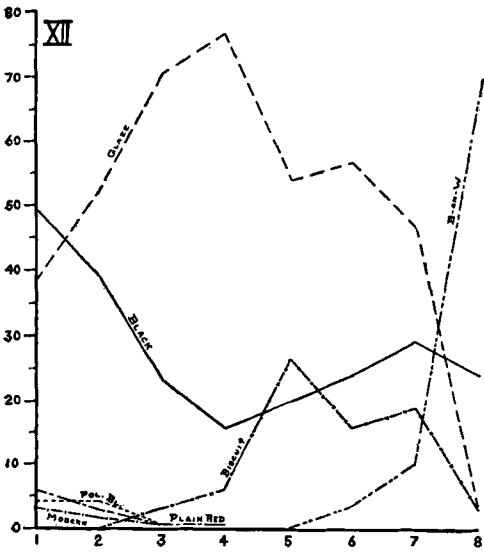
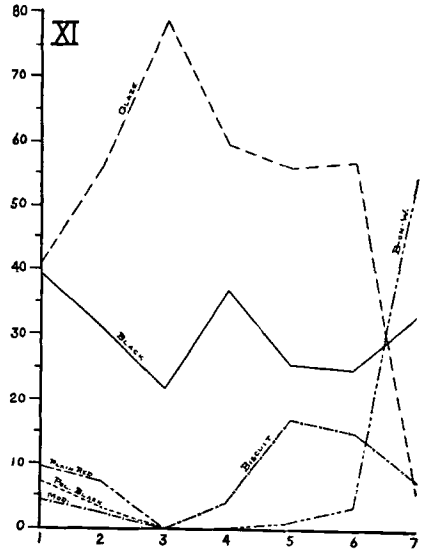
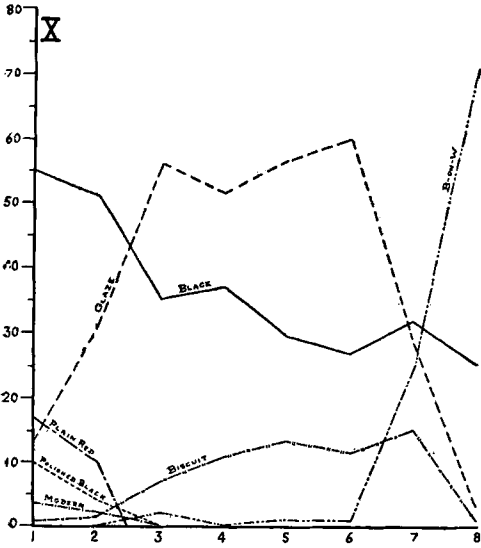


FIG. 54.—Charts illustrating graphically the distribution in percentages of the principal wares.

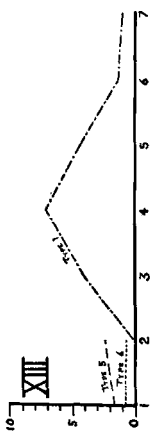
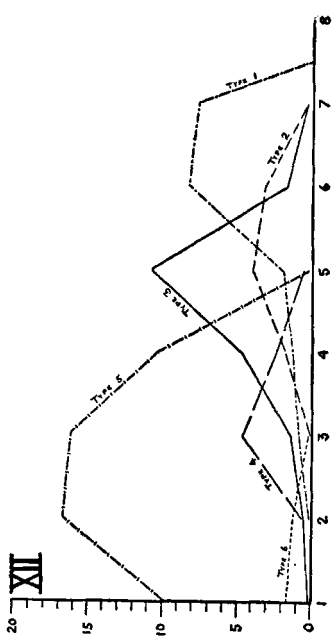
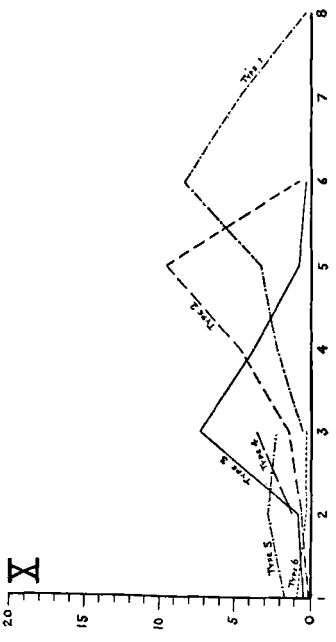
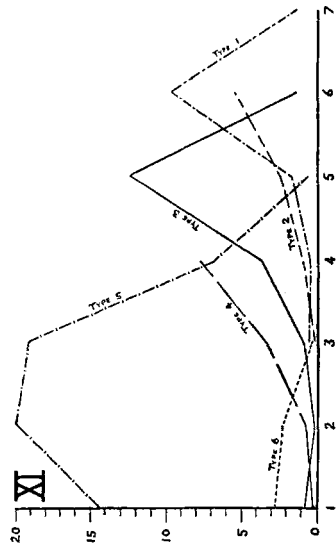


FIG. 55.—Charts illustrating the range of the types of glaze.

TABLE V
TEST XII

Cut No.....	Number of Sherds								Approximate Percentages.							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Black olla rim.....	41	132	32	6	20	31	10	6	11	11	7	4	5	5	4	7
Black olla body....	143	335	75	20	63	128	66	14	38	28	16	12	15	19	25	17
Polished black.....	14	54	3						4	4	1					
Late plain red.....	20	23	4	2					6	3	1	1				
Modern painted....	11	25	4						3	2	1					
Glaze bowl rim.....	43	232	114	34	74	83	23	2	12	19	23	21	18	13	9	2
Glaze bowl body....	53	201	104	55	88	131	49	1	14	17	21	33	21	20	18	1
Olla-bowl.....	2	34	15	3					1	3	3	2				
Glaze olla rim.....	2	20	20	6	10	17	4		1	2	4	4	2	3	2	
Glaze olla body....	35	131	94	29	53	141	35		10	11	20	17	13	21	13	
Biscuit B bowl rim.		5	2	1	16	8	1		×	×					1	×
Biscuit B bowl body	1	1	9	1	65	42	4	1	×	×	2	1	16	6	2	1
Biscuit A bowl rim.				2	3	21	13	2				1	1	3	5	2
Biscuit A bowl body	1		5	3	8	36	32		×		1	2	2	6	12	
Biscuit olla.....		1		1	12	3			×		1	3	×			
B.-on-W. bowl rim.		1			2	5	9	18	×			×		1	3	21
B.-on-W. bowl body		1			2	13	15	40	×			×		2	6	48
B.-on-W. olla.....							3	1							1	1
Totals.....	366	1,196	481	163	416	659	264	85	100	100	100	100	100	100	100	100

TABLE VI
OCCURRENCE OF GLAZED WARE TYPES AS SHOWN BY BOWL-RIMS. TEST XII

Cut No.....	Number of Sherds								Percentages							
	1	2	3	4	5	6	7	8 ¹	1	2	3	4	5	6	7	8
Type 6.....	6	16	1						1.6	1.3	.2					
Type 5.....	36	201	78	17	1				9.8	16.7	16.2	10.4	.2			
Type 4.....		8	23	4	2					.6	4.7	2.4	.4			
Type 3.....	1	6	7	8	46	7	1		.2	.5	1.4	4.8	10.9	1.7	.3	
Type 2.....			1	3	17	21	1			.2	1.8	4.0	3.1	.3		
Type 1 (yellow)....		1	2	2	6	28	7			.1	.4	1.2	1.4	4.2	2.6	
Type 1 (red).....			2		2	27	14				.4		.4	4.0	5.3	
Totals.....	43	232	114	34	74	83	23		11.6	19.2	23.5	20.6	17.3	13.0	8.5	
Type 1 (both phases)		1	4	2	8	55	21		.1	.8	1.2	1.8	8.2	7.9		

¹ The two glazed bowl rims in cut 8 were too battered for identification.

TABLE VII

TEST XIII

Cut No.....	Number of Eherds							Approximate Percentages						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Black olla rim.....	26	26	2	6	12	22	16	4	3	1	3	3	4	5
Black olla body.....	415	472	87	90	254	320	234	68	64	47	42	62	63	69
Polished black.....	43	33						7	4					
Late plain red.....	30	29						5	4					
Modern painted.....	11	4						2	×					
Glaze bowl rim.....	16	26	8	15	19	8	5	3	3	4	7	5	2	1
Glaze bowl body.....	45	97	36	45	59	41	16	7	13	19	22	14	8	5
Olla-bowl.....		2							×					
Glaze olla rim.....		3	3	2	3				×	1	1	1		
Glaze olla body.....	25	65	35	39	44	26	4	4	9	19	19	10	5	1
Biscuit B bowl rim.....	1		2						×		1			
Biscuit B bowl body.....	1		3	3	1				×	2	1	1		
Biscuit A bowl rim.....		3	1	1					×	1	1			
Biscuit A bowl body.....		3	10	4	12	29	9		×	5	2	2	6	2
Biscuit olla.....														
B.-on-W. bowl rim.....		1		3	2	5	14		×		1	1	1	4
B.-on-W. bowl body.....	3	1	1	2	6	51	38	×	×	×	1	1	10	11
B.-on-W. olla.....				1		4	5				×	×	1	2
Totals.....	616	766	188	211	412	506	341	100	100	100	100	100	100	100

TABLE VIII

OCCURRENCE OF GLAZED WARE TYPES AS SHOWN BY BOWL-RIMS. TEST XIII.

Cut No.....	Number of Sherds							Percentages						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Type 6.....	6	6						.9	.8					
Type 5.....	10	17						1.7	2.2					
Type 4.....														
Type 3.....														
Type 2.....														
Type 1 (yellow).....		2	5	11	8	2		.2	2.6	5.2	1.9	.5		
Type 1 (red).....		1	3	4	11	6	5	.1	1.5	1.9	2.6	1.0	1.4	
Totals.....	16	26	8	15	19	8	5	2.6	3.3	4.1	7.1	4.5	1.5	1.4
Type 1 (both phases).....		3	8	15	19	8	5	.3	4.1	7.1	4.5	1.5	1.4	

blackware curves to dip toward the middle of the charts, and to rise toward their upper ends, we cannot attempt to judge. The total frequency of black relative to other wares seems to depend on the size of the sherds collected. Black vessels break into very many very small fragments, so that if only sherds of 3 inches square were kept, black would fall to almost nothing; whereas if the most minute bits were saved it would rise to well over 65 per cent. An example of this is seen in the plot of test XIII, a section including small fragments.

Black-on-white ware is shown in each chart to drop rapidly from a high initial percentage, its appearance in very small quantities in the middle and upper cuts (as in test x) being due, probably, to churning of the heaps during deposition, or to the dumping of old rubbish from the mesa top. In no case does black-on-white make a respectable showing after the real beginning of the rise of glaze.

Glazed ware is represented by normal frequency curves in all the charts, rising from practically nothing at the bottom, to a high percentage at or somewhat beyond the middle, and declining toward the end little less rapidly than it rose. Although no test is free from glaze in its lowest cuts, nor does any one show the entire extinction of glaze as a ceramic trait, we believe, from evidence other than stratigraphical, that there was a short period at the beginning when the art was not practised, and that no glazed ware was made during the closing years of the occupation of Pecos.

The curves for biscuitware are comparable to those for glaze; both rise together, and both tend to have similar contours. There are, however, these important differences: (1) that biscuit is always a minor or secondary ware in point of frequency; (2) that while glaze runs as far as or even beyond the upper limits of each test, biscuit has a considerably shorter life, its curves becoming negligible in every case while those for glaze are near their highest points.

The remaining three curves: those for polished black, plain red, and modern painted, have their origin at about the point of extinction for biscuit, and are on the rise in the last cut of each test. There is, however, so little overlapping of the biscuit curves

and of these three later ones that we do not believe that the wares actually overlapped in time. It seems more probable that polished black, plain red, and modern painted are all parts of a single ceramic group that replaced the glazed wares.¹ This we may call for convenience the late group.

To sum up: it appears that there were three main stages in the ceramic history of Pecos: the black-on-white, the glazed, and the late; that the black-on-white ended soon after the settlement of the mesa, and the late began only shortly before its abandonment. Within the glazed period, then, falls most of the history of Pecos. For this reason a close study of the glazed ware is essential and is greatly facilitated by the fact that the pottery is subdivisible into six easily recognized types.

A cursory examination of the test material, when sorted and laid out cut by cut, shows that three of these glazed ware types, namely nos. 1, 3, and 5, succeed each other in the order given. The chronological positions of the three others (nos. 2, 4, and 6) are strongly indicated: (1) by their occurrence at certain levels in the tests; (2) by technological and decorative features. One would like, however, to have more tangible evidence as to the exact relations of these latter to the more obviously placeable groups (1, 3, 5) than can be had by a mere inspection of the test material. For this purpose we have plotted the distribution of all six types.² In the resultant diagrams each of the plotted types tends to form a normal frequency curve, indicating that each one had a natural rise, vogue, and decline. One's general impression is that they are all successive phases of the single glazed pottery trait, and that each one of them developed from its predecessor.

As to the position of Types 1, 3, and 5 there can be, as was remarked above, no doubt. Type 1 is surely the oldest, it being

¹ Here we seem to get a hint that when a style breaks up it is succeeded by two or more new styles (as black-on-white by glazed and biscuit); and that one of these eventually dominates. More research is needed.

² As it is impossible to classify accurately undecorated sherds from glazed vessels, and as there is often uncertainty even in the case of decorated fragments which do not show the rim-contour, we have used only rim-sherds in making the type distribution study. What is lost in bulk of material is more than made up for in certainty of identification.

the only one represented in the bottom cut of each of the tests; in test x, indeed, it is the only type in the two bottom cuts, and it stands by itself in the five lowest cuts of test XIII. In test x it is succeeded quite definitely by Type 2, which in turn reaches its maximum and is well along in decline before the real rise of Type 3. In tests XI and XII the evidence for placing Type 2 between 1 and 3 is somewhat less decisive, and were it not for test x and for the marked transitional appearance of the ware itself, we might perhaps have been led to consider it as a contemporary variant of Type 3.

In the case of Types 4 and 5 we are confronted with rather greater difficulty. Type 5, as is shown by the plots of tests XI and XII, is without question a later style than 3; furthermore it has from the technical and decorative points of view the appearance of being a direct outgrowth from it. Type 4, according to the plots, lies within the limits of distribution of Type 5; in tests x and XI it comes in abruptly; nowhere do we get any direct evidence, as was the case with Type 2 in test x, for calling Type 4 transitional or even chronologically intermediate between 3 and 5. The ware itself does not help us, as it fails to fit well into what seems to be the developmental series. One point, however, should be noted: that the curves for Types 2 and 4 are very similar in test XI; and also very similar (though of different form from those in test XI) in test XII. Type 2 is fairly well established as transitional, so that the resemblance between its curves and those of Type 4 may be significant.

Type 6 is shown by the plots to begin at about the time of the maximum frequency of Type 5; it is in the ascendant at the top of each test. The glazed trait as a whole, however, being decidedly on the wane at the top of each test, we may reasonably consider Type 6 to be the last phase of the industry.

Summing up the foregoing, we see that Type 1 is the earliest; Type 2 is without much doubt transitional between it and Type 3, which latter in turn may develop directly into Type 5; the exact morphological position of Type 4 is still uncertain, but chronologically it is either between 3 and 5 or contemporaneous with early 5; Type 6 represents the last stage of glazing.

The value of glazed ware as an archaeological index for Pecos is now obvious. It was made from almost the beginning to shortly before the end, and it may be subdivided into easily recognized types which are chronologically sequent. Glazed ware can therefore be used for assigning relative dates to burials, refuse beds, rooms, kivas, etc.; and also as a criterion for assigning to their proper chronological positions other wares, types of artifacts and the like, which are found in conjunction with one or another of its phases.¹

Having made out the succession of the three main ware classes, black-on-white, glaze, and late, and having also arranged the principal types of glazed ware in their proper order, we have built up the framework, so to speak, of the ceramic history of Pecos. The greater part of our work, however, still remains to be done; for it is more important to know how and why the observed changes took place than to have merely learned that they did so. The method to be pursued in further research is clear: we must make an intensive study of the wares themselves. For this we must have not only large amounts of material, but also as nearly as possible unmixed material, from each archaeological horizon. The purest representation of any given period is, of course, to be derived from isolated sites inhabited only during that period. For the earlier stages such sites can easily be found, as in early times the people lived in small scattered communities, which often shifted their locations.² The one-period site of later times is, however, much rarer, the Pueblos then having been gathered together in large and more or less permanently established towns whose rubbish heaps contain the inevitably somewhat mixed debris of several periods. Isolated heaps must therefore usually take the place of isolated sites; and, though they are difficult to find, careful search at any large ruin will be rewarded by the discovery of pure deposits.³

¹ Black-on-white, biscuit, modern, and even black, are all undoubtedly subdivisible and will eventually also be of use for the above purposes.

² Cf. "N," p. 179.

³ Most often to be found among the houses, in places where rooms have fallen temporarily into disuse, have been filled with dumped rubbish, and have then been sealed up by the construction of new floors.

For certain transitions, and for periods from which no isolated heaps can be found, we must, however, turn to the large middens, and make stratigraphical tests. To pick out only the best for the illustration of the desired horizons, we must be able to analyze these tests understandingly. To make this point clear, let us consider the ones we have before us.

Test *x*, according to its glaze-type chart, contains an orderly deposition of Types 1, 2, and 3. Types 4, 5, and 6, on the other hand, are very weakly represented and their curves are far from normal. We conclude, therefore, that at the end of the Type 3 period the heap was practically abandoned as a dump, and that its top cuts accumulated so slowly as to be nearly valueless for close study.¹ We should, then, concentrate on the six bottom cuts for information as to Types 1, 2, and 3. Had we been guided in this case by the total-glaze curve alone, we should have fallen into error, as we would doubtless have believed (because the total-glaze curve falls in this test most nearly to zero) that the upper cuts would give us excellent material for the concluding phases of the ware.

Tests *xI* and *xII* are quite different from *x*, but are similar to each other. The plotted analyses of their glaze types show that their lower parts were built up much more slowly than was the case with *x* (two cuts from the bottom to the apex of Type 3, as against six cuts in test *x*); whereas they have five cuts containing the strong curves for Types 4, 5, and 6 (as against two cuts in *x* with very weak curves). Interpreting this, we see that tests *xI* and *xII* came slowly at first, but finished rapidly; they are therefore best for the study of the later glazes. Test *xIII* is in some ways the most useful of all, though this fact would not be suspected by examining its ware-group chart alone, for there the curve for total-glaze is much like the glaze curves of the other tests. Turning to the glaze-type chart, however, it is seen that following Type 1 there is no representation whatever of Types 2, 3, and 4, Types 5 and 6 coming in abruptly at a relatively high per cent. This shows

¹ It may be considered axiomatic that the faster a heap accumulates the purer and less disturbed will be its contents.

that there was no deposition whatever of refuse, from some time during the life of Type 1, until the comparatively late date when glaze as a trait was on the decline, and the late wares had already come into vogue (see curves for modern, polished black, and plain red).¹ We have, then, in test XIII a long section of pure Type 1 debris, making clear the rise and development of that type, and providing helpful knowledge as to its relation to the precedent black-on-white and the contemporaneous phases of biscuit. This test proves, for example, a thing which we had not hitherto suspected, *viz.*: that biscuit *B* came into limited use before the origin of Type 2 glaze.

We cannot, within the limits of this paper, and with the scanty material now at hand, go further into detail; but enough has been said to show the value of test analysis and the importance of plotting the results graphically.

RECAPITULATION

The earliest ware found on the Pecos mesa is the black-on-white. With it occurs blackware of the strong blind-corrugated variety and a small percentage of true corrugated, but never as far as our investigations have shown, is there any indented corrugated. Further, the dull-black-on-red and the black-on-white with basket-marked exterior, both classes noted by Mr. Nelson from Tano ruins and by the author from the lesser sites on the Pajarito and near Santa Fe,² are not represented at Pecos. They are to be found, however, at "Bandelier Bend," a ruin a little below Pecos on the opposite side of the arroyo, and at several other places near Glorieta. As the corrugated technic gradually fades out at Pecos from the early strata upwards, the most strongly marked specimens there occurring at the bottom, it is reasonable to suppose that the ruins which produce the best grades of the ware are earlier still. Hence we conclude that the Pecos mesa was not settled until toward the close of the black-on-white period. Whether or not glazing

¹ As an illustration of the purely archaeological value of test analysis it may be said that the lacuna in this particular rubbish heap throws very important light on the method of growth of the north end of the Pueblo.

² "N," p. 171; "K," p. 414.

had been discovered or introduced at that time is still an open question. The great preponderance of black-on-white pottery in the early strata prove that glazing could not have attained any considerable vogue, yet the lowest cuts in all our tests show traces of glazed pottery. On the other hand, isolated rubbish heaps of the north terrace, and a black-on-white cemetery on the west slope, contain no glazed sherds at all. We believe, therefore, that for a short time at least, the black-on-white industry was the only one practised at Pecos.

When glazing did come in it very quickly drove out the older style. This is clearly shown by the charts; they indicate, however, that glazing and black-on-white existed for a short time side by side. This is of course only natural, for we have no reason to think that there was an abandonment of the pueblo during the transition, or that any wholesale influx of outside clans brought the change about abruptly.¹

Glazing was probably not of simultaneous origin in the whole country. It was undoubtedly discovered accidentally at some one site by the mixing of a flux in the pigment, and spread outward from there, the novelty and beauty of the paint aiding rapid dissemination. While it is of course futile to try to locate the point of origin with any exactitude, we believe that it lay to the west, probably in the Little Colorado; our reasons for this belief are as follows: The earliest form of glazing in the Rio Grande was the black-on-red. This has been pointed out by Mr. Nelson, and is confirmed by the Pecos finds. Now black-on-red is exceedingly rare in dull-paint pottery of the Rio Grande black-on-white period; and, if our Pecos observations are correct, it had entirely disappeared during the later phases of that period. Hence, it seems strange that a new paint, if discovered locally, should first have been applied over a slip of a color that was seldom if ever used locally at the time. The southern and western parts of the pueblo district seem always to have been the greatest centres for the manufacture of red wares,

¹ Clan-migration should only be called upon as a last resort to explain pottery changes, for while we know that such movements were common and a very potent factor in the makeup of all the later pueblos, we have no evidence that they were capable of producing radical overturns in resident cultures.

therefore the sudden appearance of a redware with a new form of paint in the east suggests western influence.

The above conclusion is entirely theoretical; to strengthen it, however, we have a few bits of archaeological evidence. In the Little Colorado drainage there occurs a redware with glaze decoration, whose bowls bear characteristic exterior designs in chalky white paint. Although Fewkes and Hough have figured a number of pieces, the chronological position of the style has never been fixed; the vessels, however, bear internal evidence of belonging to a fairly well-developed ceramic industry. We know of four fragments of such vessels from the Rio Grande: one from the Rowe ruin, an almost straight black-on-white site; two from Agua Fria "schoolhouse," which from its preponderance of black-on-red glazed ware we are justified in assigning to an early period; one from cut 7, Test x, a very early stratum, as it contains 25 per cent. of black-on-white ware. These were presumably all trade pieces and so serve to indicate with some degree of probability that glaze decoration was present and perhaps even fairly well advanced in the Little Colorado while it was still a very young art in the Rio Grande.

The locating of the origin of glaze to the west rests, of course, on possibly faulty theoretical grounds, and at best very meagre archaeological evidence. It is, however, a convenient working hypothesis which further research in the western districts and a close study of the designs will either prove or disprove. Whether or not glaze was first discovered in the west, it reached its maximum development in the east; and that development was, as far as we can see, a gradual and purely local one.

Returning to the Type 1 glazed wares, we may repeat that the black-on-red phase was at first the preponderating one. The black-on-light, however, slowly gains in importance and, as we approach Type 2, the red falls away. Type 2 is marked by a degeneration of the glaze, which becomes thicker and less adaptable to the production of fine-line designs; by a parallel deterioration of the clear yellow color of the slip; by a thickening inwards of the bowl rim (which, however, still remains square on top); and by the appearance on bowl exteriors, first of slashed marks and

crosses, then of red-filled decorations. The transitional nature of Type 2, both technologically and stratigraphically, was pointed out in the preceding section. Although the ware is less uniformly specialized than those of our other groups, it appears at Pecos in large quantities, indicating that its manufacture was carried on during a considerable period of time; further, the ware is characteristic of at least one isolated site which contains nothing else.¹ For these reasons we have given it typical rank.

The other wares associated with Types 1 and 2 glaze are the black and the biscuit. Of the former little need be said; it shows a steady elimination of the visible signs of the structural coil and a progressive modification of the rim. Biscuitware presents several interesting features. Biscuit *A*, the early variety, is unslipped on bowl exteriors and bears decorations which seldom if ever conform to the highly specialized design-system of biscuit *B*; but which seem, on the basis of the sherds, to be allied rather closely to those of the black-on-white. That the ware is a development from the black-on-white would naturally suggest itself, and indeed seemingly transitional pieces are not rare. The change from biscuit *A* to biscuit *B* consists in the raising and straightening of the bowl-rim, in the specialization of the design, and in its extension with the slip to bowl exteriors. In general, biscuit *A* is associable with Type 1 glaze, *B* with 2, 3, 4, and very early 5.²

Returning to the development of the glazed wares, we see that in Type 3 the slip on visible surfaces is almost invariably light, but is of poor and uncertain quality; the glaze lines also are seldom sharp-edged and clear black, but are heavy, "runny," and of various shades of rusty black, brown, and greeny-brown. Because of the intractability of the paint the interior designs of bowls and the body designs of ollas are considerably simplified; the exteriors of bowls and the necks of ollas, on the other hand, bear handsome decorations (usually oblique variants of the double-ended key figure) in red with glaze outlines. Type 5 seems to be merely a further growth along the same lines, *viz.*: glaze becomes even heavier;

¹ The "Frijolito" ruin, see "K," p. 454.

² Test XIII shows biscuit *B* to have originated a little earlier than Type 2 glaze.

interior decoration of bowls is simplified to a mere pair of red filled lines encircling the piece just below the lip; exterior design grows more varied; and finally the rim reaches a maximum of thickness.

Found in the same strata that produce the latest forms of Type 3 and the earlier forms of Type 5, is a certain percentage of pieces scarcely, if at all, different from the pottery which in a former paper we have called "Pajaritan,"¹ and have described as Type 4 in the present one. It seems to come in abruptly, runs but a short course, and abruptly disappears, apparently with no preceding or succeeding type. Its high rather thin rims, red color, good glaze, and specialized decoration, do not fit at all well in the Pecos series. It was commonly buried with the dead, as were Types 1, 2, and 3; while Type 5 vessels were almost never so deposited. One of three conclusions might be arrived at:² (1) that it was really transitional between 3 and 5, but that we have not sufficient evidence or sufficient acumen to enable us to recognize it as such; (2) that it was a short-lived secondary style, arising from Type 3 and running a course parallel to early Type 5; (3) that it was made by a group of people from the Pajarito who settled at Pecos, as the Hano did at Hopi, were assigned a section of the site, made their own style of pottery, and continued their own mortuary customs; finally losing their cultural identity or moving away. Careful work in the rubbish will, without much doubt, eventually settle this interesting problem.

The wares found in conjunction with Type 5 glaze are the featureless black and, towards the end, the striated black; with its earlier phases, or roughly synchronous with the Pajaritan admixture just noted, there is a considerable amount of biscuit *B*, which seems to average yellower than the earlier biscuit *B* and to have higher rims. This ware rapidly decreases in importance and, shortly after the middle of the Type 5 glaze period, it entirely disappears.

Type 5 continued well into historic times. This is proved by the finding in Type 5 rubbish of the bones of domestic animals

¹ "K," p. 417.

² Specimens are too common to be considered trade pieces.

and objects of European manufacture. At just what period in the life of Type 5 the Conquest occurred cannot yet be stated, as the bones and artifacts from the tests have not yet been studied, nor can we as yet put a date to the appearance of Type 6, the last stage of native glazed ware.

Type 6 is distinguishable from the preceding one by the diversity and eccentricity of the vessel shapes, and by the extremely "runny" nature of the glaze. We quote Mr. Nelson's excellent description:

Generally the iridescent glaze substance is of such striking and excellent quality as to incline one to believe that it was compounded after a Spanish formula. The fact that the artist could not control it at all seems suggestive of the same idea. The designs attempted, though of the very simplest geometric nature, were almost invariably spoiled by the running of the glaze. The color and general appearance is a very characteristic dark brown when thickly applied and of a greenish hue when the coating is thin.

The fact that the ware is all of historic date lends much weight to Mr. Nelson's supposition that the glaze was compounded after Spanish formulae. If such was the case, the style must have been a very short-lived one indeed, as Spanish influence strong enough to have seriously affected the manufacture of pottery can hardly be believed to have exerted itself prior to the actual settlement of the country at the beginning of the seventeenth century, and Mr. Nelson has shown that the making of glazed pottery ceased at about the time of the revolt of 1680.¹

Next came in the dull-paint vessels described above as "modern-painted ware." Their whole appearance, color, pigments, and decorative elements are radically different from those of glazed pottery. The only resemblance is in the high, outcurved rim that is common both to modern and to glaze Type 6. As to the rapidity of the rise of modern ware we cannot yet supply much data, as our tests all tend to become unreliable toward the top. That it eventually completely superseded glazed ware is proved by the total absence of the latter from certain isolated heaps of late rubbish found at Pecos, and by Mr. Nelson's observations at Cienega no. 1 and Cieneguilla.² The origin of the style is as yet a mystery. On its

¹ "N," p. 175. The Pecos ruin can hardly be expected to add corroboration to this, as the site was not deserted at any time during the rebellion.

² "N," p. 176 and table p. 179.

first recorded appearance it bears designs that by no stretch of the imagination may be believed to be the direct descendants of any of the glazed designs. Technically it is most nearly allied to biscuitware, and some of the decorative elements may possibly be derived from biscuit prototypes. If it is a late outgrowth of biscuit, that growth can hardly have taken place at Pecos, for our test material shows that the making of biscuit had probably ceased completely some time before the modern came into vogue. Mr. Nelson throws out the hint that the type may have been derived from the Keresan region to the north, and this is a particularly useful suggestion in view of the fact that biscuitware was primarily a northern product, reached its maximum development in the upper reaches of the Rio Grande and the Chama, and seems to have continued in use in that district rather longer than it did in the central Rio Grande. It is possible, therefore, that we may yet find that modern painted ware was a normal growth from an ancient prototype, probably biscuit, in some region to the north, and that the unsettled conditions of the rebellion, with their constant movements of people, may have brought about its introduction to the central Rio Grande as an already perfected style. If this is so, we will not be forced to postulate a conscious revolt against what Mr. Nelson calls "the degenerative tendency of the seventeenth century"; or to believe, as we have sometimes done, that the modern ware was the result of an archaistic revival carried out by the Pueblos at the time of the rebellion in a desire to do away with everything savoring of Spanish influence, and to return to the dull-painted wares that observation of the sherds about their villages must have shown them were made by their prehistoric ancestors.

That there were changes in the modern ware after its introduction and continuing until the time of the abandonment of Pecos in 1838, can be seen by examining the pottery fragments in and around the houses on the mesa-top. Similar changes evidently also took place in the polished black and the plain red. Late debris, however, in large enough quantities for satisfactory tests, has not yet been found lying conformably upon earlier strata. Such deposits surely exist at Pecos, but until they have been

located and examined it is idle to attempt to carry the study of type-sequence beyond the end of glaze-making times.

TENTATIVE DIVISION OF THE CULTURE-HISTORY OF THE EAST-CENTRAL RIO GRANDE INTO CHRONOLOGICAL PERIODS (the leading ware of each period is italicized).

I. Formative period.	Wares?	Nelson's pre-pueblo, not yet found in Pecos valley.
II. Archaic period. . . .	Indented corrugated, <i>black-on-white</i> , black-on-red.	Nelson's I. Not found at Pecos, but present at other nearby sites.
III. Late archaic.	Corrugated (little), strong blind-corrugated, <i>black-on-white</i> .	Nelson's I.
IV. Period of introduction of glaze. ¹ . . .	Strong and medium blind-corrugated, <i>glaze 1</i> , biscuit <i>A</i> .	Nelson's II. Author's Agua Fria "school-house."
V. Period of concentration. ²	Faint blind-corrugated, <i>glazes 2 and 3</i> , biscuit <i>B</i> .	Nelson's III. Author's "Frijolito."
VI. Late prehistoric. ?-1600.	Featureless black, <i>glaze 4</i> , <i>glaze 5</i> , biscuit <i>B</i> .	Nelson's III. Author's "Pajaritan."
VII. Early historic (1540) 1600-1680.	Striated black, late <i>glaze 5</i> , <i>glaze 6</i> , modern begins (?).	Nelson's IV.
VIII. Late period 1680-1840.	Striated black (?), plain red, polished black, <i>modern</i> .	Nelson's V.
IX. Present period 1840-1917.	Polished wares (Santa Clara), <i>painted wares</i> (San Ildefonso, Santo Domingo, Tesuque, Cochiti).	

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¹ And possibly also of the kiva.

² Concentration had been going on from the earliest times, but apparently became particularly strong at about this time in the Pecos valley and on the Pajarito. In the Tano country it took place somewhat later (see Nelson's chart, p. 179), perhaps because the Galisteo basin was less exposed to raids from the north and east.