ARCHAEOLOGICAL STUDIES IN NORTHEAST ARIZONA

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RALPH L. BEALS, GEORGE W. BRAINERD,
AND WATSON SMITH

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A Report on the Archaeological Work of the Rainbow Bridge–Monument Valley Expedition

BY

RALPH L. BEALS, GEORGE W. BRAINERD, AND WATSON SMITH

With Appendices by JOHN T. HACK *and* VOLNEY H. JONES

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PREFACE

THE RAINBOW BRIDGE–MONUMENT VALLEY EXPEDITION was organized by Ansel F. Hall, who directed scientific and educational activities in the western National Parks during the two decades prior to 1937. While Mr. Hall was establishing a museum at Grand Canyon in 1930, an expedition which he had put into the field assisted Mr. Harold T. Gladwin to make a survey of prehistoric sites in Grand Canyon National Park as part of a study being conducted by Gila Pueblo. Following promising leads during this and the following season, Mr. Hall made preliminary scouting trips into the Monument Valley region, where, in collaboration with Mr. John Wetherill, then Custodian of Navajo National Monument, plans were developed for a future expedition to work intensively on a comprehensive survey of the archaeology of that fascinating region, collaborating with other field sciences that might contribute to such studies.

Seven of Mr. Hall's associates, who had acted as scientific and business advisers for a number of previous expeditions, agreed to serve as sponsors for the proposed expedition to the Monument Valley country. They were: Dr. William S. Badè, Dr. Ralph W. Chaney, Mr. Francis P. Farquhar, Dr. William B. Herms, Mr. Duncan McDuffie, Dr. Knowles A. Ryerson, and Mr. Robert Sibley.

Announced in the University of California *Alumni Monthly* under the title "Wanted: Ten Explorers!" the project gained immediate and widespread response from university men, both students and instructors, not only in California but also in other states throughout the country. The Expedition was organized on a coöperative basis, each member of the field party assisting toward defraying his share of expenses. The services of staff members were contributed chiefly by various universities. Without this substantial coöperative support, both by the men and by their institutions, it would have been impossible to have maintained such an extensive field program, especially during the lean years of the Depression.

There was no lack of volunteers. As plans for the first Rainbow Bridge–Monument Valley Expedition began to mature during the early spring of 1933, candidates from eastern universities were interviewed by Mr. Hall at the Explorers' Club of New York City, where subsequent direction and leadership were given by archaeologist Alonzo W. Pond of that organization.

By early June, two caravans took to the field, one from New York and one from California. Traveling by station wagon and truck and augmented by men from points en route, the field party numbered seventy-four men when assembled at the rendezvous at Marsh Pass in the remote northern part of the Navajo Indian Reservation in Arizona. Fortunately, provision had been made for aerial reconnaissance. Preliminary flights soon yielded information that the area to be explored and studied was much more extensive than previously anticipated—and the topography much rougher. It was therefore decided to devote the first field season to extensive reconnaissance, by motor where practicable, but for the most part afoot and by pack train, augmented by boat transportation in the deep and inaccessible canyons of the San Juan and Colorado rivers. This season of pioneering yielded extensive but somewhat attenuated scientific data; its chief importance was to delineate the major problems of the area and to permit the staff to develop a coördinated plan of attack, which was subsequently followed through five additional seasons, yielding ultimately the definitive results partly recorded in this paper.

Following the first field season and the formulation of an extensive scientific program, the Expedition was incorporated as a nonprofit educational organization. Members of the Advisory Board were: Mr. Horace M. Albright, Dr. Wallace W.

Atwood, Commissioner John Collier, Dr. Harold S. Colton, Mr. Francis P. Farquhar, Dr. Herbert E. Gregory, Dr. Vierling Kersey, Dr. A. L. Kroeber, Dr. George D. Louderback, Dr. Frank E. Lutz, Mr. E. S. Martin, Mr. Jesse L. Nusbaum, Dr. Knowles A. Ryerson, and Mr. Robert Sibley. Ansel F. Hall continued to serve, in a voluntary capacity, as organizer and general director; Dr. Charles Del Norte Winning, appointed as field director in 1935, directed activities in the field during that and subsequent seasons; Dr. Tracy R. Kelley contributed his services as permanent secretary. The board of trustees was made up of Messrs. Hall, Farquhar, Kelley, Ryerson, and Sibley. To all these men who gave so generously of their time in helping to plan the Expedition's scientific program and to find resources for long-continued campaigns should go much credit. Theirs was much of the hard work but little of the glory!

List of Personnel

On other pages due recognition is given to the leaders of field parties in archaeology. Adequate acknowledgment cannot be given for the assistance rendered by the scores of Expedition members over many years. It seems proper that their names be recorded.

1933 Season

John E. Armstrong
Paul H. Baldwin
Stanley Bee
B. M. Black
Clifford Bond
L. Morgan Boyers
C. R. Brady
Robert B. Branstead
James W. Brewer
L. T. Broock
Richard E. Camp
Joseph P. Chamberlain
Stewart B. Chandler
Donald Collier
DeBert W. Connell
Marvin Darsie
Luther B. Davis
Theodore H. Eaton
John W. Edgemond, Jr.
E. D. Elliott
Walter M. Enger
James B. Enochs
Arthur H. Fenske
Ralph H. Fisher
Henry Dodge Freeman
William M. Gaylor
Ansel F. Hall
Lyndon L. Hargrave
Curham L. Harkness
Edward W. Harrington
Graham Heid
Herbert Hultgren
Ernest P. Hunt
Max Imhoff
G. L. Jessup
Boynton S. Kaiser
Joseph G. Kaye
Donald G. Kelley
Tracy R. Kelley
Robert Keyston
Robert A. Kissack
Lloyd T. Lowrey
Torrey Lyons
Thorn L. Mayes
John H. Manley
John M. McGee
Lester McNichols
Leland S. Miller
J. C. Fisher Metz
F. Linden Naylor
Norman Nevills
Jesse Peter
Alonzo W. Pond
James T. Pyle
J. Randolph Sharpsteen
Miller Simon
E. C. Smith
Omer Stewart
John B. Swift
Leonard G. S. Thatcher
Robert H. Thomas
Lyn Thompson
V. L. VanderHoof
Charles L. Walton
Glen W. Watson
Howard O. Welty
Benjamin W. Wetherill
John Wetherill
Milton Wetherill
Charles M. Wheeler
Charles B. Winning
Floyd Wood
William Wood

1934 Season

Alexander C. Atherton
J. Ballard Atherton
Suren H. Babington (M.D.)
Gordon L. Bell
Justin O. Blackwelder
Herbert E. Bolton
Robert E. Burton
Philip D. Cahn
H. Reed Christensen
Clarence C. Clark
Lamont C. Cole
Stephen S. Goodspeed
Ansel F. Hall
J. Bruce Hamilton
Charles W. Hoover
Grace E. Hoover
Robert E. Keyston
Frederic B. Loomis
Frederic B. Loomis, Jr.
Wilbur C. Matteson
Charles B. McKee
Thomas N. Merideth
John H. Oakie
Curt M. Rocca
Dale W. Roe
Henry N. Russell, Jr.
James A. Russell
George E. Smithson
Charles H. Toll, Jr.
Benjamin W. Wetherill
John Wetherill
Russell M. White
Charles Del Norte Winning
Frank C. Wymond

1935 SEASON

William P. Anthony
Arthur G. Atkinson
Suren H. Babington (M.D.)
Lee W. Beach
Bayne Beauchamp
Clifford Bond
George W. Brainerd
Walter W. Buss
Hernan C. Chable
C. C. Clark
Lamont C. Cole
Roy R. Crawford
Donald C. Dow
F. Gaynor Evans
Willard K. George
Gerald H. Greenwell
Robert B. Grinnell
Ansel F. Hall
Edward T. Hall, Jr.
Stanley C. Hayward
Frederic B. Holmes
Richard W. Jackson
Drew King
William Kiss
Hugh R. Lawrence
Dwight H. Lowrey
Wilbur C. Matteson
Alfred H. Murphy
Daniel T. O'Connell
John B. Peck
Esten W. Ray
Robert Ray
John B. Rinaldo
Elihu Root, 3d
Franklin O. Rose
H. O. Russell
Watson Smith
Robert R. Sterm
Robert H. Thomas
David F. Walkington
Benjamin W. Wetherill
John Wetherill
Charles Del Norte Winning

1936 SEASON

Joe C. Antrim
Meidel Applegate
Max J. Babbin
Suren H. Babington (M.D.)
Stephen L. Beckwith
Charles L. Bernheimer
James H. Blee
Clifford Bond
William J. Branstrom
Gordon Boskirk
Frederick A. Coe, Jr.
Roy R. Crawford
William S. Curtis
Edward H. Eakland
Truxton H. Emersen, Jr.
Alan M. Ferguson
Robert B. Finley
Edward W. Flickenger
Eugene F. Freeman
Martin Gambee
Robert Grinnell
Ansel F. Hall
Preston Hendrickson
Willard T. Hill
Norman D. Hubbert
Louis G. Huntley
Francis M. Jackson
Dilworth D. Jensen
Alan Johnstone
Henry M. Lemon
Lloyd Lowrey
Torrey Lyons
James C. McGlynn
Nye McLaurey
Thomas N. Merideth
Stewart Mitchell
Alfred Murphy
Arthur William Nelson
John B. Peck
John G. Penrod
William S. Putnam
Miller Simon
Watson Smith
Frank W. Stead
Lee Thomas
Perry Thomas
Charles LeRoy Watson
Benjamin W. Wetherill
John Wetherill
Herbert H. Wheaton
George G. White
Charles Del Norte Winning
Tom Yale
Henry P. Zuidema

1937 SEASON

Robert P. Arnold
Ralph L. Beals
John W. Bennett
George B. Burnett
Gilbert L. Campbell
Charles R. Cafarella
Robert L. Chambers
C. C. Clark
Peter S. Corn
Herbert G. Crowle
Shepard J. Crumpacker, Jr.
Waldemar E. Doyal
Alan M. Ferguson
John E. Fobes
Lawrence B. Frank
Martin Gambee
Ray Garner
Burwell Glenny
Hoyt Glenny
John R. Gray
Ansel F. Hall
Richard Hammerstrom
Jerry W. Hanson
James V. Harvey
Frank M. Jackson
George A. Jackson
Carl M. Kayser
William Kiss
Richard MacNeish
John S. MacSparron
Stewart Mitchell
Frank R. Morris
Bruce L. Morris
Dan P. Morse
William B. H. Sawyer
Robert B. Shaw
Roland C. Shaw
Watson Smith
Stanley B. Southkin
Leonard D. M. Steiner
David C. Twitchell
Charles LeRoy Walton
Bill Walton
Frederick W. Weihe
Benjamin W. Wetherill
John Wetherill
Dwight Williamson
Charles Del Norte Winning
Angus M. Woodbury

1938 SEASON

Ralph L. Beals
Paul D. Bordwell
George W. Brainerd
Walter R. Buss
Walter R. Buss, Jr.
Peter S. Corn
David G. Davis
Charles W. Field
Martin Gambee
Hoyt Glenny
Frank D. Gray
Ansel F. Hall
Alexander R. Imlay
William Kiss
Bertram S. Kraus
Richard S. MacNeish
Myron B. Mittleman
Ernest W. Mueller
Henry N. Russell, Jr. (M.D.)
Stanley J. Sarnoff
Leonard D. Steiner
Charles LeRoy Walton
Charles Del Norte Winning
Angus M. Woodbury

ACKNOWLEDGMENTS

In addition to the individuals who aided and supported the field work of the expedition, several persons and institutions also assisted in the preparation of this report. The University of California, Los Angeles, provided laboratory facilities during 1937 and 1938. The Board of Research of the University of California also supplied funds to aid in bringing the manuscript to completion. N.Y.A. help was delegated by both the University of California and Ohio State University in laboratory work. During the year 1938–1939 work was continued by George Brainerd and Watson Smith in a laboratory provided by the Ceramic Engineering Department of Ohio State University. A part of this time was spent by Dr. Brainerd in technical work on the ceramic collection of the Expedition, which is only partly covered by this report. The collections for 1933 and 1934 are kept at the Museum of Northern Arizona in Flagstaff, and this institution permitted study of that part of the collections. The collections of the seasons from 1935 to 1938 are now kept at the University of California, Los Angeles, as a loan collection.

Cordial and helpful coöperation was also given by the University of Arizona, Tucson, and the University of Utah, Salt Lake City. Each of these institutions granted permission to study its collections from the region under investigation and to take notes and make photographs. The perishable organic material collected by the Expedition was sent to Volney H. Jones of the University of Michigan. His report forms Appendix II of this report. Several hundred wood specimens were examined under the direction of Harry T. Getty of the University of Arizona. Only one specimen yielded a reliable date. The Peabody Museum of Harvard University permitted John T. Hack to spend several days in the field in 1938. Appendix I is a report by him on the recent geology of Tsegi Canyon.

Invaluable aid was given by Katharine Babcock in the reading of the design section from the point of view of art criticism, for aid in the design analyses, and for editorial work on the manuscript.

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INTRODUCTORY NOTE

In any coöperative enterprise it is impossible to assign full credit to all participants. In this investigation many persons have shared both in the field and laboratory work and in preparation of the report. The major part of the laboratory work was done by George W. Brainerd and Watson Smith, with Ralph L. Beals a frequent consultant but a participator only to a minor extent. This is also true of the writing of many parts of the manuscript. However, some sections deserve special mention. The description of Site RB 1006 is by Beals, that of Sites RB 551 and RB 564 by Smith, and those of Sites RB 1008 and RB 568 by Brainerd. The writing of the section on design analysis was done by Brainerd and Smith. Most of the maps, tables, figures, and plates were prepared by Brainerd and Smith. Appendix III was written by Brainerd. This outline of the approximate division of labor may help the reader to apportion praise or blame where it belongs, although in some measure the responsibility must fall upon all three authors.

Method of Reference to Plates and Figures

Objects illustrated in plates and figures in this volume are usually identified in two ways. Each plate and figure bears a number and in most of the illustrations each individual object shown is designated by a letter. Identification of these objects is made in the text by reference to the plate or figure number and the letter of the object. In addition, each object is designated by a field-catalogue number. This number consists of the letters "RB" followed by a numeral which designates the survey number of the site at which the object was found. Following the site number is usually a hyphen and a second numeral designating the serial number of the object within the collection from the site indicated. When no serial number is given, the collection from the site was quite small and the object indicated has not been segregated from the collection. At Site RB 551 a special method was followed in segregating sherds from the stratigraphic trench excavated in the refuse mound. In the designation of sherd material from this site a letter and a digit follow the site number. These symbols indicate respectively the horizontal and stratigraphic section in the trench in which the sherd was found.

GEOGRAPHICAL AND HISTORICAL SKETCH OF THE AREA

THE GENERAL REGION selected for archaeological study by the Rainbow Bridge–Monument Valley Expedition is that part of the Navajo Indian Reservation, in northeastern Arizona and southeastern Utah, extending from the San Juan River on the north to the ridge of Black Mesa on the south, and lying between Navajo Mountain on the west and the Chinle Valley on the east. This vast territory of more than 3,000 square miles has probably received less systematic study by competent scientists than any area of comparable size in the continental United States.

The scenic grandeur of the region is unsurpassed. In it occur a great variety of colorful canyons, broad mesa tops, deserts, mountains, fantastically eroded buttes, and rushing streams (pls. 1, *a, b;* 5, *a, b;* 12, *a;* 19, *a;* 31, *a, b*). Monument Valley, Tsegi Canyon, and the north face of Black Mesa are among the spectacular features of the area. Elevations range from 4,500 feet to 8,000 feet. The country is arid in character—warm in summer, but with snowfall in winter. Heavy summer thunder showers provide most of the rainfall.

The early history of the region is vague and indefinite. No mention of it is made by chroniclers of the Spanish regime of New Mexico, although a name and the date 1661 are inscribed upon a wall of Inscription House, a prehistoric pueblo near Navajo Mountain.[1] This inscription suggests that the region was entered by at least one European during the Spanish occupation of the Southwest. Although it is probable that trappers followed down the San Juan River and thence up some of its tributaries in search of beaver, the next historic record seems to be an inscription on Long House in Marsh Pass. The name is that of Lt. Bell, U.S.A., and clearly proves that a United States military party penetrated into the region perhaps as early as 1859.[2] Kit Carson may also have penetrated this far west on his campaign of 1863. Undoubtedly, reports in the archives of the War Department at Washington refer specifically to this region, for a heliograph station was established on the top of Navajo Mountain in 1884 under a Captain Thomas.[3]

The known history is linked closely with the movements of the Wetherill family, the first white settlers in the region. Members of this family still live at Kayenta and for many years have been instrumental in making the country known. The history of the Wetherill family has been written by Mrs. John Wetherill and Miss Frances Gillmor.[4]

Benjamin Wetherill writes:[5]

> Although the more obvious cliff-dwellings along the main Tsegi were seen by Kit Carson's troops and others, Richard Wetherill undoubtedly discovered most of the sites of all of the branches coming in from the north, except Dogoszhi Biko and many of the hidden sites along the main canyon. The thoroughness of his exploration in these canyons is shown by the name and date in Ladder House[6] near the head of Long Canyon, the longest branch of the Tsegi. Many of the sites up the side canyons were probably hard for the earlier explorers to reach due to lakes held in them by sand dams. At the time Richard Wetherill and Charles Mason were exploring the Tsegi, one dam was still holding in one of the side canyons coming in from the north, below the mouth of Kitseal Canyon. A few years before, or about this time, a large lake, called "Tielzth Nogi" (moving cat-tails) by the Navajo, broke out of Dogoszhi Biko.

[1] Colton and Baxter, p. 68.
[2] Fewkes, 1911, p. 10, note b.
[3] Personal communication from John Wetherill.
[4] Gillmor and Wetherill.
[5] Letter from Benjamin W. Wetherill, dated December 4, 1933. In quoting, changes were not made in the spelling of names.
[6] The name "Ladder House" has been applied rather promiscuously to cliff pueblos of the region, but adequate description of a particular site with this name and location has not appeared in print. Therefore "Ladder House" is not identified by the writers as the name of a pueblo in the Tsegi.

He says further that Richard Wetherill, B. A. ("Al") Wetherill, and Charles Mason, a brother-in-law of the Wetherills, all did some exploring south of the San Juan River during the late 1890's, mostly between Bluff, Utah, and the head of the Tsegi.

Another member of the Wetherill family, one who has contributed much to the archaeology of the region and who is to this day active in the pursuit of archaeological knowledge, is "Hosteen" John Wetherill. His first exploration trip into the Monument Valley–Oljato–Tsegi-ot-sosi area was about 1900. In 1906 he moved to Oljato from Pueblo Bonito and since then has spent some time every year exploring the canyons and mesas between Monument Valley on the east, Navajo Canyon on the west, the Henry Mountains on the north, and Black Mesa on the south. He was especially active in this region until 1912. Several of the earlier trips he made alone or with anyone who cared to go along. In 1909 and 1910 he guided Byron Cummings, W. B. Douglas, and a few parties over this part of the country. Furthermore, according to Benjamin Wetherill, his father "discovered and brought to the attention of archaeologists many of the Monument Valley ruins and most of the Tsegi-ot-sosi sites. We had located most of these caves and visited many by 1908." That John Wetherill discovered several of the Tsegi cliff pueblos is a certainty. Undoubtedly he was the first white man to visit many of the sites in the branches of Navajo Canyon and around Navajo Mountain, and he probably is the discoverer of most of the cliff pueblos in the head of Nakai Canyon, and around and under the rim of Skeleton Mesa from the head of Nakai to Tsegi Canyon.

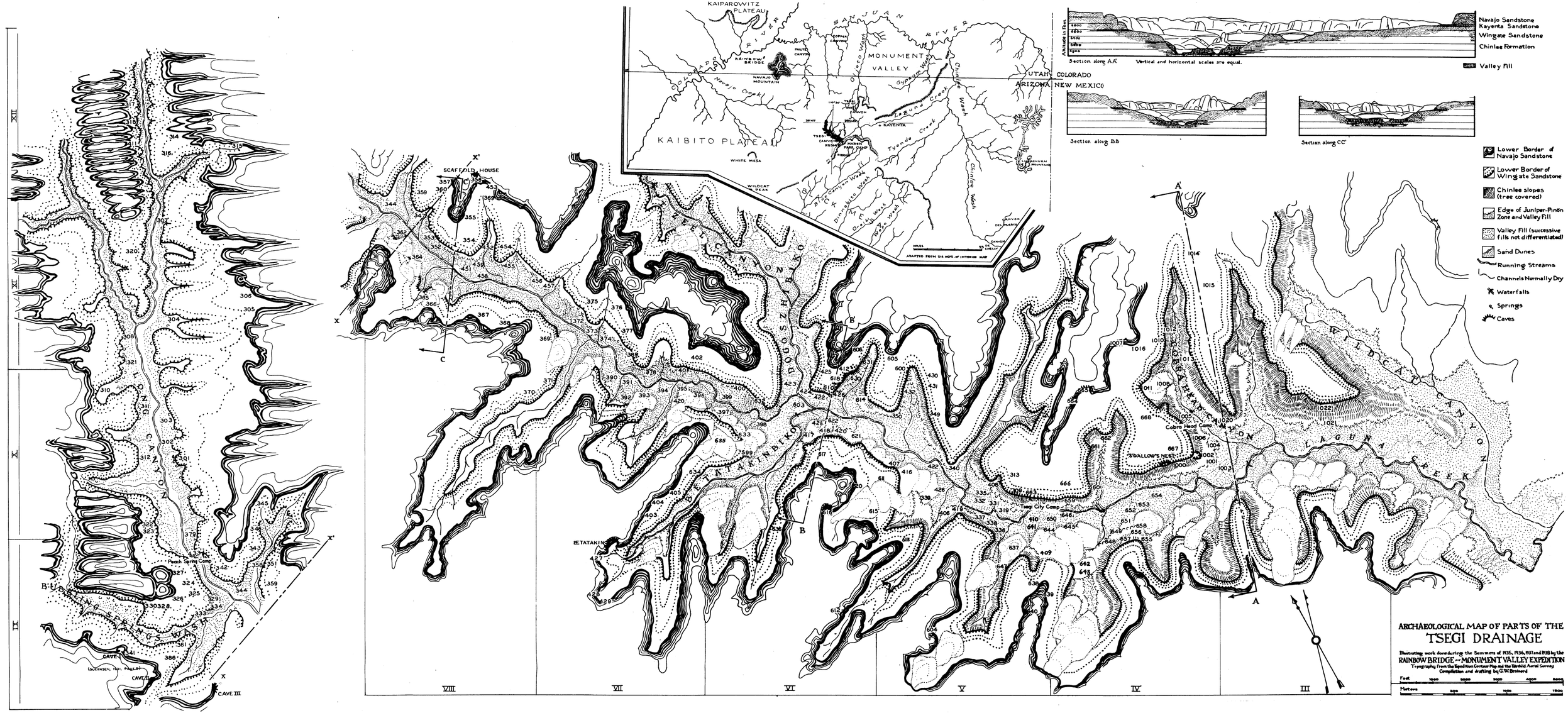
The Navajo Indian has also had an important part in the discovery of many of these sites, for, reticent though he was when Richard Wetherill was exploring the region, his reserve was eventually broken down by Mrs. John Wetherill, who sometimes "spent days questioning Navajos regarding locations of ruins and legends concerning them."[7] So thorough were the Wetherills either in seeking out cliff pueblos or in learning of their locations that by 1912, or even by 1909, there were comparatively few cliff pueblos in the area explored by them that had not been visited by some member of the family.

Other than the Wetherills, a few explorers, during past years, have materially contributed to our knowledge of the region. Nevertheless, little information of a detailed nature is available. Some work was done by the United States Geological Survey in preparing a rough map of the region during the latter part of the nineteenth century, and the geology was studied by Gregory from 1909 to 1913.[8]

Although the Wetherills brought the archaeology of the region to the attention of scientists, Cummings was the first archaeologist to explore the Tsegi.[9] He explored and excavated in the region every summer from 1907 to 1920 and from 1927 to 1930. He has doubtless covered the ground more thoroughly than any other one man, but unfortunately his findings remain as yet unpublished. Among the more important ruins studied by Cummings are Kiet Siel, Swallows' Nest, Betatakin, Inscription House, Bat-Woman House, Twin Caves, and such sites as Kinklachi, Kinklitso and Tachini Point. He was frequently accompanied on these expeditions by John Wetherill, and their parties were the first white men to see some of the ruins named above.

Word of the unusually large cliff pueblos reported by Cummings in the Tsegi soon reached William B. Douglas, United States Examiner of Surveys, General Land Office, who investigated the more conspicuous pueblos in 1909.[10] Though the

[7] Letter from Benjamin W. Wetherill.
[8] Gregory, 1916, 1917.
[9] Judd, p. 7.
[10] *Ibid.*, p. 6.



To accompany Beals-Brainerd-Smith, "Archaeological Studies in Northeast Arizona," Univ. Calif. Publ. Am. Arch. & Ethn., Vol. 44. No. 1.

Map 1. Map of that part of the Tsegi drinage which was covered by the reconnaissances of the Rainbow Bridge–Monument Valley Expedition, showing location of sites and the significant geologic and topographic features.

investigations of Cummings really constitute the first achaeological survey of the drainage with recording of data and detailed plans, Douglas supplemented much of this work with a sketch map of the region, which was submitted to officials at Washington. Upon Douglas' recommendation, which anticipated a recommendation by Cummings, certain areas were set aside as the Navajo National Monument.[11]

Following the recommendation of Douglas and Cummings, J. Walter Fewkes was dispatched to examine further and report upon the archaeology of the region. His findings were published in 1911.[12]

Following the investigation and report by Fewkes, no studies, other than those made by Cummings, were conducted up the eastern tributary (Dogoszhi Biko) of the Tsegi Canyon. The Peabody Museum of Harvard did, however, work in Marsh Pass and also in the neighborhood of Tsegi-ot-sosi.[13] The excavations and the resulting reports set a new standard for thoroughness in the study of Southwestern archaeology. In fact, so thorough was it that no further work was done in the region until it became advisable to reconstruct Betatakin. This reconstruction, under the supervision of Neil M. Judd,[14] may well serve as a model for such work. Beam specimens saved by Judd played an important part in the early studies in dendrochronolgy by A. E. Douglass. More recent investigations were directed by Harold S. Gladwin of Gila Pueblo, Globe, Arizona. Gladwin states:

> [The work] in the Kayenta–Navajo Mountain region has been confined to a survey of the general area. This covers approximately two hundred sites in the Marsh Pass quadrangle, of which about seventy-five are in Piute Canyon, the remainder lying between Tuba City and Marsh Pass, including Sagi Canyon.

Gladwin further reports "a stratigraphic test in a deep rubbish mound in Turkey Cave near Kiet Siel which carried through Basketmaker III to the beginning of Pueblo IV."[15] Since then the territory has been almost untouched except for a few localities easily reached by road or popularized for tourist travel.

Explorations have been conducted in other related localities, however, which resulted in more accurate knowledge of the region north and west of Navajo Mountain and the Colorado River between the junction of the San Juan River and Lee's Ferry. Bernheimer and Morris made a memorable trip in pioneering a trail to Rainbow Natural Bridge and took notes on the archaeology of the localities visited.[16] In 1928 and 1929 Morss conducted an archaeological investigation for the Peabody Museum upon the Kaibito Plateau.[17] Some work also was done in Navajo Canyon by the Public Museum of the City of Milwaukee.[18]

Archaeological investigations at the base of Navajo Mountain were made by the University of Arizona, the Los Angeles Museum, and the University of Pennsylvania, but results have not as yet been published. When the findings of these institutions are correlated with the findings of the Rainbow Bridge–Monument Valley Expedition, our knowledge of the archaeology of the region will be greatly augmented.[19]

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[11] *Ibid.*
[12] Fewkes, 1911.
[13] Kidder and Guernsey; Guernsey and Kidder; Guernsey.
[14] Judd.
[15] Hargrave, 1935*a*, p. 17.
[16] Bernheimer.
[17] Morss.
[18] West.
[19] This historical review is adapted from the sketch compiled by Lyndon L. Hargrave and published by the Expedition. Hargrave, 1935*a*, pp. 8–17. See also Hargrave, 1934; 1935*b*.

THE EXPEDITION

OBJECTIVES

The plans of the Rainbow Bridge–Monument Valley Expedition, crystallized in the first field season, called for a coördinated attack upon the scientific problems of the area included in and between the localities from which the expedition took its name. The archaeology consequently formed but one of the aspects of the field work, although it was the one most intensively pursued. It was felt that a simultaneous study of the diverse problems of the area might lead to a better understanding of its human occupation and history in relation to ecological factors. A degree of cross-fertilization and stimulation was also hoped for.

As a consequence of this general aim, the expedition each year included not only archaeologists, but geologists, zoölogists, botanists, and engineers. The engineers undertook the making of a number of preliminary maps and also made a contour map with 25-foot intervals of a large part of Tsegi Canyon. Until all the reports have been completed and a final summation of the results of the work is available, it will be impossible to evaluate properly the results of the simultaneous approach to the area by the several disciplines. It is certain, however, that the archaeologists benefited by having at hand consultants upon various immediate and related problems.

The archaeological objectives were directed toward the most complete reconstruction possible of the human history of the region. The final achievement of this aim naturally has not yet been reached. Not only does it involve an enormous labor in itself, but in the course of the explorations carried out thus far it has been evident that complete solution of the problems of this area must await more work in surrounding regions.

During the years 1933–1938, in each of which the Expedition maintained parties in the field, the parts of the general area explored and investigated were necessarily limited in extent. In order to carry the long-term program through effectively, a twofold method of attack was found desirable. The first attack was a series of general exploratory surveys: (*a*) to obtain data on what particular areas might most richly repay intensive local study; (*b*) to determine what apparent similarities and dissimilarities might be expected between such areas; and (*c*) to discover favorable locations for camps from which to operate and investigate the possibilities of transport and supply for these camps. The second attack was a series of intensive studies at individual archaeological sites or within strictly limited regions, carried on simultaneously with the general surveys.

Prior to the first field season in 1933 earlier field workers had indicated that the most promising places in which to begin operations were the Tsegi and Tsegi-ot-sosi drainages. However, most of the published work of Kidder and Guernsey[20] had been concentrated on Basketmaker III and Pueblo I cave sites, while Judd's report deals solely with one ruin of the late Pueblo III horizon.[21] In addition, none of the earlier investigators had attempted a systematic survey for the purpose of ascertaining the distribution of sites or their relative chronology.

Recognizing that the Basketmaker and Pueblo I periods in the Tsegi region had been carefully studied and reported and that a good beginning had been made in the investigation of Pueblo III, the staff of the Rainbow Bridge–Monument Valley Expedition realized that there still remained almost an untouched field in the Pueblo II horizon as well as the probability of much additional material in the Pueblo I and Pueblo III horizons, at least from sites other than those in caves.

[20] Kidder and Guernsey; Guernsey and Kidder; Guernsey.
[21] Judd.

Work Accomplished by Seasons

In the field seasons of 1933 and 1934 it was determined to begin a systematic surface survey of a part of the area, together with such intensive excavation as might prove desirable and feasible. The work of both seasons was carried on in collaboration with the Museum of Northern Arizona, Flagstaff, Arizona, and the field parties were under the direction of Lyndon L. Hargrave, of the staff of that institution, assisted by Alonzo W. Pond, formerly of Beloit College. The results of the 1933 season have been published.[22] Consequently, it is necessary here only to indicate the regions investigated. In June, 1933, the first field party entered the mouth of Tsegi Canyon at Marsh Pass. Explorations were made up Dogoszhi Biko from a camp near the mouth of Betatakin Canyon, and many sites were examined. The expedition, on foot, with twenty-seven burros to carry equipment and supplies, then ascended a precipitous old Indian trail at the head of Dogoszhi Biko to Skeleton Mesa. The part of the mesa above Dogoszhi Biko was virtually *terra incognita,* for few white persons had ever penetrated it. The party crossed the mesa to Hawk's Nest Spring in Sand Valley, and finally reached Dunn's Trading Post at the foot of Navajo Mountain. Here two weeks were spent in reconnaissance in the Rainbow Bridge and Forbidding Canyon drainages. Later that season some general survey work was done in the lower Chinle Valley and around Bluff City, Utah.

During 1934 explorations and surveys were carried out in the Tsegi-ot-sosi drainage and in Water Lily Canyon of the Tsegi drainage. A Basketmaker III cave site in Water Lily Canyon, called Horned Owl Cave, was excavated.[23]

In 1935 the major part of the archaeological program continued the site survey, concentrating in Tsegi Canyon from its mouth at Marsh Pass to a point two or three miles above the mouth of Bubbling Springs Wash. The part of the main canyon above Bubbling Springs Wash is usually known as Long Canyon. Camp was established at a reliable spring in the left wall of Long Canyon about one-fourth mile above the mouth of Bubbling Springs Wash. This spring was used by a Navajo to irrigate a small peach orchard, and the camp became variously known as Peach Orchard Camp or Camp Anasazi. For several weeks, daily survey parties operated from Peach Orchard Camp, and in this manner Long Canyon and its shorter tributaries were intensively surveyed to a distance of about three miles above camp, and the main Tsegi Canyon a like distance below the camp. Later in this season the archaeological work consisted of excavations at Sites RB 564 and RB 568, all of which are more fully described in subsequent sections of this report.

In addition to the surveys in Long and Tsegi canyons, however, other and more extended survey trips were made for the purpose of obtaining sherd collections and general information in adjoining areas, on the basis of which comparisons might be made between these areas and the Tsegi drainage, and sites for future investigation might be located. Three motor trips were made by small groups under the direction of Ben Wetherill—two across Black Mesa to the Hopi towns and one to Alkali Ridge and Montezuma Creek in southeastern Utah and southwestern Colorado. A fourth exploratory survey was made by an expedition which navigated the San Juan and Colorado rivers from Moonlight Creek to Lee's Ferry, under direction of Bayne Beauchamp, Walter Buss, and Lloyd C. Lowrey. On each of these trips, all sites noted were described on standard site cards, and sherd collections were made from the surface.

During the season of 1936 the site survey of Tsegi Canyon was continued down-

[22] Hargrave, 1935*a*, pp. 19–53.

[23] The data and specimens from this excavation are in the Museum of Northern Arizona. See Hargrave, 1934*b*, 1935*b*.

stream to a point just above the mouth of Cobra Head Canyon. It also embraced all of Betatakin Canyon and other tributaries. A temporary camp, known as Tsegi City, was established in Tsegi Canyon about six miles above Marsh Pass. After midseason the personnel of this camp moved to the base camp at Marsh Pass. During the latter half of the 1936 season, three enterprises were carried on: first, the excavation of burials at Site RB 568 was continued; second, excavation was begun at Site RB 551 on Black Mesa; third, a survey of Monument Valley was begun, operating from a temporary camp on Gypsum Creek.

In the season of 1937 a camp was established at the mouth of Cobra Head Canyon, from which the site survey was extended to include this canyon and an additional part of Tsegi Canyon to a point about two miles above Marsh Pass. The Cobra Head camp also served as headquarters for the excavation of Site RB 1006 under the direction of Ralph L. Beals, which is described in this report. During 1937 also the excavation of Site RB 551 was completed and that of Site RB 568 continued, with especial attention to the study of the architectural remains there.

Toward the end of the 1937 season an expedition was made to the top of the Kaiparowitz Plateau in southern Utah. The purposes of this trip were: first, to make sherd collections for comparative study from the sites of that region; second, to blaze a trail for future use in the event of later more intensive work there; third, to locate, if possible, a means of access to the Colorado River at or near the point of the plateau. The archaeological survey was directed by Ben Wetherill and in a short time located nearly one hundred sites, from which sherd collections were taken and descriptive notes made. The study clearly indicated the presence of a large number of small sites, but the sherd collections were mostly too small or too badly weathered to afford a basis for any definitive study, and have not been considered in this report. These collections did indicate, however, marked differences in the ceramic typology of the region from that of any of the other regions studied by the Expedition, and they have all been filed and catalogued for further study in connection with additional data which may be collected in the future.

In the season of 1938 the excavations at Sites RB 1006, RB 1008, and some other early sites near by, were completed and further work was done at Site RB 568.

As a necessary concomitant to the archaeological survey it was felt that an accurate and detailed map of the areas under investigation should be made. No really adequate large-scale map of the region existed, and therefore the Expedition set out to compile one. A preliminary map was compiled in 1933 by Thorn L. Mayes[24] and throughout the seasons of 1935, 1936, and 1937 a corps of experienced topographers accompanied the archaeologists. Partly by the use of transit and partly by plane table a contour map was compiled, embracing Tsegi Canyon from the Peach Orchard to Marsh Pass, all of Betatakin and Kiet Siel canyons, Cobra Head Canyon, and the first three miles of Wild Cat Canyon. In addition to the instrument survey, aerial photographs were made in 1933 by Robert Kissack and Thorn L. Mayes with F. Linden Naylor as pilot, in 1935 by Ansel F. Hall with Keith Scott as pilot, and in 1937 by E. P. Beckwith, who flew over the entire region with Miss Amy Andrews as pilot. Copies were also obtained of an aerial map previously compiled by the Fairchild Aerial Surveys, Inc. From these sources and from the data contained on the site cards prepared by the archaeologists, the conventionalized map published with this report was later compiled by George W. Brainerd (map 1). Those who directed the instrument survey and the making of the contour map were: 1935, Franklin Rose, Arthur Atkinson; 1936, Herbert Wheaton; 1937, Herbert Crowle, Jerry W. Hanson.

[24] Hargrave, 1935*a*, p. 22.

The total personnel of the several field parties varied at different times and in different seasons from thirty to over seventy. At some periods as many as five different groups living and working in different places were maintained. During the first two seasons the Expedition's headquarters were at Kayenta, but in 1935 a permanent base camp was established near the highway at Marsh Pass. This camp eventually included a mess hall seating seventy-five men, a laboratory and workshop, a photographic dark room, and other necessary structures.

Because of the large personnel of the Expedition and the sometimes complicated problem of transport and supply, a well-functioning field organization was required. During the seasons from 1935 to 1938 inclusive the field staff was directed by Professor Charles D. Winning of New York University, to whom more than to any other one person is due the credit for the achievements and the efficient operation of the Expedition. Dr. Winning maintained his heaquarters at the Marsh Pass camp throughout each season and from that point directed the work of all subsidiary groups and delegated to group leaders the immediate direction of the various enterprises undertaken. The automotive equipment of the Expedition has consisted of two 1 ½-ton Ford trucks and as many as nine Ford station wagons, all of which performed their arduous duties with great reliability. By this means the entire personnel and all supplies were transported to Marsh Pass. Most of the food supplies for men and animals were brought by truck from Flagstaff, some 160 miles distant. A train of mules was also kept at Marsh Pass for the establishment and maintenance of subsidiary camps.

In the six summers that the Expedition was in the field no less than eleven passages were made by boat through the canyons of the San Juan and the Glenn Canyon of the Colorado. This voyage of some 200 miles usually occupied from two to four weeks from the time the party embarked at Mexican Hat or at the mouth of Copper Canyon until they arrived at Lee's Ferry, the next accessible point. The trips were made in ten- and fifteen-foot boats built by the Wilson Fold-Flat Company of Los Angeles. These light folding craft proved to be exceptionally seaworthy and tough.

Since this report does not concern itself with the geological, biological, or botanical phases of the Expedition, we will here mention more fully only the detailed organization of the archaeological parties.

Methods of the Archaeological Survey

Although the membership and direction of the site survey differed in the various years, the general method was uniform. Most of this work was carried on from the Tsegi Canyon camps. Each morning one or more small parties would leave camp on foot to survey a definitely defined area. The group was always led by an experienced archaeologist and might consist of from two to six men. The ideal was to cover every square yard of ground so thoroughly that no prehistoric remains could possibly be overlooked. The group leader usually assigned to each man a particular portion of the area, himself remaining in a position within call of the others. Each man carried a number of blank "site cards," printed forms on which pertinent data relative to each site discovered could be entered (fig. 1, *a*). He also carried a set of small cloth sacks and paper bags, for the purpose of collecting and carrying sherds, and perhaps a camera and a compass.

Because of the nature of the terrain it was usually expedient for one man to cover the valley floor, another the sand dunes against the sandstone cliffs, a third the relatively level bench which usually exists along the uppermost stratum of the Wingate sandstone, and a fourth the talus at the foot of the higher Navajo sand-

RAINBOW BRIDGE EXPEDITION - ARCHAEOLOGICAL SITE RECORD

Site No. RB-MV 456 Other Institution Nos. None Photo. ✓

Location On sand dune and terrace 1/8 - 1/4 mile South of Scaffold House Wash, close to Wingate S.S.

Character, Extent and Condition Several closely related sherd areas, about 200 yds. from N. to S. with possible pithouse indications.

Pottery: Corrug. - Gray - B/W - B/R - Or'ge. - Polych. (Small amt.)

Nearest Water Main Tsegi 200 yds. W.

Principal Flora Pinyon, Juniper, Russian thistle, rabbit brush.

Principal Geological Elevation Terrace below Wingate s.s. 6600

See other side for sketch + further notes

Entered on Map ✓

Artifacts Collected None

Approx. No. of Sherds Coll. 200+

Type and location of marker Painted on Rock, near middle of site.

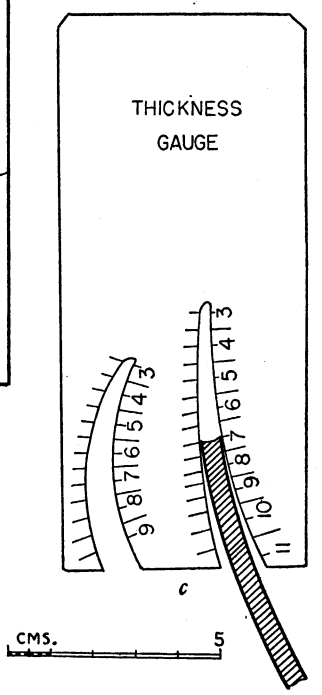
Recorded by, Watson Smith Date 7/2/35

a

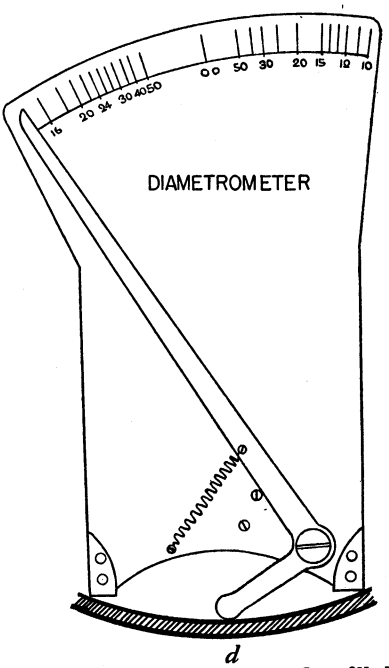
R. B. 456 U. C. l. a.

Type	Bowl	Jar	Total	Misc. Data
Tusayan W. Ware	5	4	9	(Indeterminate B/W)
Kana-a B/W	4	15	19	
Deadmans B/W	1	2	3	
Dogoszhi B/W	1		1	
Sosi B/W		1	1	
Tusayan B/W				
Betatakin B/W				
Kayenta B/W				
Plain White			44	
Tusayan G. Ware				
Lino Gray			80	less than 4 coils 15; 4 to 5 coils 17; 6 coils 4; over 6 " 4
Lino B/G				
Kana-a Gray		40	40	
Tusayan Corr.		8	8	
Moenkopi Corr.		13	13	1 rough coil (6 rows); 12 flat coil
Kiet Siel Gray	1		1	
San Juan R. Ware				
~~Deadmans~~ Bluff B/R (?)	2	1	3	
Medicine B/R	5	1	6	
Tusayan B/R	2	1	3	
Citadel Poly.				
Tsegi Orange				
Tsegi R/O	2		2	
Tsegi B/O				
Tsegi Poly.				
Tusayan Poly.				
Dogoszhi Poly.		1	1	
Kayenta Poly.				
~~Flagstaff~~ B/W	1		1	
			236	

b



c



d

Fig. 1. Record cards and measuring devices used in the field and laboratory: *a*, site card as filled out by a reconnaissance party in the field; *b*, pottery-type tabulation card as filled out in the laboratory for a site studied in the survey; *c*, diagrammatic sketch of gauge used in measuring thickness of sherds; *d*, diagrammatic sketch of the diametrometer used in estimating size of vessels from curvature of individual sherds.

stone. This position enabled each man to remain about on one level with a minimum of scrambling up and down, and also permitted the entire group to progress forward in a fairly uniform front. Of course local conditions frequently required alterations in this formation.

Whenever any member of the surveying party came upon a prehistoric site, as evidenced by the presence of potsherds, flint chips, masonry remains, or charcoal concentrations, he immediately made a collection of sherds and worked flint from the surface and painted a site number on a rock as nearly the center of the site as feasible. Usually the group leader went to each site located and entered descriptive field notes on a standard site card. Less frequently this was done by the man finding the site. Usually a sketch plan and often a photograph were also made, especially if there were notable architectural features.

At the end of the day the site cards and sherd collections were taken back to camp. Either at the local camp, or later at the Marsh Pass base camp, all site cards were copied in duplicate on a typewriter. All sherds were washed in plain water to remove all mud and earth, next in a dilute muriatic acid to remove lime deposits, and finally in a baking-soda solution to neutralize the acid. After the sherds had thoroughly dried, the appropriate site number was either written on each sherd with India ink or stamped with a rubber stamp. The collection was then resacked or boxed in sealed cartons and stored, pending its final shipment to the Expedition's permanent laboratory. In addition to the washing and cataloguing, a preliminary attempt was made to reconstruct broken vessels from sherds, whenever this appeared possible. As has been said, the cartographers worked in collaboration with the archaeologists, and each site was spotted on the map as soon as possible after its discovery.

Those who took charge of the field-survey groups were:

1933–1934: Lyndon L. Hargrave, Alonzo W. Pond.
1935: Edward T. Hall, Ben Wetherill, George W. Brainerd, Watson Smith.
1936: Charles A. Amsden, George W. Brainerd, Watson Smith.
1937: Ralph L. Beals.
1938: George W. Brainerd, Ralph L. Beals.

Since detailed discussions of the actual excavations carried on at certain sites are contained in other parts of this report no mention will be made here of that part of the work.

The present volume does not purport to be a complete or final report on all the archaeological work accomplished in six field seasons by the Expedition. The work of the first season is covered by a previous report,[25] and while some of the results therein discussed have been utilized and incorporated in this volume, the present writers have sought to avoid duplicating the substance of that report. Neither have we attempted to include herein a full discussion of some of the enterprises undertaken during the years 1935–1938, since several of these are as yet incomplete and others were undertaken for the purpose of providing a collection of comparative material for study rather than as a basis for the publication of conclusions based thereon. A series of Basketmaker sites excavated near the mouth of Cobra Head Canyon under the direction of Ralph L. Beals will be reported in a separate publication.

[25] Hargrave, 1935*a*.

Laboratory Methods

Sherd Sorting

The following methods were used in analyzing the vast amount of sherd material. Approximately fifty thousand sherds[26] in all were collected and catalogued from five hundred and forty-three sites. The major objective of the analysis was to ascertain what, if any, chronological correlations might be established on the basis of sequential changes in ceramic typology.

The pottery collection as a whole was analyzed along broad typologic lines, and later broken down into its components for the sake of isolating possible local or temporal diagnostic traits. As has been said above, all sherds had been labeled in the field with the number of the site of their provenience, and each site collection was segregated in a separate container. As the initial step in the analysis all sherds from all sites in the Tsegi drainage were pooled in a single mass. This mass was then first divided on the basis of gross characteristics, into such groups as black-on-white, black-on-red, orange, polychrome, corrugated, and plain wares. At this point recourse was had to descriptions already published, and the names and descriptive characteristics formulated by Hargrave and Colton were tentatively adopted.[27]

In accordance with these descriptions, the sherds were segregated into type groups, with jar sherds separated from bowl sherds. Each sherd which did not exactly fall within the limits of an already published description was temporarily laid aside. Later, nearly all these were found to differ from the published descriptions only in minor or superficial respects, mostly with reference to details of painted decoration, and eventually it was found possible to include most of them by slightly expanding the published descriptions to embrace these added features. No completely reformulated descriptions appear herein, but the comments and amendments contained in various parts of this report are to be taken as qualifying previously published descriptions of types, at least in relation to their occurrence in the sites investigated. In no major respect were the previous descriptions found erroneous or inadequate, and unless express statement to the contrary is made in any instance, the use of a type name herein carries with it the implication of the features of that type as described by Colton and Hargrave in their *Handbook*.[28] Some general qualifications should be made, however. No new types have been identified or named, but in a few instances tentative subdivisions of recognized types have been made; for example, two forms each of Moenkopi Corrugated and Kiet Siel Gray (p. 140), a separation of decorative features of Black Mesa Black-on-white (p. 57),[29] and the definition of certain design elements and arrangements of chronological significance in the Pueblo III black-on-white types. For the purposes of this study, however, certain groups heretofore named and considered as separate types have been combined because of evidence that the distinctions between them were not valid as chronological or regional diagnostics in the material under consideration. Instances of this amalgamation are the grouping of Tusayan Black-on-red and Medicine Black-on-red and the retention of the former name for examples of both; and the abandonment of the names Tsegi Polychrome, Dogoszhi Polychrome, and Citadel Polychrome and their inclusion in the category of Tusayan

[26] This figure does not include material from several sites excavated in 1938 which are not included in this report, but does include sites surveyed in neighboring areas but not included herein.

[27] Colton and Hargrave, pp. 70–77, 92–101, 190–218.

[28] Colton and Hargrave.

[29] This type was called Deadmans Black-on-white by Colton and Hargrave. The change from the *Handbook* name was suggested by Colton (Colton, 1941, pp. 164–165).

Polychrome, on the hypothesis that they were probably minor variants of Tusayan Polychrome, with which they occurred in association. Many of the sherds of the above-named types were so nearly indistinguishable from each other that statistical analysis was unprofitable.

Although it was not clear whether Kayenta Polychrome and Kiet Siel Polychrome were valid types, they were differentiated from the other polychromes on the basis of the use of white paint, but were usually considered together as a single category. In general, the minute subdivision of types in Tsegi Orange ware has seemed unnecessary and impracticable in the study of sherd material. A useful distinction between two-color vessels and polychrome vessels certainly should be made, and has been observed herein, but there were so many variations within each of these groups that a further typological breakdown should be approached only on the basis of much wider data than is now available. For the present, a broad consideration of Tsegi Orange ware as a whole seems the proper course.

In the white-ware category all names of Pueblo II types have been retained, with some qualifications, mostly suggested by the overlapping or intergrading of decorative features hitherto regarded as peculiar to a single type. Black Mesa Black-on-white was broken down for laboratory purposes into several subdivisions that proved very useful and may be significant. At this time, however, no new types are proposed.

In the category of Pueblo III black-on-white a simplification was made by ignoring Betatakin Black-on-white. Isolation and identification of examples of this type were difficult and unconvincing, and they were grouped with either Tusayan or Kayenta Black-on-white, both of which were recognized without material change.

Further discussion is given in the sections on ceramic design and shape.

Such amplification or reclassification of the published work of prior investigators seems justifiable, for no investigator can ever have at hand all possible material on which to base his studies. Many of the original type descriptions of pottery from this area were formulated by Kidder and Guernsey[30] from the data available to them; these were later enlarged by Colton and Hargrave[31] on the basis of the broader view made possible by additional material, and they are herein expanded and clarified still further. Precisely because the alterations and enlargements are relatively superficial, and perhaps representative of only local idiosyncrasies, type and ware names are retained in full appreciation of the debt owed to others for their invaluable systematizing work.

NOTES AND MEASUREMENTS

Once all sherds of a particular type had been segregated, they were studied first with reference to decorative design features only. In this connection, comparisons were made with a card-index file containing drawings or photographs and descriptions of all whole pottery excavated by the Expedition, and photographs and data on all museum specimens from the area represented in the collections of the Universities of Utah and Arizona and the Museum of Northern Arizona.

For ease and dispatch in taking these measurements, two simple devices were designed which we believe other workers may find useful. The thickness gauge (see fig. 1, *c*) was formed from a plate of heavy metal about 2 mm. in thickness, into which were cut two curved slots, 12 mm. wide at the outer extremities, tapering to a width of 3 mm. toward the center of the plate. At graduated points along the edges of these slots were engraved figures indicative of the width of the slots at each point. In order to measure the thickness of a sherd, it is inserted into the groove as far as its thickness permits, and the indicated thickness is read from the scale at this point. Two slots with dif-

[30] Kidder and Guernsey, pp. 129–144, 152–153; Guernsey, pp. 100–101, 110–111.
[31] Colton and Hargrave, pp. 70–77, 92–101, 190–218.

ferent radii of curvature were provided in order to accommodate sherds from vessels of different diameters.

The diametrometer (fig. 1, *d*) was made from a similar plate of metal, the lower edge of which had been cut in a concave outline with the two lower corners carefully machined and reinforced to prevent wear. A second piece of flat metal, formed in the shape of an L, was pivoted to the main plate so that its shorter arm could swing downward and extend beyond the concave edge of the main plate. The longer arm was tapered and swung through an arc across the upper edge of the main plate. When the instrument is placed in contact with the curved surface of a sherd, three points of contact are effected: the two fixed corners of the main plate, and the extremity of the movable short arm of the pivoted member. The relationship of these three points determines the circumference of a circle, and the diameter of this circle is automatically indicated by the longer arm of the pivoted member on a carefully calibrated scale, engraved along the arc through which the arm moves. Thus, the diameter of the vessel from which any sherd has been broken can be read instantly. Although irregularities in a given sherd introduce an element of inexactness, a series of test readings gave, with few exceptions, reasonably precise results.

Next, full-size ink-and-brush drawings were prepared of all sherds large or distinctive enough to be significant for the purposes of design study. Approximately fifteen hundred such drawings were made, numbered, and filed. These were executed as nearly as possible in the stylistic manner of the originals, displaying not alone design features as such, but also the character of brush strokes employed, the degree of care and freedom used by the painter, and so on. Similarly, profiles of every rim sherd were drawn. Characteristic sample sherds were also set aside for the technological analysis of the materials used for each type recognized.

Following the completed study of a type in gross, a tabulation was made of the total number of sherds of that type occurring in each site. These totals, subdivided into bowl and jar categories, and with special notations for unusual examples, were then entered on printed cards, numbered in accordance with the site numbers (fig. 1, *b*).

In the study of corrugated wares, it has long been recognized by Southwestern archaeologists that the classification of this important group of ceramic material on the basis merely of the presence or absence of unobliterated "clapboard" coils, finger-dented coils, or smoothed surfaces has been altogether too broad for useful analysis. The width of the coils, their manner of application, the relative dimensions of finger indentations, their direction, and the character of pressure applied in forming them—these and other criteria have been recognized as desirable, but usually lack of time has prevented their systematic and statistical calculation. We were unable to carry out such a study in the detail desirable, but in at least one feature a beginning was made which has borne provocative results.

In broad terms the finger-indented or "corrugated" sherds among our material fall within the definition of Tusayan Corrugated.[32] This type name and the essentials of its definition have been retained, but it has been subdivided on the basis of the average size of the finger indentations and the width of the coils.

To measure these factors directly would be extremely tedious, and therefore a simple device was used to achieve the result. From a small piece of cardboard a hole, 4 cm. square, was cut. When this templet was applied to the outer surface of a corrugated sherd, the number of coils as well as the number of indentations visible between the edges of the cut-out square could be rapidly counted and the sherd classified. In practice it was found, among the sherds measured, that the number of coils varied from 6 to 12 (or occasionally 13 or 14) per 4 cm., and the number of indentations from 3 to 7 per 4 cm. In other terms, the average width of coils varied from about 6 mm. to 3 mm. and the average width of indentations from about 13 mm. to 5 mm. These measurements were very consistent in any given sherd or vessel.

Thirty categories were thus identified and all corrugated sherds were classified in accordance therewith, and so entered on the pottery-record card for each site.

[32] Colton and Hargrave, p. 196.

Some consistent statistical results were obtained from a study of these data, which will be discussed later in connection with the apparent chronology of the various sites.

A similar method of measuring and classifying was applied to sherds in the general category of Kana-a Gray. In this study only one factor required consideration, viz., the width of the coils, since this type excludes sherds with finger indentations.

As has been said above, still other factors involved in Tusayan Corrugated sherds could profitably have been systematically studied; for example, clockwise or counterclockwise coiling, angle of finger indentation, left- or right-hand indenting, and angle of pressure applied in indenting. Time for such a detailed analysis was not available, however, although we believe these factors to be possible indicators of chronology.

CLASSIFICATION OF SITES

It cannot be emphasized too strongly that the primary, if not the sole, justification for carrying out such a meticulous sherd analysis as has been described must be for the purpose of using the data thus obtained in constructing a calendar and identifying regional variations. The esoteric mystery of innumerable pottery types with the intricate statistical calculations based on sherd counts, which are so baffling to persons not intimately acquainted with the particular material in hand, is largely dispelled when this simple fact is borne in mind. There is no magic and no inherent virtue in potsherds taken simply by themselves. To the archaeologist they are primarily time fossils, and are valuable so far as their objective characteristics can be utilized to indicate temporal or regional differences or similarities between the sites from which they come. In thus compiling a prehistoric chronology it often transpires that reliance can be placed on apparently inconsequential features, which for any other purpose, such as that of artistic study, are of no particular value. The present study, therefore, had only this chronologic objective, and no claim is made that it can in itself be used as a basis for cultural or artistic inferences. Separate studies of the ceramic material were carried on from those points of view and are discussed elsewhere.

Pottery chronology.—As has been said, the ultimate objective in this survey was to determine, if possible, a chronological relationship between the various pottery types occurring in the region and through this means to date (at least relatively) the individual sites. In order to render more efficient the analysis of the ceramic data, a visual method was applied which proved very effective. For each site a strip of cardboard 30 cm. long was prepared, with the site number, the ecological provenience, and the architectural character indicated at the left margin. The major part of the strip, however, was ruled vertically into percentage subdivisions of the total length. Each pottery type was assigned arbitrarily a distinctive color, and the percentage of each type in proportion to the total collection at a given site was then indicated in crayon in its assigned color. The vertical width of the strips varied proportionately with the size of the sherd collection from each site, so that a site having a large collection, and therefore likely to be relatively more accurate in its indication of type relationships, was represented by a wide strip, whereas a site with a small collection was represented by a narrow strip.

By means of these strips, and by the further analysis described in Appendix III, it was readily possible to group together those sites which displayed similar ceramic complexes and to arrange all groups in a hypothetical developmental and chronologic sequence. Of course, strictly speaking, from this data alone one could not justifiably assign one particular group of sites to an earlier time horizon than an-

other group, but the work of the earlier investigators, Kidder, Guernsey, Colton, Hargrave, and Gladwin, had already established a general time relationship between the more prominent pottery types. In addition, the stratigraphic work that the Expedition had carried on, especially at Sites RB 551, RB 564, and RB 1006, showed consistent superposition of certain types over others.

Of course this method, even if its results are perfectly reliable, can provide only a relative chronology. But fortunately a number of sites in the series had yielded datable wood specimens. These exactly dated sites form the outline of a calendar, and other sites can be approximately dated through the more or less close correspondence displayed by their ceramic complexes to the complexes of the wood-dated sites.

Architectural classification.—In studying and classifying the sites discovered by the survey several objective factors were taken into account in addition to ceramic complexes. The general character of the architectural remains, if any, was noted, and also the ecological or geological situation. Any attempt to arrive at a systematic grouping of unexcavated sites on the basis of architectural features must be of a highly generalized nature, since only visible surface characteristics can be noted. It was possible, however, to group the sites broadly in the following architectural subdivisions:

1. Sherd areas where no superficially identifiable architectural remains were visible.
2. Pit-house sites where a large depression seemed to indicate a subterranean structure.
3. Small masonry sites where stone wall fragments standing on the ground surface indicated the existence of houses of from perhaps one to four rooms, usually in a single continuous row (often called "unit-type" dwellings).[33] Although usually the exact form and size of these structures could not be precisely determined without excavation, many of them could be quite clearly outlined. Typical examples, showing the general arrangement of rooms, are shown in a schematized manner in figure 2. Usually a circular depression, indicative of a subterranean room, accompanies these house units.
4. Large masonry sites, where surface remains indicated the existence of more complex houses, sometimes up to forty or more rooms. Many of these occur in caves or shelters. Usually one or more circular depressions, indicative of subterranean rooms, are found at these sites.

Ecological classification.—The ecology also suggested the possibility of significant groupings. In a region like that under investigation, in which the terrain is scarred by deep canyons and the surface broken by sand dunes, rocky cliffs, eroded caves, and varied flora, the mere horizontal distribution of sites does not in itself provide an adequate indication of their situation. Within the distance of a few hundred yards, sites may occur at elevations varying by hundreds of feet and in quite divergent immediate environments. In order to reduce these factors of location to a systematic classification more exact and significant than mere lateral position, the area was subdivided into several zones and the position therein of each site was indicated on its card. These zones, although generally bearing a vertical interrelationship to each other, were not mere arbitrary altitude levels. A technical discussion bearing on these zones is given in Appendix I. Map 1 shows the arrangement of the zones, and the landscape photographs in plates 1, *a*, *b* and 31, *a*, *b* show their appearance at various points. These geological and ecological zones as defined for table 2 follow:

1. The arroyos, or actual stream beds, either constant or intermittent. These vary in depth from a few feet to forty feet. In some places the main Tsegi is considerably deeper. The arroyos are usually almost vertically walled gullies cut into the unconsolidated sand which has been laid down in the canyon bottoms in the recent past. Almost no vegetation occurs in the existing arroyos, which are at present in a very active state of erosion and did not exist during the prehistoric occupation of the region (see Appendix I).

[33] Prudden, 1903, pp. 234–235.

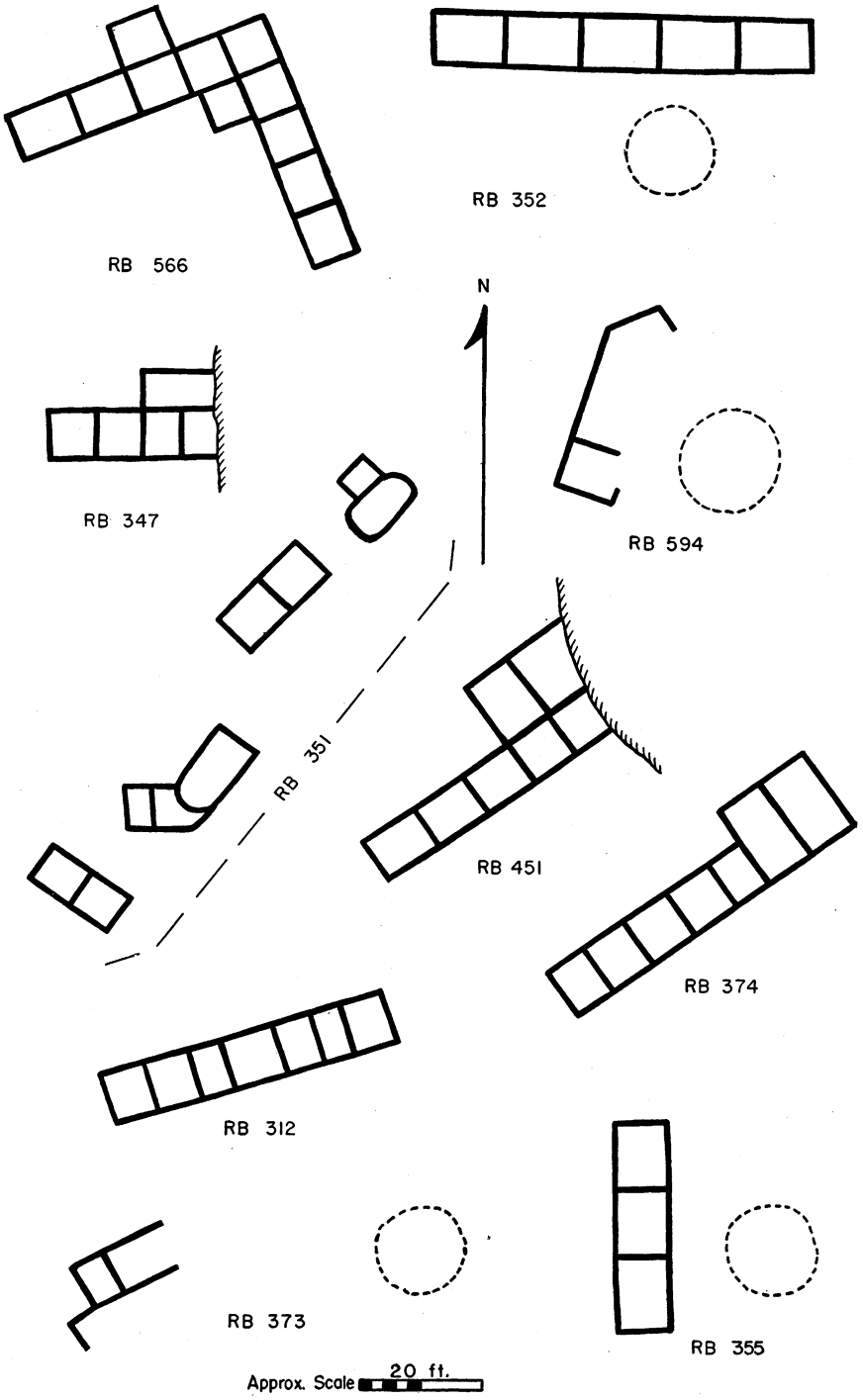


Fig. 2. Examples, in simplified outline, of typical "unit type" masonry structures from the Tsegi region. Numerals indicate site numbers.

2. The canyon floor, or fairly level plain extending from the edges of the arroyos to the lower extremities of the side walls of the canyons. This is usually covered with grass and low scrub of various species, but is devoid of trees. It consists of former stream terraces or the bottoms of old lakes, some of which survived up to about forty-five years ago.

3. Sand-dune areas. These are aeolian in origin and are irregularly distributed, usually rising fanlike from the valley floors and extending upward against the southwest side walls of the canyons. Often they bear no vegetation.

4. The irregular and usually battered outcrops of the Chinle formation. These afford dwelling sites only in the lower reaches of the canyon, but provide good building material through most of the canyon length.

5. The steep cliff faces of the Wingate sandstone, which in most of the region rises steeply from the valley floor to a height varying from a few feet to eighty or occasionally more than one hundred feet. Small caves often occur in these cliffs, suitable for shelter or dwellings.

6. A relatively level bench formed by the upper stratum of the Wingate sandstone and extending from the Wingate cliffs to the Navajo sandstone. On this bench usually grows a fairly luxuriant forest of piñon and juniper and, where a good underground water supply is available, scrub oak, box elder, alder, willow, and sometimes western yellow pine and Douglas fir.

7. The talus that has accumulated against the base of the Navajo cliffs and the thin, decayed stratum of Kayenta sandstone. This is made up of large and small blocks of Navajo sandstone and is often covered with aeolian dunes. Where the talus is not too steep or rocky, the cover is similar to that on the Wingate sandstone bench.

8. The almost vertical cliffs of the Navajo sandstone, rising sometimes to a height of seven hundred or eight hundred feet. In or near the base of these cliffs occur many large, dome-shaped caves.

9. The uneroded mesa top, above the Navajo sandstone. Here again occur piñon, juniper, and numerous species of grasses and shrubs.

On a consideration of the combined factors of sherd statistics, architecture, and ecology a chronology of the region has been built up. The foregoing rather lengthy discussion has been introduced for the purpose of describing the methods used in arriving at the statistical data on which later conclusions are based.

Following the analytical study of the various ceramic criteria pertinent to the sites recorded by the reconnaissance in the Tsegi Canyon and its tributaries, a hypothetical chronology of these sites was developed. This was done primarily on the basis of previous knowledge of the time relations of certain pottery types in this region, and the sites were grouped into nine categories based on the presence of significant quantities of certain key pottery types and the absence or near-absence of others. Each group was then considered as a unit and a composite chart was prepared showing the proportions of every pottery type in each group. A technical discussion of the statistical methods used in the compilation of these data will be found in Appendix III. The result of this analysis is given in the lower half of table 1, which indicates graphically the chronological life of each of the pottery types included. Absolute dates cannot be assigned for the life spans of these types, but the general trends, together with the associations of any given type with other types, is fairly accurately indicated.

A few specific examples may clarify the foregoing and aid in an intelligent reading of table 1. For example, the fourteen sites included in group H on the chart all have in common the characteristics of possessing over 90 per cent of Lino Gray, Kana-a Gray, and Kana-a Black-on-white taken together. It is taken as established that these types were diagnostic of Pueblo I or Early Developmental Pueblo in this region, and that as time passed they tended to diminish and finally to disappear.[34] Groups I, J, and K show such a tendency, and also the beginning and continuous

[34] The present tendency in terminology appears to be toward the modifications of the Pecos classification suggested by Roberts (1935, p. 32). Although the less rigid classifications proposed by Roberts have definite advantages, especially in dealing with the peripheral areas, we feel that for the Tsegi region Pueblo I and Pueblo II periods are so clearly distinguishable that abandonment of the precision of the original Pecos terminology would be a distinct loss. In this paper we have, therefore, endeavored to employ a usable combination of the two classifications in the following manner: Basketmaker II has been retained; Modified Basketmaker and Basketmaker III

increase of certain other types, such as Tusayan Corrugated, Black Mesa Black-on-white, and Sosi Black-on-white, until in group M there appears a ceramic complex characteristic of Pueblo II or Late Developmental Pueblo.

In group N, however, these typically Pueblo II types tend to diminish in quantity, and the various polychrome types appear for the first time, and in group O Tusayan and Kayenta Black-on-whites first appear. Group P displays a typically Pueblo III ceramic complex.[35] Other less significant types follow characteristic trends and are indicated on the chart.

On the upper half of table 1 are shown the ceramic complexes of the sites excavated by the Expedition. These were not considered in preparing the main chart, since the relatively large numbers of sherds included in them would have overbalanced the smaller collections from the surveyed sites. A comparison of the two charts will show, however, a close correlation, so that there is ample justification for assigning the excavated sites to the respective positions in the time sequence indicated. The large excavated samples also serve as "anchoring points" in the less reliable series of surface collections.

In table 2 following this section is given a list, in numerical order, of the sites surveyed, from which pottery-sherd collections of significant size were obtained. Following the site numbers are five columns, with signification as follows:

In column 2 is indicated the chronological group into which each site falls, based on its ceramic complex, as explained in the immediately preceding paragraphs (see table 1).

In column 3 is indicated the section or area of map 1 in which the site is located.

In columns 4 and 5 are indicated very generally the architectural nature of the site, so far as this can be determined from surface indications, showing the presence or absence of cysts or depressions (subterranean rooms?) and the approximate number of rooms apparent at those sites at which masonry remains are visible. When there is no evidence at a site of cysts, depressions, or masonry, the site in question shows on the surface merely an area of sherds and miscellaneous cultural debris.

In column 6 is indicated the ecological or vertical position of the site, as explained on pp. 15 f. The symbols used in this connection are the Roman numerals I to VI, which have the following significance:

I. The open floor of the valley, between the edges of the arroyo and the base of the lowermost cliffs of the canyon wall (this is Wingate sandstone toward the head of the canyon, Chinle formation at the lower end).

II. The talus at the base of this lowermost cliff.

II*c*. A cave in the Wingate sandstone.

III. The relatively level bench above the Wingate sandstone.

IV. At or near the base of the upper cliffs of the canyon walls (Navajo sandstone).

IV*c*. A cave in the Navajo sandstone.

V. Sand dunes against the canyon walls.

VI. The open mesa top above the Navajo sandstone.

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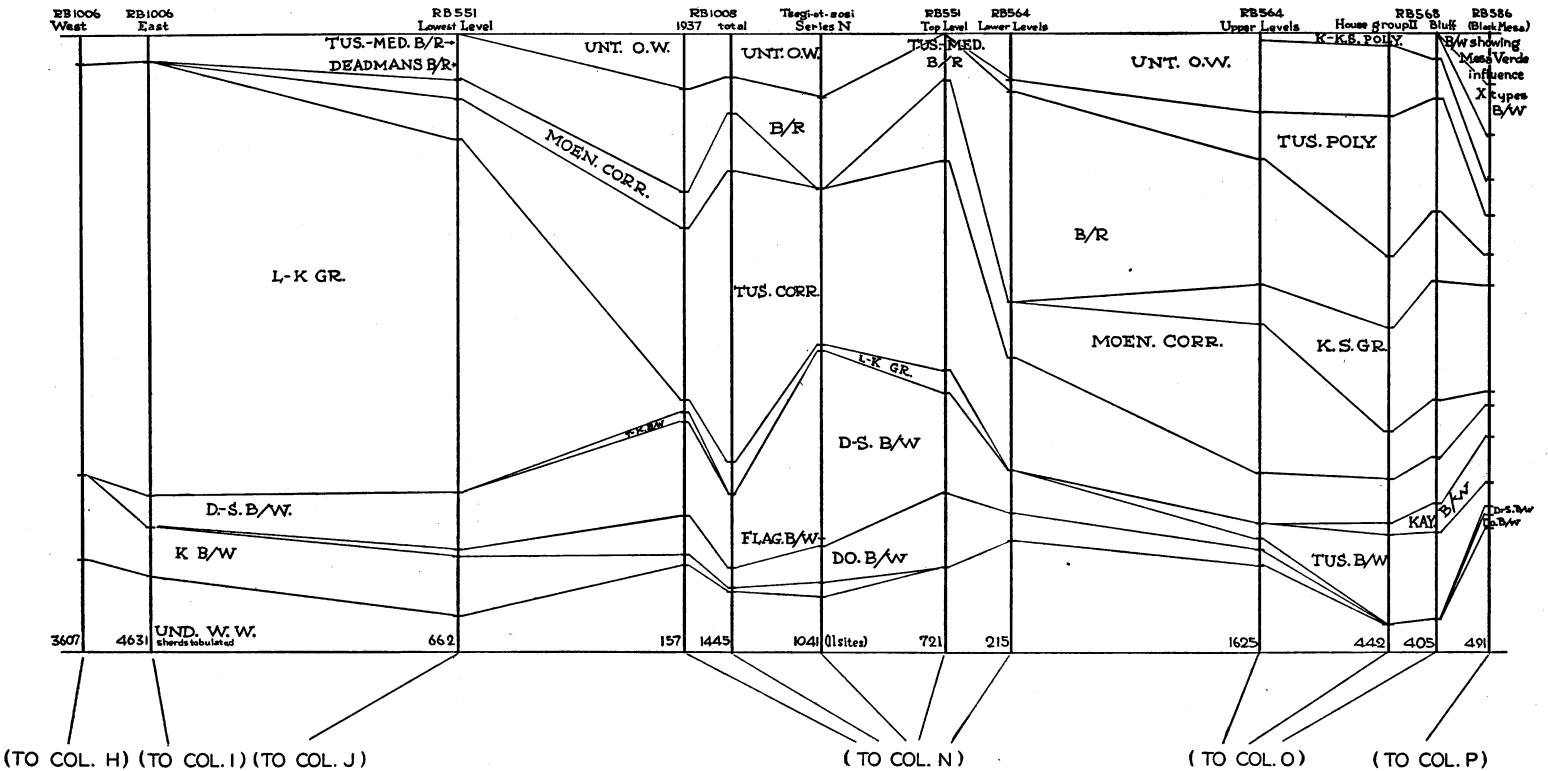
are used interchangeably; Early Developmental Pueblo is used as the equivalent of Pueblo I; Late Developmental Pueblo is used as the equivalent of Pueblo II; Great Pueblo is used as the equivalent of Pueblo III. In many instances we have used both terms in referring to a period. When only one term is employed, we have usually given the term used in the Pecos classification.

[35] The reader may be confused concerning the placing of the Pueblo II–Pueblo III transition. This is the situation in brief, which is discussed more fully later: The manufacture of the two main Pueblo III pottery determinants, Tusayan Polychrome and Tusayan–Kayenta Black-on-whites, began at different times in the Kayenta area (table 1, group N); and big-house architecture is not apparent on any of our sites until the latter of these pottery groups (Tusayan–Kayenta Black-on-whites) appears (table 2). Site RB 564 is Pueblo II in architecture, bears Tusayan Polychrome but no clearly recognizable Tusayan Black-on-white serration—which is the easiest identifying criterion of Pueblo III black-on-white pottery. For the purpose of this report, in which the dating is perforce mainly based on pottery typology, the easiest time to begin Pueblo III is at the beginning of the polychrome horizon, thus allowing the plentiful and completely distinctive polychrome to be used as the major defining type for Pueblo III. This usage also has the advantage of placing Pueblo III as beginning *circa* 1100 A.D., the date usually given for this area. This usage is admittedly arbitrary, and neglects the widespread, important, and eminently usable architectural criterion. Such usage in this report is merely for ease of definition and is not meant to establish a precedent.


RB1006 West
RB1006 East
RB551 Lowest Level
RB1008 1937 total
Tsegi-et-sosi Series N
RB551 Top Level
RB564 Lower Levels
RB564 Upper Levels
House group II
RB568 Bluff
RB586 (Black Mesa)
TUS.-MED. B/R
DEADMANS B/R
MOEN. CORR.
L.-K GR.
D.-S. B/W.
K B/W
UND. W. W.
sherds tabulated
UNT. O.W.
B/R
TUS. CORR.
L-K GR.
D-S. B/W
FLAG. B/W.
DO. B/W
(11 sites)
TUS.-MED. B/R
MOEN. CORR.
K-KS. POLY.
B/W showing Mesa Verde influence
X types B/W
TUS. POLY
K.S. GR.
KAY. B/W
TUS. B/W
3607
4631
662
157
1445
1041
721
215
1625
442
405
491
(TO COL. H)
(TO COL. I)
(TO COL. J)
(TO COL. N)
(TO COL. O)
(TO COL. P)

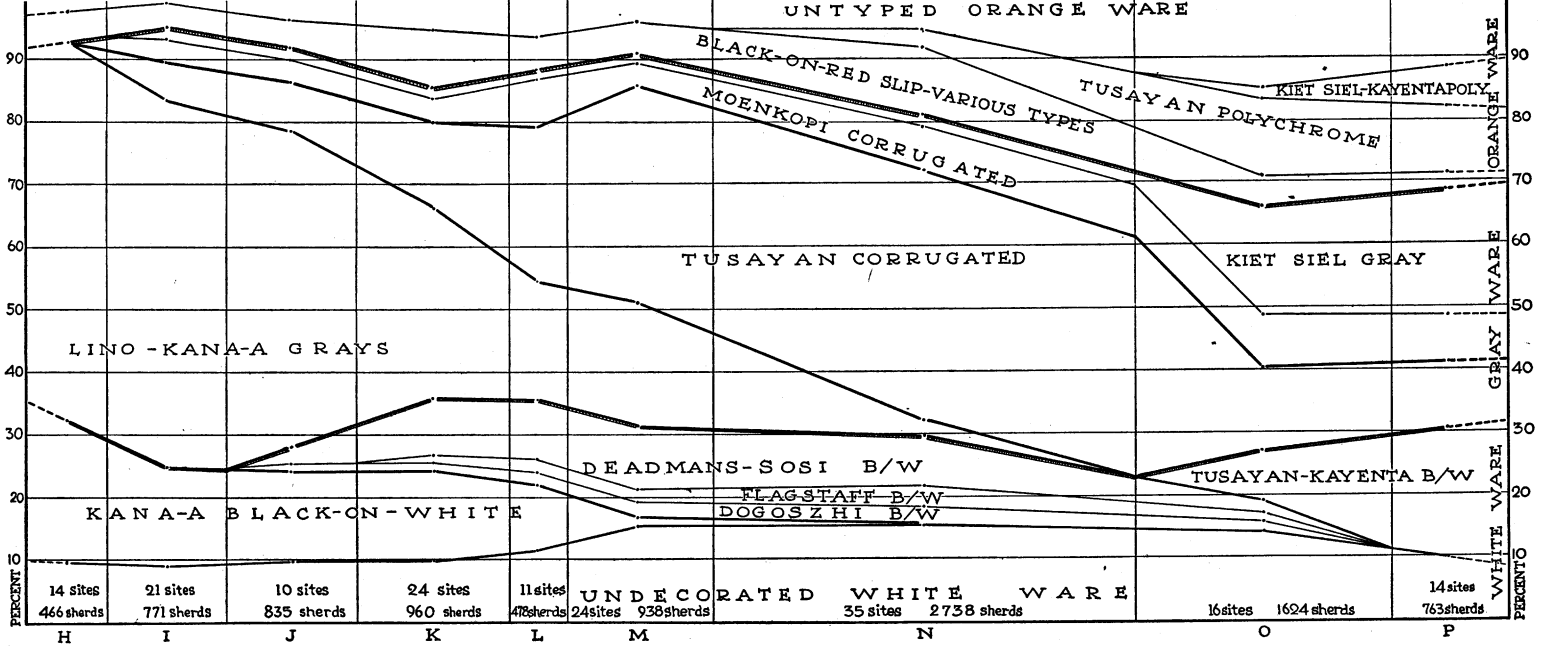


TABLE 1. This table presents a history of the development of pottery types in the Tsegi region. In the upper chart, arranged chronologically from left to right, are shown the proportions of all types found at certain selected places indicated by vertical lines. At the base of each vertical line is listed the total number of sherds considered, while the quantity of each type is shown as its percentage of that total. The division points on each vertical line are arbitrarily connected by straight lines, so that the areas thus enclosed give an approximate picture of the growth and subsidence of each type. The abbreviated type names are spelled out in full in the lower chart, which should be considered in connection with the upper.

The lower chart is a similar presentation of pottery-type development as indicated by the survey of 169 sites in the Tsegi drainage itself. The sites listed in the upper chart were not included in the lower. A detailed explanation of the construction and interpretation of this table will be found on pages 16–17. As this table was prepared before Colton modified his own nomenclature, the term Deadmans Black-on-White instead of Black Mesa Black-on-White appears in this and other tables.

TABLE 2

CERAMIC AND ARCHITECTURAL COMPLEXES IN THE KAYENTA AREA

List of sites in Tsegi drainage showing ceramic complex, architectural character, and geographical locations. For meaning of symbols see text pp. 16–17.

Site no.	Ceramic group	Map location*	Cysts and depressions	Masonry	Geographical location
RB 301	N	X	....	1 room	II
RB 302	N	X	....	....	I
RB 303	J	X	....	....	II
RB 304	L	XI	....	....	II
RB 306	M	XI	....	....	IV*c*
RB 310	R	X	....	10 rooms	IV
RB 311	M	X	....	....	V
RB 312	N	X	....	7 rooms	III
RB 315	N	XII	....	40 rooms	IV*c*
RB 317	M	XII	....	2 granaries	II
RB 318	L	XII	....	? rooms	III
RB 327	R	IX	....	....	III
RB 328	M	IX	....	8 rooms	III
RB 331	H	V	1 small	....	I
RB 334	I	IX	1	....	II
RB 336	L	V	1	....	I
RB 337	I	V	....	....	V
RB 342	N	IX	....	? rooms	II
RB 343	L	IX	....	? rooms	III
RB 344	M	IX	....	....	V
RB 345	R	X	....	....	II
RB 346	L	X	1	....	II*c*
RB 347	N	VIII	....	5 rooms	II
RB 348	M	X	....	....	VI
RB 349	J	V	....	....	VI
RB 350	M	V	1	....	V
RB 351	N	IX	....	8 rooms	IV
RB 352	L	VIII	....	? rooms	I
RB 354	I	VIII	1	....	III
RB 356	O	VIII	....	Scaffold house	IV*c*
RB 358	N	IX	2	1 room	III
RB 361	I	VIII	1	....	V
RB 362	M	VIII	....	....	II
RB 362	N	VIII	....	4 rooms	II
RB 364	N	VIII	....	....	I
RB 365	I	VIII	....	? rooms	III
RB 366	I	VIII	....	....	V
RB 370	H	VIII	5	....	III
RB 371	I	VII	2 large 2 small	....	III
RB 372	L	VII	....	....	V
RB 373	O	VII	1	8 rooms	V
RB 374	M	VII	....	10 rooms	II
RB 378	I	VII	....	....	II
RB 380	N	...	....	....	VI
RB 381	J	...	....	....	VI
RB 384	N	...	....	....	VI

* In this column ellipses indicate that site is not given on Map 1.

TABLE 2—(*Continued*)

Site no.	Ceramic group	Map location*	Cysts and depressions	Masonry	Geographical location
RB 385	N	...	....	....	VI
RB 386	R	IX	3 large	1 room	III
RB 387	M	IX	....	1 room	III
RB 391	N	VII	....	2 rooms	III
RB 392	L	VII	....	....	III
RB 393	R	VII	....	....	II
RB 394	M	VII	....	....	V
RB 395	L	VII	....	....	III
RB 396	I	VII	....	2 rooms	II
RB 397	L	VI	....	? rooms	V
RB 398	O	VI	....	? rooms	III
RB 399	N	VI	....	2 rooms	V
RB 400	N	VI	....	2 rooms	II
RB 401	J	VII	....	2 rooms	II
RB 410	O	V	....	....	II
RB 413	J	...	12 small	....	I
RB 415	O	...	....	....	VI
RB 416	L	V	....	? rooms	I
RB 417	O	V	....	....	V
RB 418	N	V	....	....	I
RB 420	R	VI	1	....	V
RB 421	N	VI	....	....	V
RB 423	M	VI	....	10 rooms	V
RB 424	L	VI	....	....	IV
RB 425	O	VI	....	....	V
RB 429	M	VII	....	....	IV*c*
RB 451	N	VIII	....	12 rooms	I[1]
RB 452	L	VIII	....	....	V
RB 453	M	VIII	....	? rooms	IV*c*
RB 454	I	VIII	1	....	III
RB 455	M	VIII	1	? rooms	II
RB 456	J	VII	1 large	....	V
RB 457	L	VII	....	....	V
RB 551 (early levels)	M	...	1 large	6 rooms	I
RB 551 (later levels)	M	...	1 large	6 rooms	I
RB 551 (architecture)	M	...	1 large	6 rooms	I
RB 564 (early levels)	N	...	1 large	6 rooms	V
RB 564	O	...	1 large	6 rooms	V
RB 565	H	...	....	? rooms	I
RB 566	N	...	....	6 rooms	V
RB 567	R	...	....	....	V
RB 569	N	...	....	? rooms	VI
RB 593	O	...	....	? rooms	I
RB 598	N	VI	1	....	III
RB 599	I	VI	....	? rooms	V
RB 603	N	VI	....	? rooms	I
RB 604	N	V	....	....	IV*c*
RB 611	I	V	....	? rooms	III
RB 618	N	VI	....	? rooms	II*c*
RB 633	M	VI	....	....	II
RB 641	J	V	....	....	V

TABLE 2—(*Continued*)

Site no.	Ceramic group	Map location*	Cysts and depressions	Masonry	Geographical location
RB 645	I	IV	....	....	?
RB 647	M	V	....	? rooms	I
RB 651	I	IV	....	....	I
RB 652	I	IV	1	....	I
RB 653	J	IV	....	? rooms	I
EB 656	N	IV	....	2 rooms	I[1]
RB 660	O	IV	....	....	I
RB 665	I	IV	....	....	IV
RB 666	N	IV	....	....	III
RB 1001	H	IV	....	....	I
RB 1002	I	IV	....	1 room	IIc
RB 1004	N	IV	....	....	I
RB 1005	M	IV	....	2 rooms	V
RB 1008 (1937 excavation)	N	IV	....	3 rooms	V
RB 1008 (1938 excavation)	M	IV	....	3 rooms	V
RB 1010	N	IV	....	? rooms	I
RB 1013	M	IV	....	1 room	V
RB 1016	N	IV	....	....	III
RB 1020	M	III	....	2 rooms	I
RB 1021	O	III	....	1 room	?
RB 1022	O	III	....	? room	V
NA 2409	I	...	....	....	I
NA 2502	R	...	....	? rooms	IVc
NA 2504	O	...	....	6 rooms	I
NA 2508	N	...	....	? rooms	I
NA 2521 (dated 980±6)	R	(Turkey House)	1 large	3 rooms	IVc
NA 2524	L	...	....	....	I
NA 2526	H	...	....	....	III
NA 2532	I	...	....	....	I
NA 2533	N	...	....	....	V
NA 2540	I	...	....	....	II
NA 2541	L	...	....	....	V
NA 2543 (dated 1065)	R	...	....	13 rooms	IVc
NA 2544	L	...	....	7 rooms	IVc
NA 2608	H	...	....	....	V
NA 2609	R	...	....	? rooms	?
NA 2610	H	...	....	....	IV
NA 2612	L	...	....	....	?
NA 2613	L	...	....	....	?
NA 2614	L	...	....	....	?
NA 2615	I	...	....	....	V
NA 2616	H	...	....	....	?
NA 2619	N	...	....	....	V
NA 2621	I	...	....	....	?
NA 2622	H	...	....	? rooms	?
NA 2623	M	...	2	....	?
NA 2624	I	...	....	? rooms	V
NA 2627	J	...	....	....	III
NA 2628	H	...	....	....	?
NA 2630 (Len-a-kin.—dated 1124, 1130)	N	...	1 large	82 rooms	IVc

* In this column ellipses indicate that site is not given on Map 1.

TABLE 2—(*Concluded*)

Site no.	Ceramic group	Map location*	Cysts and depressions	Masonry	Geographical location
NA 2631	L	...	....	6 rooms	IV*c*
NA 2633	L	...	....	....	VI
NA 2651	N	...	....	....	I
NA 2662	M	...	....	....	I
NA 2663	H	...	....	....	?
NA 2664	M	...	....	....	I
NA 2700A	H	...	....	....	IV*c*
NA 2704	L	...	....	10 rooms	IV*c*
NA 2707	O	...	....	? rooms	IV*c*
NA 2710	O	...	....	4 rooms	IV*c*
NA 2711	J	...	....	4 rooms	IV*c*
NA 2712	J	...	1 large	2 rooms	IV*c*
NA 2714	R	...	....	....	I
NA 2715	L	...	....	....	I
NA 2718	J	...	....	? rooms	I
NA 2719	M	...	....	....	?
NA 2725	M	...	....	....	?

EXCAVATIONS

One of the major enterprises necessary to complete the prehistory of the region under investigation was a detailed and comprehensive survey of the material culture of the horizons of Pueblo I, II, and III as manifested at characteristic sites in the vicinity. In the course of the survey several such sites had been located, and five were excavated wholly or in part.

Two of these were situated within a few hundred yards of each other near the mouth of Cobra Head Canyon, which debouches into the Tsegi Canyon about four miles above Marsh Pass. They appear on map 1 as Sites RB 1006 and RB 1008. The former was a site evidencing two periods of occupation, one that seemed to be typical of Pueblo I, the other transitional between Pueblo I and Pueblo II. This site is discussed in detail below. Site RB 1008 was apparently occupied in the later part of Pueblo II, subsequent to the major time range of Site RB 551 mentioned below.

A third site, Site RB 551, was situated on Black Mesa in the valley floor formed by the upper reaches of the wash that farther downstream flows through what is known as Boo-Koo Dot Klish or Blue Canyon (see inset, map 1). Occupation of the site extended through at least the early and middle part of Pueblo II and perhaps began during the transitional era from Pueblo I.

Overlapping the later occupancy of Site RB 551 and extending beyond it into early Pueblo III times was Site RB 564, situated about a mile southwest of the Expedition's base camp in Marsh Pass. The architectural remains at Site RB 564 were not excavated, but stratigraphic tests were made in the refuse mound there, which served to fill out the picture of late Pueblo II–early Pueblo III ceramics. The earlier strata began during the later occupation of RB 551; the later strata bore a considerable amount of pottery normally considered characteristic of Pueblo III times.

Finally, Site RB 568 was excavated thoroughly. The largest and most productive site of all, it contained a burial ground from which fifty burials containing several hundred pottery vessels were exhumed, as well as extensive though sadly disintegrated masonry structures. Site RB 568 lay outside the main Tsegi drainage, and was situated about seven miles northwest of Kayenta, in the valley of Kaycuddie Wash (see inset, map 1). It seems to have been occupied in the early and middle parts of Pueblo III, following immediately upon Sites RB 564 and RB 1008, and was probably abandoned prior to the final flowering of Pueblo culture as manifested at the large cave ruins such as Kiet Siel and Betatakin.

Site RB 1006

The excavation of Site RB 1006 was carried out in the 1937 and 1938 seasons under the direction of Ralph L. Beals. The site is located on an elongated fossil sand dune on the west side of Cobra Head Wash about 200 yards north of the base of the prominent formation known locally as the Cobra Head. The Cobra Head is between 4 and 4½ miles west of Marsh Pass in the Tsegi. The long axis of the dune runs almost exactly east and west. On the west edge of the site the dune is partly overlaid by wash from the talus slope at the foot of the Wingate Sandstone cliffs and the last outlying rocks of the talus lie within the sherd area. On the north and south the site is roughly bordered by small water channels 6 or 7 feet in depth; these are dry except during and immediately after heavy rains. The bench mark established on the site near surface structure 1 has an elevation of 6,279.70 feet.

The dune covers members of the Chinle formation and its base probably rests

in part on the upper or Tsegi terrace (see p. 152). It is possible that the dune rests entirely on Chinle rocks; if so, its formation may be considerably older than the terrace formations of the Tsegi. Two test excavations, 10 feet and 10 feet, 6 inches respectively below the present surface, show the composition of the dune to be relatively homogeneous fine pink sand which is highly compacted. Occasional mixture of clay and small pebbles probably represents wash from the cliffs and talus slopes above accumulated during the formation of the dune. Occasional small fragments of charcoal, the largest about ⅛ inch in diameter, occur to depths of at least 9 feet. It has been suggested that rodents are responsible for this, but absence of any associated cultural debris and lack of evidence of rodent holes at such depths renders this explanation doubtful. The other alternative is that the fragments were blown in during the formation of the dune, which raises the question whether human occupants lived in the area during or before this period.

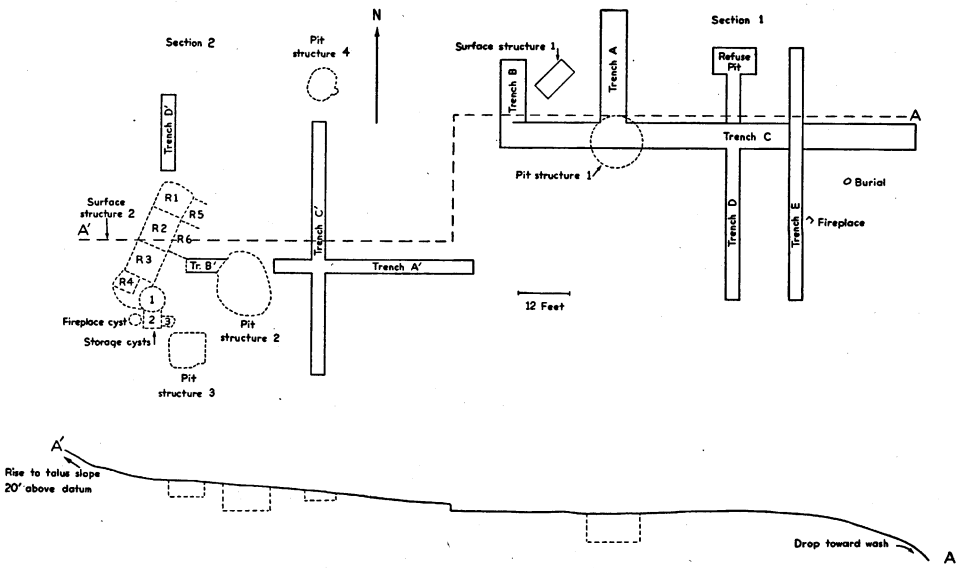
The summit of the dune today is almost free of vegetation. A few scattered small junipers and large piñons occur. The surrounding slopes carry, for this region, a fairly heavy growth of junipers and piñons. The near-by terraces to the south support grass, rabbit brush, chamise, and other small plants. The terrace areas should have provided abundant good farm lands, particularly if the arroyos were not in an erosion stage and the water table was fairly high at the time of occupation. A permanent spring of moderate size providing good water occurs beneath a Chinle limestone outcrop in the bed of Cobra Head Wash about 150 yards north of the site.

Site 1006 was selected for excavation for two reasons. One was the variety of pottery types of the Developmental Pueblo period in its earlier and middle phases, which occurred on the surface and suggested a relatively long occupation. The second was the abundance of surface sherd material, which offered hope of encountering stratification. Actually, these expectations were not realized. The site proved to be the result of two distinct occupations on different parts of the dune with the refuse of the second occupation overlapping part of the earlier refuse. The western and earlier part showed no intermixture with later types of pottery either on the surface or subsurface. Moreover, the abundant sherd material proved to be almost wholly on the surface, forming a thin skin rarely over four inches in depth. This absence of refuse materials in contrast to the abundance of sherds calls for explanation. It is believed that a layer of refuse did accumulate on the mound during the period of occupation. It is suggested that, after abandonment of the site, most of the refuse materials except the pottery and stone objects were washed or, more probably, blown away, restoring the mound approximately to its original contours.

ACCOUNT OF EXCAVATION

The following methods were followed in the excavation of the site. The surface was first divided roughly into four areas, and all surface sherds and stone artifacts were collected, except very small fragments. The sherds collected on the surface numbered about 8,200, and 4,700 more were later excavated. A true east-west line was established, which nearly paralleled the long axis of the dune. As two rather widely separated points showed evidence of buildings, two grid systems were laid out, utilizing 6-foot intervals between stakes. The eastern grid area was designated section 1, the western section 2.

To simplify the taking of levels an arbitrary datum was established 20 feet below the bench mark at 6,279.70 and all levels read with the bench mark as plus 20 feet. Trenches were laid out as shown on map 2 and excavation was begun in arbitrary 12-inch levels carried well into sterile earth. Sherds occasionally occurred at levels



MAP 2. Site RB 1006. Plan and vertical cross section, showing all structures found, test trenches, and burial. Solid lines indicate trench boundaries; broken lines outline the structures.

below the discolored soil containing refuse and organic matter, but these probably were carried down by rodents. The trenching, except as an aid to locating pit structures, was unproductive. The trenches were excavated in 3-foot horizontal sections in either 6-foot or 3-foot widths. The following record from parts of trenches A and B, section 1, indicates the sterility of the subsurface material from all levels of sections measuring 3 by 6 feet:

	Excavation section	*Number of sherds*
Trench A	1	0
	2	5
	3	2
	4	5
	5	0
Trench B	1	2
	2	1
	3	4
	4	1
	5	4

At the north end of trench D an irregular depression filled with refuse was found. This depression was probably an excavation, for what purpose could not be determined. Neither here nor in any other spots with deeper refuse was enough sherd material recovered to give significant stratigraphic results. In trench E a small roughly circular area about 1 foot in diameter appeared to have been a fire hearth slightly excavated in the original dune surface. It was underlain by an irregular flat stone. Just east of trench E a partly buried square stone fireplace of sandstone slabs showed on the present surface. Because of the disappointing results of trenching, the remainder of the site was tested at regular intervals in the hope of finding a refuse deposit of some depth. Two unsuspected pit structures and a burial were located as a result. Such testing is ordinarily undesirable, but here the thinness of the refuse deposit and the large area to be covered made it the only practical way of searching for deeper refuse areas.

All structures were excavated as separate units, and the methods are described for each. The excavations will be described approximately in the order in which they were undertaken.

Section 1.—Pit structure 1 was suspected from a circular but very shallow depression in front of surface structure 1.[36] A stratigraphic test column 3 feet square was laid out inside the house outline and excavated from the surface in 12-inch levels. The small number of sherds found precluded definite results, but the material appeared no different from surface finds in the vicinity. The remainder of the floor was then cleared. The floor was nearly a perfect circle averaging 13 feet, 6 inches in diameter. The elevation was 12.97 feet above the datum plane or 81 inches below the present surface.

Pit structure 1 was probably a dwelling room, to judge by the evidence of use and the character of the debris on the floor. It had been excavated in the hard compacted dune sand and the walls plastered with a thin coat of clay and sand, indistinguishable in color from the dune sand. For this reason it was difficult to identify except under perfect conditions and with very careful techniques. Enough was exposed in good condition to indicate that the plaster had been polished, probably with a smooth stone. The roof was supported on four posts (fig. 3) against the walls, but no evidence of roof construction was obtained. There was a suggestion of a center post, although, if such existed, it did not penetrate the floor (see p. 29). The floor was of clay about ¼ inch thick, evidently carefully laid. Ash, finely pulverized charcoal, and red sand, all well compacted, covered the clay floor, especially between the fireplace and the ventilator. In numerous places below the apparently undisturbed clay floor were shallow lenses of clean gray, white, yellow, and pink sand. The lenses varied from 3 inches to 10 inches in depth. Some of these contained pottery fragments and almost always had a few small fragments of charcoal at the bottom. It seems certain that these lenses were formed intentionally, perhaps for ceremonial purposes.

The structure was evidently abandoned while still in good condition and became partly filled with wind-blown sand which banked against the walls. This process apparently lasted some time, for the sand was laminated. The sand deposit was about 12 inches deep in the center, rising toward the walls. After an unknown time the roof burned, depositing a thick layer of fine charcoal containing no fragments suitable for dating. Some rocks in the fill were probably on the roof when it burned. The walls then appear to have been eroded or to have collapsed into the depression remaining; they could not be traced at the higher levels. If the rafters of the roof rested on a bench, this bench must have been close to the surface, and all traces of it were obliterated.

The fireplace was 45 inches from the ventilator and measured 21 by 13½ inches. It was lined on all four sides by upright sandstone slabs projecting above the floor surface approximately 2½ inches. The clay of the floor was rounded upwards against these stones. The bottom of the fireplace was approximately 8 inches below the floor level. Adjoining the fireplace to the north was a rectangular ashpit of approximately the same dimensions, lined with sandstone slabs, sloping inward at the bottom and extending about 10 inches below floor level. The fireplace was filled with ash, charcoal, and a few small sherds, but the ashpit contained only well-compacted wood ash. There was no deflector.

At the foot of the south wall, 13 inches from the north-south axis, were low clay ridges modeled on the floor which probably served as a pot support. A pocket in the

[36] Since evidence of the use to which subsurface structures were put is not conclusive, the terms "house" or "kiva" are avoided.

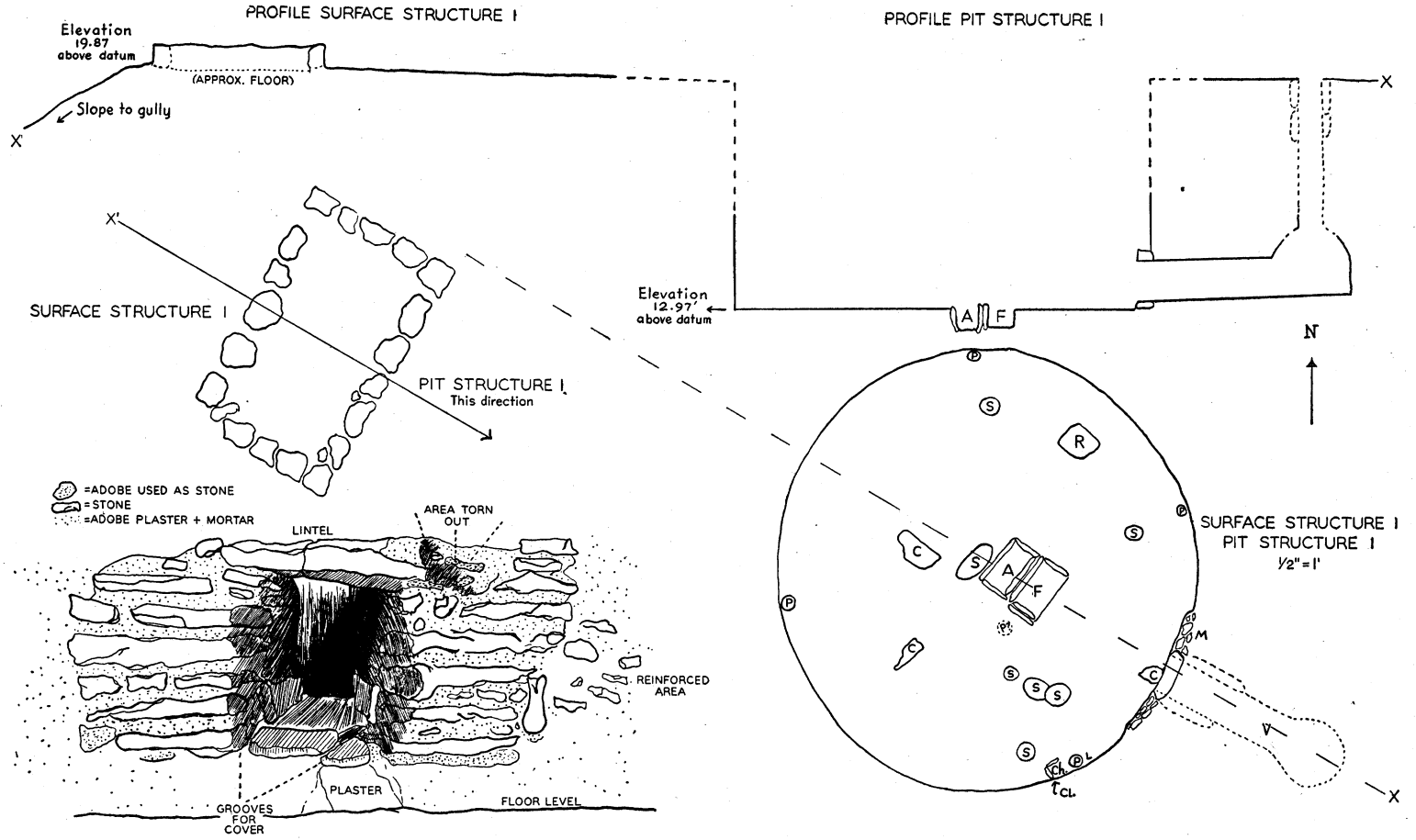


Fig. 3. Site RB 1006. Plan and profile of pit structure 1 and surface structure 1, and detail of masonry around ventilator opening, southeast wall, pit house 1–1006. A, ash pit; C, cover for ventilator; Ch., charcoal; F, fireplace; L, jarorite; M, masonry around opening to ventilator tunnel; P, postholes; R, flat rock with charcoal below; S, sand lenses beneath floor; V, ventilator tunnel; X'–X, line of profile (dotted lines indicate reconstruction).

floor inside the ridges contained charcoal and ash. Near by toward the ventilator were fragments of ochrous sand and jarorite.

Four postholes extended approximately 18 inches below the floor beside the wall. In one of these was 14 inches of an uncharred post in a badly rotted condition. It could not be dated. The postholes were from 4 to 5½ inches in diameter. Near the fireplace was a clay-and-rock reinforced circle apparently bracing the foot of a post 4½ inches in diameter. There was no hole in the floor and the post may have been either a center post or a ladder.

The ventilator opening was surrounded by the only masonry in the structure (fig. 3). A rectangular tunnel opened 3 inches above the floor and extended 72 inches to the southeast where it connected with a vertical shaft reaching to the surface. The tunnel opening was 15 inches wide and 18 inches high. A rough masonry wall of sandstone slabs, coursed, bonded, and laid in adobe mortar, extended for about 15 inches on either side of the opening. The stones were chipped about the tunnel opening to provide a groove for the insertion of a flat stone serving as a cover. One part of the cover stone lay in front of the opening. The remainder, in two pieces, lay some distance away, one piece on the floor, one several inches above the floor. This and several other facts, such as the finding of fragments of the same pottery vessel both on the floor and several inches above the floor, suggest minor disturbance of the house after the sand began to accumulate in it but before the roof burned.

The sides of the forward part of the ventilator tunnel were lined with heavy upright sandstone slabs. Apparently the roof and the remainder of the sides were lined with wood (which had burned) covered by a clay plaster. The floor was of clay and sloped upward about 3 inches from front to back. At the rear the tunnel enlarged into a circular dome-shaped space 24 inches in diameter with the shaft entering at the top. The exact shape of the shaft was obliterated by collapse of the sides. The upper part had been lined with thick sandstone slabs, and there may have been some sort of simple surface structure protecting the opening or extending the shaft slightly above the surface. This was suggested by the number and disposition of the fallen sandstone slabs in the upper part of the debris filling the shaft. The fill of both tunnel and shaft contained potsherds.

Two tubular clay pipes (Nos. RB 1006–74 and RB 1006–75) were found on the floor close together, half a pottery pitcher (No. RB 1006–3), and numerous pottery fragments, including part of a bowl (No. RB 1006–6). All the parts of a small polished white bowl (No. RB 1006–2) were found in the fireplace. The decorated black-and-white pottery found on the floor was all of an early Black Mesa Black-on-white with unusually wide lines, crude painting, and in designs more closely resembling those of Kana-a Black-on-white than the fully developed Black Mesa (fig. 49, *e, f*). Other types found were small quantities of Deadmans Black-on-red, Lino Gray, and Kana-a Gray. Considerable variation existed in the width of unobliterated coils of the Kana-a Gray. Some undecorated white ware also was found. Provisionally, the structure may be assigned to the transition point between the making of Kana-a Black-on-white and Black Mesa Black-on-white or at the beginning of Pueblo II in the area. Very few sites or examples of intermediate pottery are known, although it seems clear that Black Mesa is an outgrowth of Kana-a in design (see p. 100).

Surface structure 1 was indicated by a partly projecting wall outline northwest of pit structure 1. The long axis ran northeast and southwest. Height of the standing wall was 19.87 feet above datum, 6.9 feet above the floor of pit structure 1. The structure was rectangular, measuring 62 by 94 inches in outside dimensions, and

the masonry wall averaged 12 inches in thickness (fig. 3). The wall consisted of one or, in places, two courses of large angular stones, poorly fitted and without evidence of mortar. The wall extended only a few inches below the surface at the time of excavation. A piece of a broken trough metate was used as one of the wall stones. Scattered stones near by, and evidently from the wall, could have raised the wall at most to four courses, or between 24 and 30 inches in height. This suggests that the wall had either been robbed of stones or that the upper part was of different construction. Considerable numbers of small stones between the surface and pit structures, and extending into the fill of the pit structure, may have been from a clay-and-stone wall, but no good evidence was found to explain their presence. Inside the rectangle of the wall a definite layer of occupational earth occurred, but there was no evidence of fire hearths. Sherds were very few in number. A few bones occurred. Neither postholes nor definite indications of a floor were found. It is suggested that the structure was used as a storehouse.

Section 2.—The second area of the site contained a more complex series of structures consisting of a multiroomed surface structure (surface structure 2) and three pit structures (pit structures 2, 3, and 4). All structures were earlier than those of section 1, judging by pottery types. The types throughout section 2 were Lino Gray, Kana-a Gray, Kana-a Black-on-white, and Deadmans Black-on-red.

Pit structure 2 was discovered in the course of excavating trench B. The same technique was used as in the excavation of pit structure 1 and the stratigraphic column again yielded no evidence. The structure was irregularly egg-shaped in floor plan with the floor approximately 65 inches below the present ground surface and 22.8 feet above the datum point. On the north-south axis the diameter of the house was 214 inches and on two east-west axes it measured 148 inches and 154 inches respectively (fig. 4; pl. 2, *a*). The structure apparently was excavated in the hard sand and the bottom was probably leveled off with basketloads of tan and red sand which were dumped on the floor to form large lenses of different colors. Except for the area around the edges, the sand was covered with an uneven layer of hard violet clay (probably from the Kayenta formation several hundred feet up the near-by cliffs), from ¾ to 1½ inches in thickness. Over this floor accumulated a layer of debris, mostly sand, closely compacted by use. After the floor was in position, the wall was plastered with from 3 to 4 inches of brownish clay which became smoke-blackened. Some of this clay was found in position on the walls and many lumps occurred in the fill, some of them also smoke-blackened on one side. Near the floor large flat unshaped stones were set in the wall clay. Some were found in position, others had fallen forward near the floor level. The number, character, and position of rocks in the fill also suggested that similar rocks had been set in the wall at higher locations, but none was found in place.

The roof was at least partly supported by posts, although the position of postholes was irregular and at some distance from the walls. No evidence of roof construction nor of the presence of a bench was encountered.

After abandonment, the structure was evidently partly filled with yellowish sand, probably wind-borne, forming a deposit a foot thick in the center and higher near the walls. The roof apparently burned after the accumulation of this sand, followed by collapse of the walls. Later, a layer of sand several inches thick was blown in and the remainder of the depression was filled with refuse and sand washed and blown in.

The fireplace was irregularly circular, 34 inches in diameter, lined with sandstone slabs buttressed outside with adobe. The slabs projected only slightly above the floor level. The fireplace floor was irregular and shallow, 7 inches deep at its lowest

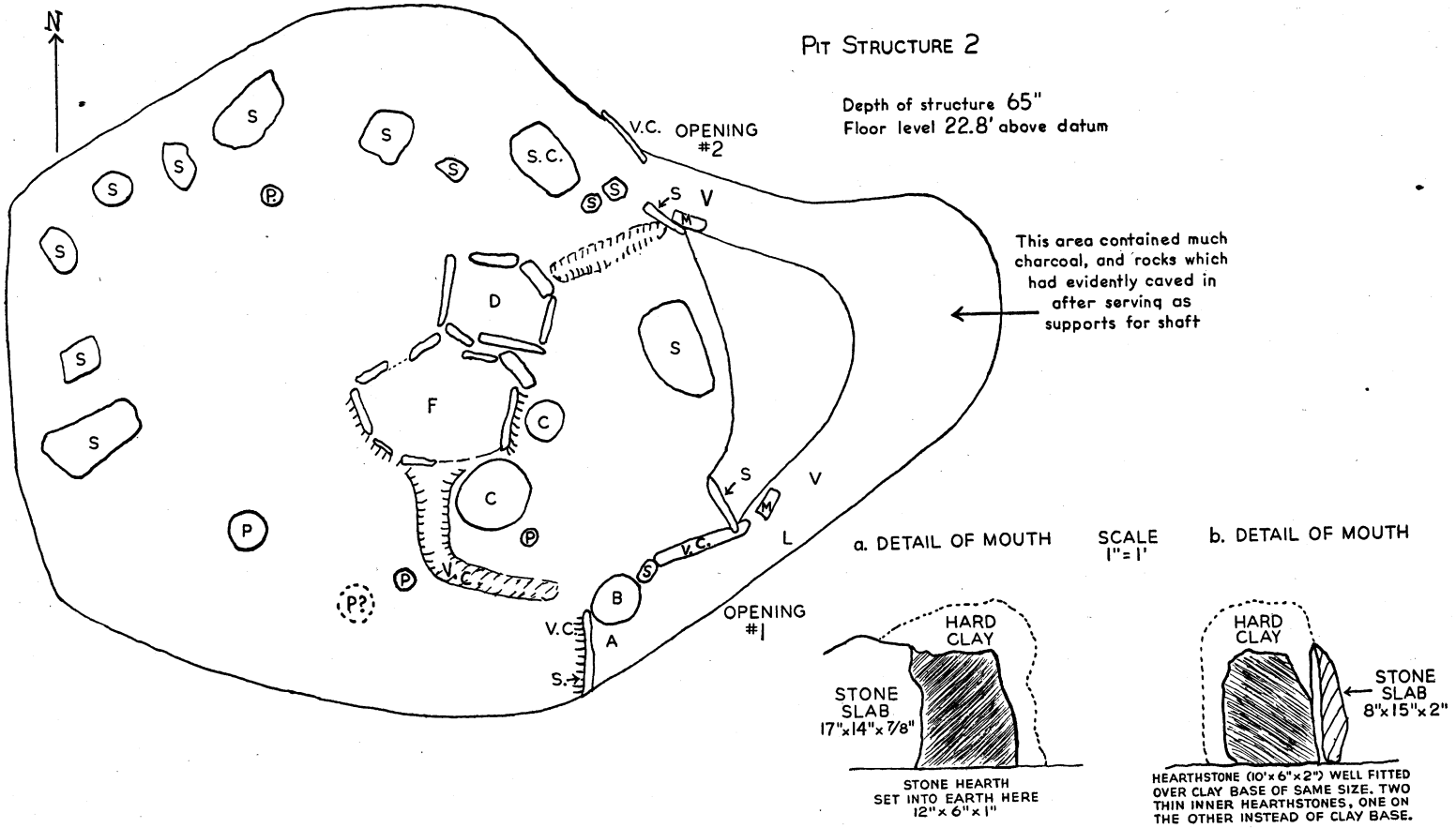


Fig. 4. Site RB 1006. Plan of pit structure 2. A, charcoal and ash below floor; B, pit containing awl and sherds; C, pits with sand, charcoal at bottom; D, "woodbox"; F, fireplace; L, limonite; M, manos; P, postholes; S, flat stones in wall, or stones on or near floor believed to be from the wall; SC, large, very smooth, flat stone with charcoal beneath it; V, ventilator tunnels; VC, violet clay used in walls and to make floor ridges. Scale: ½ in. = 7 in. approx.

point. Adjoining the fireplace to the north was an irregular squarish cyst of unknown use, possibly a woodbox, although it seems small for this. The dimensions were 18 by 18 inches and the depth varied from 4 inches on the east to 12 inches on the west. It was also lined with sandstone slabs. From the fireplace and the cyst, rounded low clay ridges, about 4 inches wide and 1 inch high, curved toward the ventilator openings (fig. 4; pl. 2, *a*). These had been modeled when the floor was laid. Near the wall at the northeast was a very smooth flat rock, separated from the floor by a circle of charcoal 4½ inches in diameter and 1 inch thick. On the southeast side of the fireplace were two pits in the floor filled with clean yellow sand. One was not vertical but extended under the fire pit. Its length was 18 inches. In the bottom were small fragments of charcoal. Four postholes were located, 3½ to 4½ inches in diameter.

The ventilator was to the southeast. Two tunnels extended from the bottom of the shaft to the house. The entrance to the south tunnel was protected by two projections from the wall, which may have had the functions of a deflector. One was about 4 inches thick and 6 to 8 inches high, formed of violet clay and terminating with a small sandstone slab. The other, projecting at right angles to the wall, was a sandstone slab, 2 by 18 by 14 inches, buttressed in place with violet clay (fig. 4). In the floor between the termini of these two projections was a depression 12 inches in diameter containing sand, sherds, and a bone awl (No. RB 1006–61). The wall area about the mouth of the south tunnel was plastered with violet clay. The south side of the opening was protected by a stone slab, 2 by 8 by 15 inches. The floor at the mouth was paved by a flat stone, 2 by 6 by 10 inches, resting on a clay base. Behind, two thinner stones of similar size were superimposed one on the other. The rest of the tunnel was plastered with violet clay. The greatest dimensions at the somewhat irregularly shaped tunnel mouth were 14 inches high, 10 inches wide. Inside the tunnel on the floor was a considerable quantity of jarorite and a mano (No. RB 1006–8–1).

The mouth of the north ventilator tunnel was protected on each side by a rock slab set in the house wall. Violet clay was plastered about the rock slabs and the opening. There were no deflecting structures. The floor was protected by a thin stone slab at the tunnel mouth. The greatest dimensions of the irregular opening were 12 inches wide, 14 inches high. Inside was an imperfectly fired gray-ware miniature ladle (No. RB 1006–8–2) and a mano (No. RB 1006–8–4).

The ventilator shaft joined the two tunnels in a chamber about 3 feet behind the house wall. In its central part, the chamber was evidently an irregular oval in cross section about 9 by 7¼ inches on the two axes. From the character of the debris in the shaft and the chamber beneath it, probably the upper part of the shaft was stone-lined or it may have terminated in a stone structure at the surface.

From the character of the artifacts, refuse, and animal bones recovered, it is believed pit structure 2 was used as a dwelling.

Pit structure 3 was found in testing the depth of the surface refuse southwest of pit structure 2. Since there were no surface indications of a structure and since two or more pit structures in association with a single surface structure had not been reported in the area, the excavation was at first conducted as a simple stratigraphic test of the refuse. It is therefore possible that some evidence was destroyed in the center portion of the floor. The structure had evidently been deliberately filled with refuse, probably while surface structure 2 was in use. It contained a high percentage of charcoal, ash, sherds, and bones, but nothing of stratigraphic significance was determined.

It is uncertain whether pit structure 3 was used for a dwelling or not. An area

of dense charcoal 18 inches in diameter in a floor depression at the foot of the north wall with a smaller depression in front may have represented a hearth. However, the small size of the structure suggests that its use as a dwelling would have been difficult.

The floor was rectangular in shape with rounded corners (fig. 5; pl. 2, *b*). It measured 8 feet, 8 inches on the north-south axis and 7 feet, 8 inches on the east-west axis. The elevation of the floor was 24.17 feet above the datum plane. The floor was of hard-packed sand and was covered with occupational debris, including some sherd material. The walls may have been covered with a very thin coat of sandy plaster. Only one posthole was found, at the northeast corner. It contained some undatable wood fragments, charred at the upper end. From 2 to 6 inches above the floor was a dense charcoal-and-clay layer with sherds and small rocks above it. This

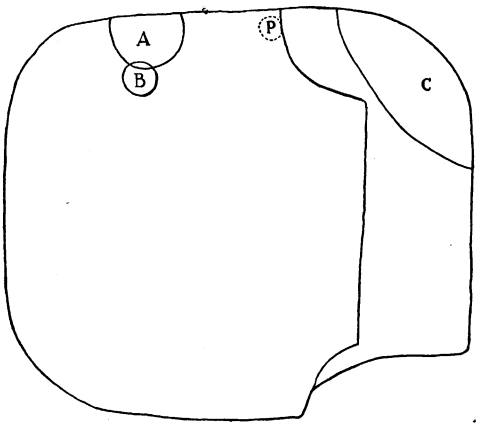


Fig. 5. Site RB 1006. Plan of pit structure 3. A, charcoal-filled depression in floor; B, sand-filled depression in floor; C, thick charcoal-and-ash deposit; P, posthole.

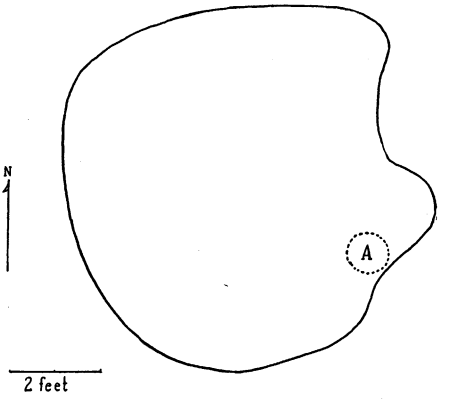


Fig. 6. Site RB 1006. Plan of pit structure 4. A, charcoal-filled depression in floor.

probably represented a burned and fallen roof. No datable charcoal was found, but the shape of some of the material and impressions on clay lumps suggest that the rafters were covered by small rods or canelike grass, ½ inch in diameter, and that this was topped with clay. Fragments of charred corn cob were recovered below the burned roof.

On the east side was a benchlike formation which, it is believed, was a remnant of the floor of an earlier and shallower pit structure of larger diameter. This conclusion is based on the fact that, in contrast to the rest of the fill, the refuse above this floor was sterile of artifacts, although containing organic matter and small charcoal fragments. At the northeast corner was an area of dense charcoal and ash, lens-shaped and 6 inches thick at the deepest point. There was no evidence of a prepared floor or of wall plaster. The elevation of this possible floor was 25.01 feet above datum.

No part of the excavation provided evidence of wall slumping except for a small area at the north, suggesting that the structure was filled quickly after the burning of the roof. There was no evidence of an entryway or ventilator for either structure.

At an elevation of 26.05 feet, 2.88 feet above the floor, there was evidence either of a bench with collapsed walls or of an earlier ground level. Part of the area in question was under the walls of storage bins 2 and 3 of surface structure 2. If the area is an obliterated bench, then the storage bins were built partly over pit struc-

ture 3. If, instead, the bench level represents an old ground surface—and on the whole the evidence suggests this rather than a bench,—then the storage bins of surface structure 2 were built after the ground level had risen approximately 18 inches after pit structure 3 was built. This may not have been a long time; indeed it may have been accomplished through dumping of earth removed to level off the floors of the earlier part of surface structure 2.

Although there is here pretty clear evidence of superposition of structures, unfortunately the differences in associated pottery are without significance. Future excavators of sites of this type may have better fortune.

Pit structure 4, like pit structure 3, had evidently been used as a refuse dump, but the character of the materials differed. Very little charcoal and ash appeared in most of the fill of pit structure 4, suggesting that it may have been filled mostly with floor sweepings, whereas pit structure 3 may have been filled mostly with fireplace refuse.

Despite its small size, the character of the sherd, bone, ash, and other materials from the lowest levels of pit structure 4 suggest that it may have been used as a dwelling. No surface indications of the structure appeared, and it was found in testing the thickness of the surface deposits just beyond the end of trench C. A relatively shallow structure, it was approximately 2 feet, 4 inches in depth. It was roughly circular except for two bays on the east side, and measured 7 feet in diameter on the east-west axis and 7 feet, 9 inches on the north-south axis. (fig. 6). The floor was evidently unplastered; it sloped up at the edges and had few sherds on its surface. About 1½ inches above the original floor was a second and more clearly defined floor surface, marked by ashes and many sherds and small rocks. The intervening material was occupational earth. There was no definite fireplace structure in either floor, but the quantity of ash on the upper floor makes it probable that a slight depression against the southeast wall filled with charcoal and ash, 9 inches in diameter and 6 inches deep, served as a hearth.

The walls of the structure had slumped badly. On the north side some slight trace of sandy clay plaster was found on the undisturbed wall, but the scarcity of clay in the fill makes complete plastering of the walls unlikely. At the east and west sides of the house a number of stones were encountered which had slumped into the structure in such a way as to suggest that they may originally have been low stone pillars, either on a bench, if such existed, or on the ground surface.

Surface structure 2 consisted of a single (in places possibly a double) row of one-story rooms with the long axis about 17 degrees east of true north (fig. 7; pl. 3, *a*). Apparently the structure originally had contained two rooms, indicated in figure 7 as rooms 2 and 3. At a later time the walls of room 3 were reinforced by a second interior wall and rooms 1 and 4 added in an inferior type of construction. Two rooms may have been added to the southeast of rooms 1 and 2. At least, dividing walls were made to serve some sort of additional structure, possibly only a ramada. The original walls of rooms 2 and 3 were made of large unshaped rectangular sandstone blocks laid up in relatively regular courses of masonry, using a sandy earthen mortar (pl. 3, *b*). The thickness was 9 to 12 inches. The outside was much smoother in finish than the interior, which was probably plastered. There were no corner bonds. The later masonry was poorer. The highest point of the standing walls was 30.7 feet above datum or 2.50 feet above the lowest floor.

All rooms were excavated carefully as independent units. In general the working surface was kept level over the entire area of each room as excavation progressed.

Room 1 at the northern end of the structure was evidently added some time after the erection of rooms 2 and 3. The shape of the room was irregular except for the

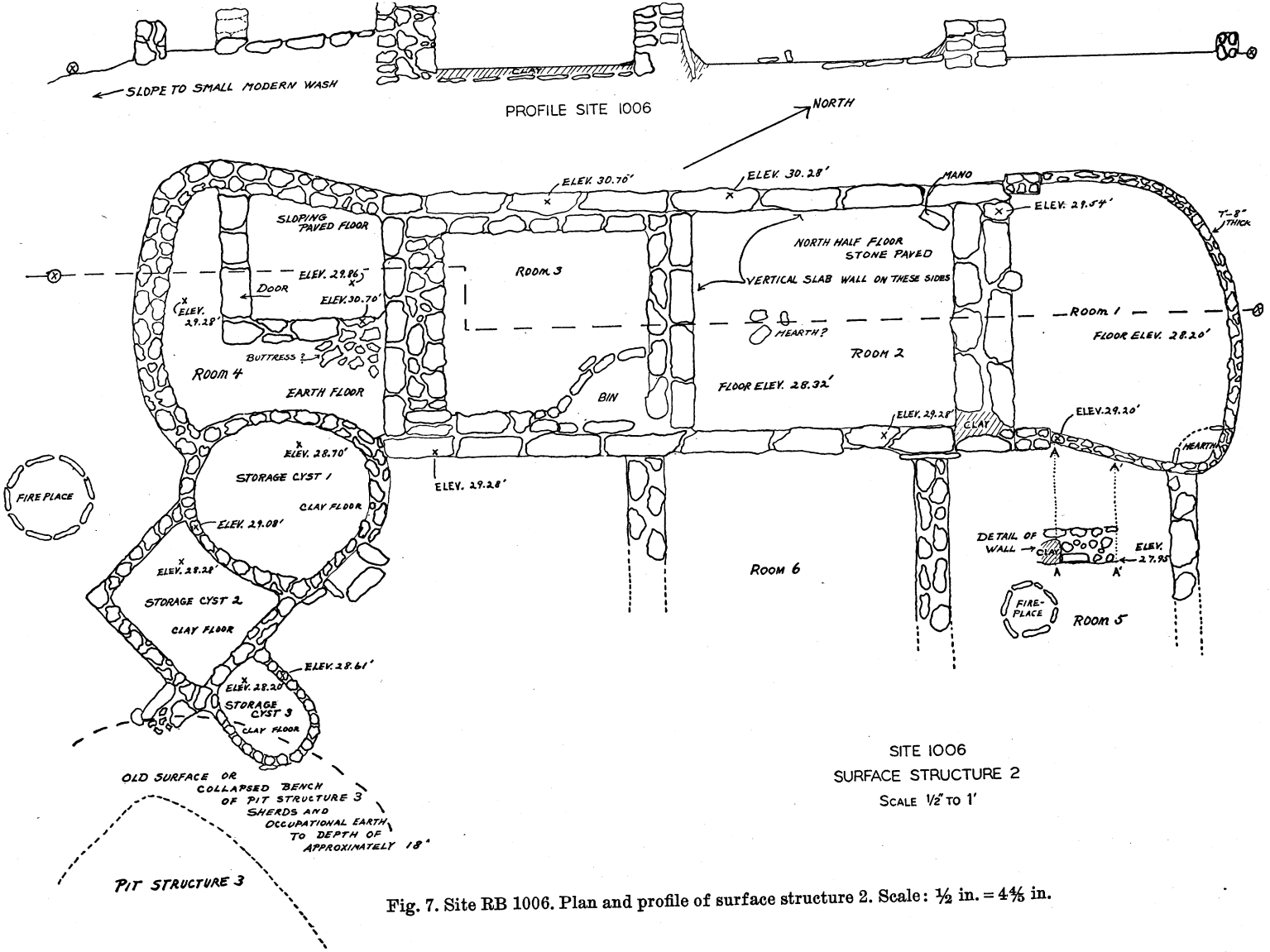


Fig. 7. Site RB 1006. Plan and profile of surface structure 2. Scale: ½ in. = 4⅘ in.

south wall, which is the north wall of room 2. The dimensions are roughly 7 feet by 8 feet, 2 inches. Two buttresses against the ends of the north wall of room 2 were incorporated in the walls of room 1, the contact being of clay without stone inclusions. The buttresses themselves were probably added some time after the construction of room 2, when the north wall perhaps showed a tendency to sag outward. The walls of room 1 were of clay containing many large irregular stones with smaller stone spalls. None of the stones was shaped; neither was any effort expended in collecting the naturally rectangular sandstone blocks abundant in the talus. There was no systematic bonding. The clay for the most part was a very sandy adobe, although some violet clay was used in spots. From the quantity of rocks in the debris it is postulated that the upper part of the walls must have been entirely clay or of perishable materials. The height of the standing walls at the time of excavation was 8 to 15 inches, the thickness between 7 and 8 inches. The walls extended 2½ inches below floor level. There was no sign of reinforcement or posts and the roof construction is problematical.

The upper part of the fill inside the room consisted of red and violet clay, earth, rock, sherds, and bones, probably from disintegrated roof and wall structures. Below was a similar layer, but with few rocks, and beneath this occurred a thin unbroken clay layer, perhaps formed by wall plaster washing down. Below this clay was another layer of from 2 to 4 inches of violet clay and sand in lenses containing a few stones. This overlay from 1 to 2½ inches of occupational debris containing sand, charcoal, bones, sherds, a few fire-blackened sandstone fragments, and decayed organic matter. There was no prepared floor, although near the walls there was some clay sloping upward from floor to wall. In the northeast corner of the room a crude fireplace was built against the wall. Two thin sandstone slabs in upright position projected at right angles from the wall. They and the wall stones behind them were smoke-blackened. A 2-inch layer of ash, charcoal, and sand occurred here.

Room 2 is 6 feet, 8 inches by 8 feet, 3 inches. The east and west walls, as mentioned, were of bonded masonry continuous with those of room 3. The north cross wall was of thick but inferior masonry, although much better than that of room 1, and was not bonded at the corners. Neither was the south cross wall. A mass of clay containing eggshell fragments, probably turkey eggs, was found at the intersection of the north and east walls, suggesting a possible ceremonial practice.

Another interesting feature of room 2 was the use of upright standstone slabs to form the base of the west and south walls. On these sides the floor of room 2 originally had been excavated into the slope of the ground, and thin standstone slabs, sloping slightly outward toward the top, had been set in violet clay in a manner similar to that found in Modified Basketmaker houses excavated by the Expedition in the near vicinity. The bottoms of some of these slabs extended below floor level. Above or behind these slabs began the coursed masonry wall, which on these sides of the room did not reach floor level. At the time of excavation these walls extended approximately 1.96 feet above the floor level at their highest point.

The top part of the fill was sand and large rocks, evidently from the upper part of the masonry walls. Below this was a layer of occupational debris 6 to 8 inches in thickness. There may have been two levels in this debris above the original floor, but the evidence was confused and inadequate. No definite fireplace was found, nor any ash or charcoal layer, but just west of the center of the room was one upright rock and a number of similar flat rocks, all smoke-blackened. Despite the absence of a fireplace or hearth, the large quantity of bones, decayed organic matter, and ash in the occupational dirt suggests use of the room for residential purposes.

The original floor was puzzling. The north half of the room had been carefully paved with thin sandstone slabs from ½ to 1½ inches in thickness. The south half was without any prepared floor. Sherds and rocks rested on the floor in both sections and the thick layer of occupational debris extended upward from the original floor. A mano (No. RB 1006–8–5) was found 2 inches above the original floor level.

Room 3 had been altered at some time by the addition of a second wall of coursed masonry inside the original wall on all four sides of the room. The masonry of the second wall was similar to that of the original wall but inferior in quality. Stones were smaller, less carefully selected, and less attention was paid to the coursing. In the northeast corner, the interior wall was not carried all the way to the original corner, and a thin partition wall, bonded to the secondary room wall, extended outward in a curve from the east wall to abut against the north wall, forming a cyst or bin (fig. 7; pl. 4, *a*). This wall was a single thickness of masonry, rather carefully laid, and reinforced by an upright postlike sandstone slab set in the floor against the outside of the curve. On the south side of the room the interior wall was thicker and may have formed a bench about 25 inches above floor level; at least it did not extend as high as did the original room wall at the time of excavation.

A bench in a square surface structure in this region and of this period would be most unusual. However, several factors suggest a possible ceremonial use for the room. First, no evidence of occupational debris occurred other than a considerable quantity of painted pottery sherds and a quantity of jarorite. The floor construction also suggests a special purpose for the room. The floor was laid of irregular sandstone slabs, carefully placed and fitted after the secondary interior walls had been constructed. If there was a previous occupation, all debris was carefully removed, for the stones rested on undisturbed sand. The stone floor had then been covered by between 6 to 7 inches of violet clay. When dry, this clay is extraordinarily hard, requiring energetic use of a pick to affect it. The lower 3 to 4 inches of this clay contained no cultural debris whatever. The upper part contained a considerable number of sherds. It is possible that this upper part may not have been part of the original floor, but rather clay washed down from the walls and amalgamated with the original floor. This is indicated by the sherd content and the irregular character of the upper surface. Against this is the absence of any clear line of demarcation between the two levels of clay. The room measured 67 inches by 78 inches.

Room 4, like room 1, was a later addition, and was irregular in outline. The masonry was similar to that of room 1, although somewhat better. On the east, the wall merged into that of storage cyst 1 (see below), which evidently was built at the same time. The northwest corner contained a nearly square interior structure, 48 by 36 inches, probably a storage room, with a stone floor sloping upward about 6 inches from front to back (pl. 4, *b*). This interior room clearly had been entered by a narrow doorway at the east end of the south wall. It was the only structure affording evidence of the mode of entry. The floor level was 29.28 feet above datum.

Rooms 5 and 6 were poorly defined and mostly destroyed. Three badly preserved walls, about 12 inches thick, abutted against the east walls of rooms 1 and 2. The center wall was in the best condition. Where it abutted against the wall of room 2, a large flat sandstone slab had been placed vertically against the wall of room 2. The wall was of crude uncoursed masonry in abundant adobe mortar. No limiting wall, postholes, or other termination of rooms 5 and 6 could be found on the east. As suggested before, these walls may have been merely division walls of a ramada, or perhaps only windbreaks. A circular fireplace, partly destroyed but evidently lined with sandstone slabs and approximately 24 inches in diameter, was found

slightly southeast of the probable center of room 5. In neither room could a clearly recognizable floor be determined.

The term "storage cysts" has been applied to three anomalous structures to the southeast of room 4 (fig. 7). Cysts 1 and 2 were built as a unit at the same time room 4 was built, to judge by the interlocking stones in the masonry. Construction of the cyst walls differed from that of the walls of room 4 only in being thinner and in using smaller stones. Cyst 3 may have been built at the same time or later; the evidence was not clear. Cyst 1 was roughly circular, 5 feet, 8 inches by 6 feet on the east-west and north-south axes. The floor, of violet clay, was 7 inches lower than the floor of room 4. Cyst 2, on the southeast side of cyst 1, was nearly square, measuring 50 inches on the east-west line and 48 inches on the north-south line on the longest walls. It probably had a thin violet clay floor, 12 inches below the floor of room 4. Cyst 3 was roughly a horseshoe shape, with the flat side against the east wall of cyst 2. The greatest dimension (east-west) was 36 inches. A violet clay floor was 13 inches below the floor of room 4. In all cysts the walls extended one course of stones below the floors. The upper parts of the walls must have been of clay or perishable materials, for not enough stones were found to account for a wall high enough to have been of any use. As indicated by the name given, it is believed that these structures were used for storage, although no clear evidence of their use or that of room 4 was found.

There may have been an additional structure to the south of cyst 2, indicated by the stub of a possible wall, and another to the east indicated by a layer of violet clay which may have been a floor. On the other hand, the clay may have washed from the upper part of the storage cyst walls when these were abandoned. West of cyst 2 was a circular fireplace cyst, 30 inches in diameter, lined with stone slabs. It was evidently located in the open.

It should be emphasized that the various structures in section 2 of the site were homogeneous with respect to the pottery and other associated artifacts despite evidence of reconstruction and possibly different times of construction. Similar unexcavated sites are known in the immediate vicinity in which the pottery assemblage and the surface architectural features are virtually identical. The predominant decorated pottery type is Kana-a Black-on-white. Other types are Lino and Kana-a Gray and Deadmans Black-on-red. Section 2 and similar sites are probably characteristic of Early Developmental Pueblo or Pueblo I in this region.

A near-by structure, possibly associated with this site, was a pentagonal cyst found north of section 1 on the next dune. It was lined with stone slabs to a depth of 25 inches. At a depth of 19 inches was a stone floor on which rested a large portion of a good Black Mesa Black-on-white vessel (No. RB 1006–94). Below the stone floor was a large mass of charcoal and ash.

Only one burial was found in connection with the site. This was located slightly south of east of pit structure 1 at a distance of about 48 feet. It was a flexed burial in seated position, the top of the skull being only two or three inches below the present surface. The pottery was clearly of the same complex as that of the structures of section 1 of the site (fig. 49, *h*; pl. 27, *h*).

GENERAL DISCUSSION

Most of the pottery sherds recovered from Site RB 1006 are plain-surfaced fragments belonging to the Lino and Kana-a Gray types. No noticeable difference in frequency of this group could be distinguished in the different areas and structures. The percentages are shown in table 3. Study of the sherds which could be more definitely typed through their showing unobliterated neck coils, however, revealed

some interesting differences. The wide neck coils of typical Kana-a Gray were found in all parts of the site. In addition to these, there were found a number of sherds which did not conform to the classical definition of Kana-a Gray. In some of these the coils were much rougher than usual; in others they were not only rough, but much narrower. In a few sherds, marks of tooling were visible, and still more rarely, indentation occurred. In table 3 these have all been grouped together as "Narrow Coil," but the majority are probably Coconino Gray. The sherds showing indentation were few in number and occurred only on the surface. Consequently, they may be disregarded. It is significant, however, that the narrow- and rough-coil types occur in appreciable quantities only on the eastern or later part of the site, where they were found both on the surface and in the fill of pit structure 1. A few

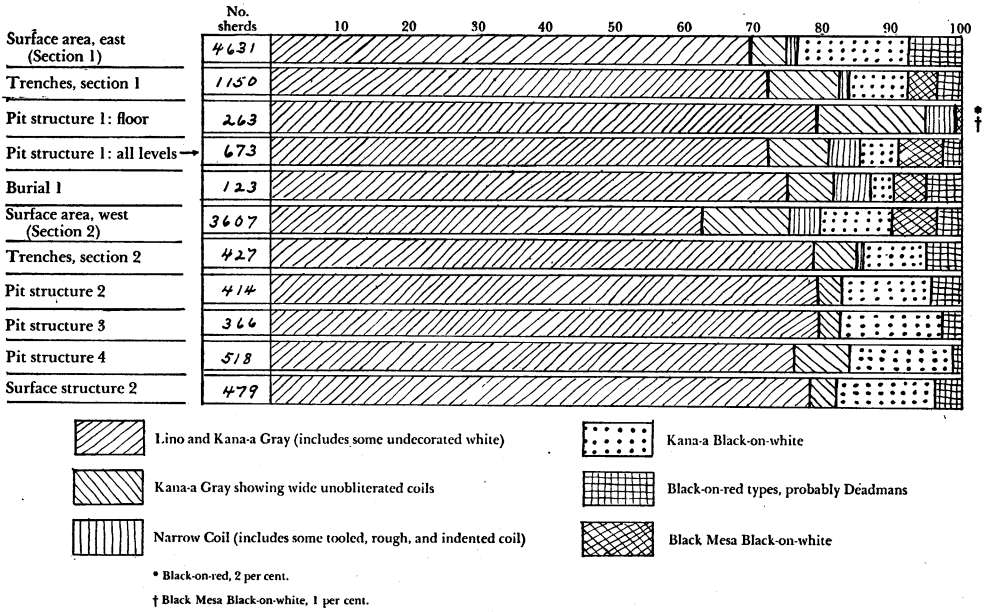


TABLE 3. This table indicates the proportions of all pottery types found at Site RB 1006. The horizontal lines represent various selected strata and areas, as indicated in the stub. The first column lists the total number of sherds from each locality, and the quantity of each type is shown on the right as its percentage of that total.

similar sherds were found from the earlier part of the site, but all were on or close to the surface; none were found in the fills of the various pit structures. It consequently appears likely that they are to be associated only with the late structures at Site RB 1006.

Among the decorated types, Kana-a Black-on-white occurred in appreciably higher percentages on the earlier part of the site. Though some Kana-a Black-on-white was found in the fill of pit structure 1 and in the burial, these may have come from the previously existing sherds on the surface. It is notable that no Kana-a Black-on-white sherds were found among the 263 sherds encountered on the floor of pit structure 1. The reverse is true with respect to Black Mesa Black-on-white; not a single sherd of this type was found on the earlier part of the site, either on the surface or in excavations. Attention is also called to the complete absence of later Pueblo II types, Sosi, and Dogoszhi Black-on-white. A single sherd of Flagstaff Black-on-white was found on the surface.

Black-on-red sherds occurred in noticeably greater numbers on the earlier part

of the site. Only 2 per cent of the 263 sherds from the floor of pit structure 1 were black-on-red. That black-on-red types were part of the pottery complex, however, is shown clearly by the location of the sherds in pit structure 1 (on the floor and in the fireplace) and by the associations in the burial belonging with the late occupation, where black-on-red sherds formed nearly 5 per cent of the total pottery, including parts of two bowls. The distribution of the pottery types is shown in table 3.

Although the sequence of pottery types in the area appears clear, architectural details are more puzzling. This is even more true if comparison is extended to Site RB 1002, a Basketmaker III site about 150 yards away from Site RB 1006, which was excavated but which is not reported upon in this paper. The pertinent facts are summarized below.

Site RB 1002 was a Basketmaker III structure with two Pueblo I structures superimposed. The Basketmaker III structure was a shallow excavation roughly circular, with a floor on two levels, dividing partition, curved entryway, and a bench. The diameter of the structure was approximately 22 feet, considerably larger than any known pit structure from the Developmental Pueblo horizon in this area. The bench wall was made of slabs set in clay similar to those found in the walls of room 2, surface structure 2 and of pit structure 2 at Site RB 1006. The structure at Site RB 1002 had an entryway, rectangular fireplace, and a possible sipapu in the floor, but no ventilator or deflector.

Pit structures superimposed at Site RB 1002 and those at Site RB 1006 were smaller in diameter. Those at Site RB 1006 were much deeper, without entryway, possibly without bench. Pit structure 2 at Site RB 1006, the earlier of the structures at that site, had a round fireplace, as did the surface structures associated with it. It had a ventilator with two tunnels, but no entryway, deflector, or sipapu.

A possible ceremonial use may have been made of a square surface room. The multiroomed surface structure of section 2 of Site RB 1006 has no counterpart in Site RB 1002.

The surface structure on section 1 of Site RB 1006, the later section, was single-roomed, evidently not used for residential purposes. Masonry was of somewhat better quality in pit structure 1 than in the earlier structures but was small in quantity. Pit structure 1 was quite deep, the fireplace was again rectangular, there was a rectangular ashpit, ventilator, a ventilator cover rather than a deflector, and probably no bench.

Later Developmental Pueblo sites in the region showed again the more elaborate multiroomed structures on the surface. The pit structures in association with them were more clearly of the ceremonial type, with bench, ventilator, and deflector (cf. Sites RB 551 and RB 1008).

Reviewing the foregoing data, one may discern certain trends in the architectural developments, but there are also contradictions. As one proceeds from Site RB 1002 to the latest structure at Site RB 1006, the floors are found to be at increasing depths. Some continuity in construction from Site RB 1002 may be seen in the use of stone slabs in the wall of pit structure 2 and room 2 of surface structure 2 at Site RB 1006. This feature also appeared at the much later Site RB 1008. The pit structures become progressively deeper with time, a trend continuing all the way through Pueblo II as exemplified at Sites RB 551 and 1008. On the other hand, the earlier pit structures, which seem still to have been utilized as dwellings, are smaller in diameter and in general seem less suited for this purpose. This might be explained through the addition of the rectangular surface structures on the Pueblo I part of Site RB 1006, but then there is the rather baffling retrogression in the later part of this same site where only one rather poorly built surface structure existed, serving probably only as a storage house. There is also the problem presented by the very definite deterioration of the later masonry of surface structure 2. From the standpoint of habitation, even the surface structures of Site RB 1008, late in Pueblo II, are definitely inferior to the rooms of early Pueblo I surface structures (not only at Site RB 1006 but also at numerous other Pueblo I sites in the vicinity). As a matter of fact, the character of the surface structure at Site

RB 1006, both for living purposes and in respect to its size and the quality of the masonry in the early part, is not duplicated in the immediate vicinity until Pueblo III times. In Pueblo II, the only site which seems similar in character and which appears to represent a progression from the early part of Site RB 1006 is Site RB 551 on Black Mesa.

There are also other puzzling phenomena. The square fireplace of the Basketmaker III site, RB 1002, is replaced by round fireplaces in the Pueblo I structures but reappears in the Pueblo II structures. The sipapu of Basketmaker times does not reappear until much later and then cannot be considered characteristic of subsurface structures in the region. The possible ceremonial use of the square surface room 2 in surface structure 2, Site RB 1006, parallels later usages in some sites and in other areas, but again cannot be considered to be in the tradition of the area.

This discussion suggests a number of population shifts in the area involving peoples who shared a common pottery tradition but not an identical architectural tradition. On the other hand, it may be equally possible that styles in pottery and in architecture followed different time sequences and different routes of diffusion which will not permit their correlation until much more detailed work has been done, both in the Tsegi and in near-by areas. The data here presented suggest that at least an open mind should be kept in correlating the various phenomena discussed.

ARTIFACTS

Stone

(All numbers bear prefix RB 1006. Identifications of minerals by Dr. James Gilluly, University of California, Los Angeles.)

½ finger ring. No. 76. Material: steatite. Dimensions: inside diameter 9/16 in., thickness 3/32 in. Provenience: 24 in. below surface in refuse at north end of trench D, section 1.

Finger ring. No. 77. Material: steatite, color gray and black. Dimensions: inside diameter 5/8 in., thickness 3/16 in. Edges beveled and whole well-polished. Provenience: in top of jar with burial.

Beads. Nos. 78, 85. Materials: soapstone, limestone, jasper. Dimensions: approximately 3/16 in. in diameter with some slight variation. Some beads drilled entirely from one side, others from both sides. Faces are not always parallel. Thickness from 1/32 to 3/32 in. Provenience: burial and surface.

Pendant. No. 79. Material: fine-grained sandstone. Dimensions: length 7/8 in., width 9/16 in., thickness 3/32 in., drill-hole from both sides near one end. Provenience: surface, section 1.

Knife blade. No. 62. Material: jasper. Dimensions: length 1 5/8 in., width 1 3/16 in., thickness 1/8 in.; slightly rounded triangle in shape with butt nearly straight, point rounded. Provenience: fill of pit structure 2.

Arrow point. No. 80. Material: chalcedony. Dimensions: length 1 1/16 in. (stem missing), width at base 5/8 in., thickness 3/32 in. Shape triangular with stem missing. Provenience: floor, pit structure 3.

Mano. No. 81. Material: fine-grained sandstone. Dimensions: length 5¼ in., width 4⅜ in., thickness 1⅜ in. Made from flat ovoid river pebble with both faces worn. One face apparently used to grind pigments. Provenience: fireplace, pit structure 1.

Mano. No. 82. Material: coarse sandstone. Dimensions irregular: length 9⅞ in., width 4½ in., thickness 1½ in. One surface and two ends polished, other face and two long sides unpolished but pecked. Slightly narrower in middle than at ends. Provenience: ½ found in fireplace, ½ on floor near by, pit structure 1.

Hammer stone. No. 83. Material: quartzite, probably from Utah. Dimensions: length 4½ in., width 2¾ in., thickness ⅞ in. Elongated oval shape, edges battered all around, large flake missing at one end. Provenience: floor, pit structure 1.

Hammer stone. No. 84. Material: quartzite. Dimensions: length 3 in., thickness 5/8 to 1⅛ in. Elongated, irregularly oval in cross section; ends slightly battered. Provenience: floor, pit structure 1.

Hammer stone. No. 8–8. Material: limey sandstone. Dimensions: length 3⅜ in., width 2¾ in., thickness 1½ in. Irregular pebble, battered on all edges, partly polished on one side. Provenience: pit structure 4 fill.

Polishing stone. No. 8–7. Material: quartzitic sandstone. Dimensions: shape irregular, greatest dimension 1 15/16 in. Provenience: fill, pit structure 4.

Polishing stones (three). No. 8–25, *a–c*. Materials: quartzite and quartzitic sandstone. Dimensions: shapes irregular, greatest dimensions from 2 to 2⅞ in. Provenience: floor, pit structure 4.

Ball. No. 86. Material: sandstone. Dimensions: diameter ½ in. Provenience: fireplace, pit structure 2.

Mano. No. 8–5. Material: sandstone. Dimensions: length 7 in., width 4⅛ in., thickness 1⅜ in. Rounded rectangle in cross section. One side only polished, remainder pecked. Ends slightly rounded and thinner. Provenience: room 2, surface structure 2.

Mano (broken). No. 93. Material: sandstone. Dimensions: length (incomplete) 3½ in., width 4½ in., thickness 1⅜ in. Rounded rectangle in cross section with slight bevel toward edges. One side only polished, other side pecked, ends rounded and slightly polished. Provenience: room 1, surface structure 2.

Mano (broken). No. 8–6. Material: sandstone. Dimensions: length (incomplete) 3¾ in., width 4⅛ in., thickness 1 in. Polished both faces, slight bevel toward edges but shape essentially a rounded rectangle, ends slightly rounded. Provenience: pit structure 4.

Mano (?). No. 8–9. Material: sandstone. Dimensions: length 3⅞ in., width 3 in., thickness ⅞ in. One side highly polished, other side pecked and partly polished, approaches round shape and shows some evidence of having been used as a hammer stone. Provenience: pit structure 4.

Angular rock fragments (6). No. 35, *a–f*. Materials: two are siliceous marl, three are chert, two are cherty marl, one is siliceous ash. Dimensions: largest is 3¼ in. in greatest dimension. Shapes very irregular. Some are flakes or partly worked implements, others are either raw materials of implements or perhaps were used to make sparks when struck with iron pyrites. The larger pieces were carefully placed by the wall of pit structure 1.

Mano. No. 8–1. Material: sandstone. Dimensions: length 10¾ in., width 4½ in., thickness ⅝ in. Back unfinished, face slightly beveled, ends rounded and all edges smoothed. Provenience: leaning against ventilator tunnel wall, pit structure 2.

Mano. No. 8–3. Material: quartzite. Dimensions: length 6 in., width 4 in., thickness 2⅝ in. Irregular pebble with two faces polished at angle. Provenience: fill, pit structure 3.

BONE

Awl. No. 87. Length 3¾ in. Provenience: room 1, surface house 2.

Awl. No. 8–29. Length 5¾ in. Provenience: fill, pit structure 3.

Awl. No. 63. Length 3½ in. Provenience: fill, pit structure 2.

Awl. No. 88. Length 2¾ in. Provenience: refuse, north end of trench D, section 1.

Awl. No. 35. Length 3⅛ in. Provenience: fill, pit structure 1.

POTTERY

Tubular pipes:

No. 74. Material: dark gray pottery. Dimensions: length 3 in., diameter of bowl 1 in. Slightly curved stem. Provenience: floor, pit structure 1.

No. 75. Material: dark gray pottery. Dimensions: length 2⅜ in., diameter of bowl 15/16 in. Provenience: floor of pit structure 1 beside preceding specimen.

Special sherds:

No. 89. 1 pointed conical lug, Lino or Kana-a Gray (?) pottery. Provenience: trench E.

No. 71. 1 flattened rim lug, Lino or Kana-a Gray (?) pottery. Provenience: pit structure 3.

Nos. 8–12; 91, *a–c*. 4 reworked sherds, roughly circular, edges unsmoothed. Provenience: pit structure 3.

No. 90, *a-d*. 4 perforated sherds, roughly circular, edges smoothed. Provenience: various.

Nos. 4, 61, 67, 92. 4 fragmentary worked sherds of various shapes evidently used as scrapers. Provenience: various.

No general description of Site RB 1006 pottery is offered since it is treated in the discussion of the areal survey and in the section on design. Pottery sherds and vessels from Site RB 1006 are illustrated in plate 27 and figures 18, 19, 20, 21, 22, 24, 25, and 49.

SITE RB 551

Site RB 551 was apparently occupied in early and middle Pueblo II, with possibly some transitional remains from late Pueblo I. Thus its beginning closely follows Site RB 1006, while its end overlaps Site RB 564.

Site RB 551 was located on the broad floor of one of the numerous valleys that dissect Black Mesa into a complex series of valleys and canyons, all trending to the southwest and eventually debouching into Moenkopi Wash. The location was somewhat outside the area most intensively studied, lying several miles beyond

the Tsegi drainage system, and was about five miles southwest of Marsh Pass in an air line (see inset, map 1). Approximately one mile south of the site is a small coal mine, still regularly worked, and reached by a fairly good road which intersects the Marsh Pass–Tuba City highway at a point about seven miles south of Marsh Pass. This road winds up the precipitous escarpment of Black Mesa and then continues downgrade into the interior valley system which exists within the mesa. At a point approximately seven miles from the Tuba City highway, this road crosses two fairly large, but usually dry, washes just above their confluence. The wash formed by these branches becomes known farther downstream as Boo-Koo Dot Klish or Blue Canyon. About 200 yards northeast of the road, and in the triangle formed between the washes, is Site RB 551. It lies on the gently sloping valley floor, at the foot of a moderate slope which rises perhaps 200 feet behind and northeast of the site. Although the exact elevation of the site is not known, it is probably between 6,500 and 7,000 feet (pl. 5, *a*, *b*).

At present the neighboring washes run in vertically banked arroyos, perhaps ten to fifteen feet in depth, but in prehistoric time, before the present cycle of erosion began, these streams were doubtless almost at the level of the valley floor. There is evidence that the area between the streams and the occupied site may periodically have been flooded. At any rate, there must have been a meadowlike condition there, providing ample moisture for grass and perhaps for agricultural crops. Today, because of the cutting of the stream beds, the former flood plain is sandy and arid except for ephemeral pools which sometimes form after the heavy summer rains. Some grass and low brush grows, however, and provides a range for the flocks of sheep regularly herded here by various Navajo families (see Appendix I).

On the slopes behind the site and on the mesa top above the valley is a fairly heavy juniper and piñon forest. Douglas fir and western yellow pine occur in slightly higher or better watered areas a few miles away.

Site RB 551 was selected for intensive study for several reasons. First, it appeared from surface indications to be one of the largest and best-preserved open sites of the Late Developmental or Pueblo II horizon that was discovered; second, it lay somewhat away from the center of the Tsegi culture area, and yet seemed, from surface indications, to contain pottery of characteristic Tsegi type; third, it was relatively easy of access by automobile from the Marsh Pass base camp.

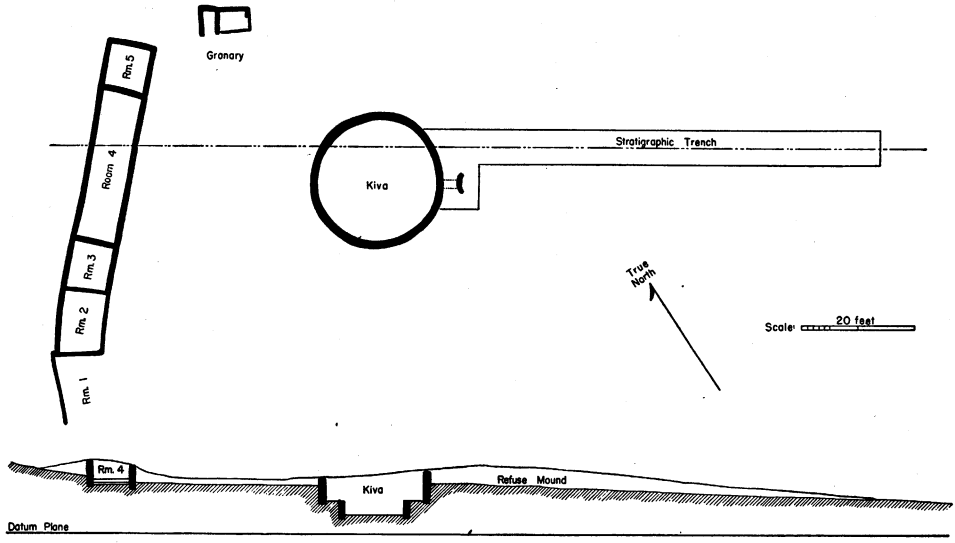
The site was first located and mapped during a reconnaissance of parts of Black Mesa in the season of 1935. Excavation of a test trench through the refuse mound and partial clearing of a subterranean structure, which proved to be a kiva, was accomplished in 1936, and the site was completely excavated in 1937. In the objective description which follows, the surface house unit will be first considered, next the kiva, and finally the stratigraphic test, without regard to the actual sequence in which the several portions of the excavation were carried out. Excavation was under the charge of Watson Smith.

HOUSE UNIT

The house or dwelling unit, as shown on the detailed plans (map 3 and fig. 8), consisted of a single row of rectangular rooms, four or possibly five in number. The uncertainty concerning the existence of the fifth room arises from the peculiar character of the southwestern extremity of the ruin. Here there existed an area which has been designated on the plan as room 1, although painstaking investigation failed to discover its complete outline. Only a low wall, extending approximately 12 feet southwesterly from the western corner of room 2, still remained in

position. It is possible that this wall may have been constructed as a windbreak or as a means of deflecting the surface water which runs off the slope to the northwest. On the other hand, the very large quantity of building stones scattered over the area of room 1 seemed to indicate the former existence of a fairly large masonry structure. Nevertheless, no floor level could be defined within the area, no charcoal or other evidence of occupation was found, and although 105 sherds were tabulated, these can be explained as merely part of the general refuse which accumulates around any habitation.

Disregarding room 1, then, as a significant part of the architecture of the ruin, we can consider the remaining rooms first as a whole, and later in more detail individually. The masonry throughout was massive and carefully constructed. Ledges of excellent sandstone outcrop on the slope less than one hundred yards to



MAP 3. Site RB 551. Plan and vertical cross section, showing kiva, surface structure, and refuse mound.

the west, and also immediately across the valley, less than one-quarter mile to the east. The builders used two different kinds of material indiscriminately. Both were Cretaceous sandstone from the local Mesa Verde formation. The better of the two was a fine-grained, well-consolidated, brownish red sandstone, heavily impregnated with iron minerals. It split readily into surprisingly regular blocks along almost perfectly rectangular planes of cleavage. This stone was extremely heavy and very durable. Today, after centuries of exposure, the blocks show little, if any, evidence of weathering. Apparently the prehistoric masons also found it unnecessary to dress these blocks, for hammer marks were rarely noticeable on them. Many blocks were extremely large, sometimes measuring 3 feet by 8 inches by 15 inches (pl. 6, *a*).

The second material used was also an evenly laminated sandstone, less finely grained and less tightly cemented. It was grayish in color and was less durable. The individual stones were often as long and as broad as those of the first material, but usually not more than 4 inches in thickness, being thus slabs rather than blocks. Many of them appeared to have been worked, and were usually slightly beveled along the edges.

Although all the walls were fairly massive, varying from about 9 to 15 inches in thickness, they were regularly constructed of a single tier of stones, each stone

extending entirely through the wall, and each wall face being smooth and even. Occasionally two narrow slabs were laid side by side to form the full thickness of the wall, but this was not usual. No jagged protrusions or depressions are apparent on either the exterior or interior surfaces. The stones were laid in even horizontal courses in a sandy mortar. Small thin spalls were freely used, not so much to fill in open spaces or to true up irregularities between the larger blocks, but rather as a definite structural element. Although no regular or systematic sequence between the courses of large stones and those of spalls is evident, the latter were very frequently laid in minor courses, several of which were often placed between the major courses of large stones.

In general, the character of the masonry somewhat resembles certain types noted in the Chaco Canyon ruins,[37] and seemed unlike what is known as the Kayenta or the Mesa Verde styles.[38] This is merely an objective observation and carries no suggestion of cultural relationship. Plate 6, *a* shows a characteristic section of the inside face of the northwest wall of room 4.

Probably the entire building was constructed simultaneously or nearly so, and there was no evidence of subsequent additions. This inference is supported by the fact that all the peripheral walls appear to have been bonded at the corners, although the interior partition walls appear to abut the outer walls, and so were very likely constructed separately. The bases of the walls all extended from 4 to 8 inches below the floor levels and frequently, though not always, the lowest course was slightly thicker than the upper part of the wall, thus forming a firm foundation.

At the time of excavation the walls stood from 2½ to 4 feet above the floor levels, and at no point was there any evidence of a doorway. It is possible, of course, that entrance to the rooms was through the roof, no significant fragment of which was found, but another hypothesis is suggested. Inside each of rooms 2 and 3, near the middle of the southeast walls, was found an upright stone, neatly worked and set firmly into the floor. Each of these stones was set about 4 inches out from the wall, and stood about 18 inches high. The upper extremity of each was smooth, as if from wear of some sort (pl. 7, *b*). In a corresponding position in room 5 a wooden post, 5 inches in diameter, was set into the floor. The part above the floor level had decayed and disappeared, so that its original height could not be ascertained, but it may well have served the same purpose as the upright stones in rooms 2 and 3. The most plausible use of these features is for the purpose of a step from the floor to doorways at a higher level than the walls extended when excavated. Similar steps might have been placed on the exterior, although nothing of the sort was discovered.

One other architectural feature may be specially mentioned. In the extreme northwest end of the wall between rooms 2 and 3, exactly at the level of the floor of room 3, and about 3 inches above the floor of room 2, existed an opening completely through the wall, 8 inches wide and 9 inches high. That this hole was deliberately constructed and not merely the result of a partly fallen wall was clear from the arrangement of the masonry surrounding it. Its purpose is puzzling, for nothing larger than a small dog could have crawled through it. Immediately beside this hole, five horizontal stone slabs had been built into the wall in such a manner as to protrude into room 3 at right angles to the wall. These slabs were placed one above the other with vertical spaces of from 4 to 6 inches between them. Three had been broken off short, but two were still complete and extended outward about 10 inches (pl. 7, *a*). It is suggested that they may have served as a ladder, which gave access to a doorway, either in the roof or high in the wall.

As has been said above, no evidence of the method of roof construction was found.

[37] Hawley, pl. 5, fig. 2. [38] Kidder, 1924, pl. 20.

Room 5 was the only part of the building which showed signs of having been burned. On the floor of this room were about twenty charred fragments of what appeared to be roof timbers; a painstaking attempt to ascertain their original position was fruitless, however, for they were too badly broken and disarranged to indicate any pattern. Although many segments of these beams were saved, none of them yielded a date.

Only rooms 2 and 4 contained floor features beyond those already mentioned. Approximately in the center of room 2 were two mealing bins side by side (fig. 8; pl. 8, *a*). These were both enclosed by thin upright sandstone slabs on the two sides and one end. The other end was open, and the bottom of each bin sloped from floor level at the open end to 4 or 5 inches below floor level at a point about 8 inches from the opposite end. Here a transverse slab was placed vertically, and extended upwards about 1¼ inches above the bottom. Placed horizontally in the lower end, and filling the entire area between this upright slab and the side walls of the bin was a carefully fitted paving slab. Apparently metates had been placed in the sloping part of the bins, but these were not found *in situ*. Four manos were found in room 2; one (No. RB 551–65) was in the southwesterly bin.

About 16 inches to the southwest of the two mealing bins was a roughly rectangular, slab-sided cyst, 4 inches below floor level and 12 by 14 inches in inside dimensions.

Room 4 contained two, and perhaps three, distinct floor levels, in the lowest of which, near the northerly corner, were two fire pits, both roughly circular. Each had apparently been originally surrounded by small upright slabs of stone slanting outward at about 30 degrees, but only a few of these remained in position. The clay of the room floor sloped upward against the outer face of the slabs almost to their upper edges to form a firm ridge outlining each pit. The two pits overlapped each other and perhaps were not used simultaneously, although both were filled solidly with wood ash and bits of charcoal. The larger was 2 feet, 2 inches in diameter and 8 inches deep; the smaller was 1 foot, 8 inches in diameter and 3 inches deep (fig. 8; pl. 9, *a*, upper left).

Immediately beneath the lowest floor (floor 1) occurred hard, compact gravel, clearly undisturbed. Floor 1 was made of adobe and sand, hard, smooth, and well-packed by use. Immediately above floor 1 was a thin layer of clean fine sand, either wind- or water-laid. Mingled with this sand on the floor occurred relatively numerous small bits of charcoal and potsherds. Several flat stone slabs and a piece of wood, about 6 inches long and 2 inches in diameter, also lay on this floor near the center of the room. Next, above the sand-and-charcoal level, was a stratum about 7 inches thick, composed of soft earth and small stones, and almost devoid of potsherds. Above this occurred another hard-packed stratum, floor 2, which could be clearly defined only toward the ends of the room, but not in the central area. That this represented a floor, however, can hardly be doubted, for at a point 3¼ feet from the southwest wall and exactly in the median line of the room appeared a round hole, about 5 inches in diameter and 7 inches deep. Its outline was clear and hard, and it was filled with clean sand. (See description of Site RB 1006, pp. 27, 32, and of Site RB 568, p. 80.) On the same level and near the easterly corner lay the fragments of two almost complete Tusayan Corrugated ollas (Nos. RB 551–51 and RB 551–52). They were both crushed, and were covered by a large flat stone slab. Each contained a small quantity of clay, suitable for pottery making. Also, near the northwest wall, on floor 2, lay a large mass of purplish clay with which sand temper had been mixed, obviously for pottery making. Fragments of eggshell lay beneath the clay.

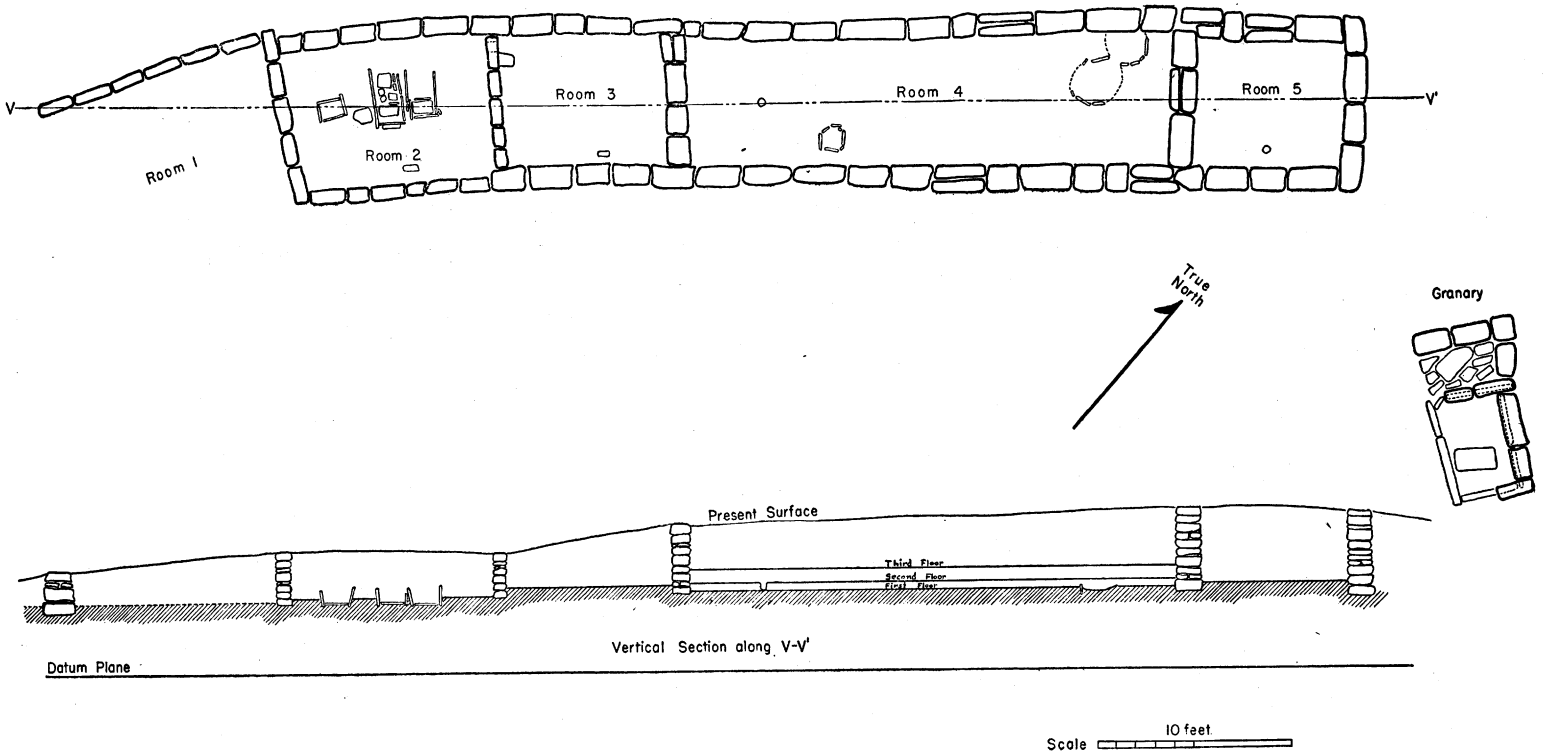


Fig. 8. Site RB 551. Plan and longitudinal section of surface structure 2, showing the floor features.

At a point about 6 to 8 feet from the southwest wall was a roughly circular area of wood ash and charcoal about 2½ feet in diameter; no fire pit existed, but the earth just beneath and around the ash had been burned hard. Mixed with the ash were a good many sherds and considerable quantities of red and yellow ocher.

Above floor 2 occurred a 7- to 8-inch stratum of hard earth, containing almost no sherds or other cultural debris, and immediately above this was a third layer of hard-packed earth, which appeared to be a third floor. Near the southerly corner of the room, at this level, was a slab-lined fire pit (pls. 8, *b*; 9, *a*). Over most of floor 3 was a layer, varying in thickness from 1 to 6 inches, composed of wood ash, charcoal fragments, and numerous potsherds. The ash and charcoal were not uniformly

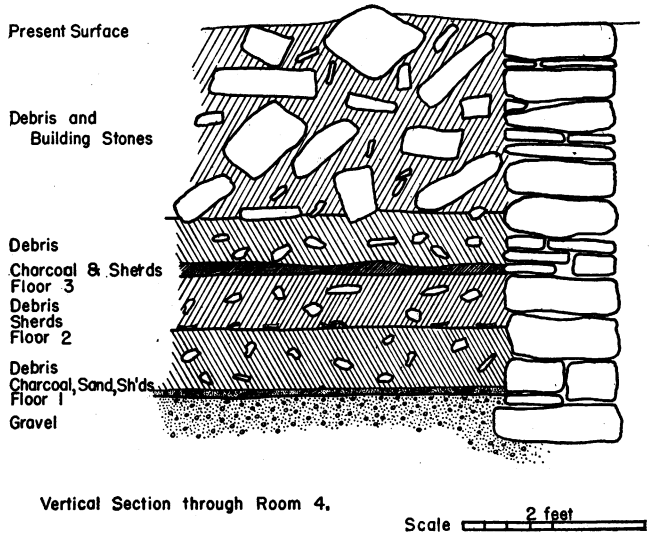


Fig. 9. Site RB 551. Conventionalized vertical section through room 4, surface structure 2, showing the three successive floors and the character of the fill.

distributed, but occurred in lenses, beneath and around which the earth showed evidence of burning. Possibly this represents the fallen roof of the house, which may have collapsed and burned at the time of the occupancy of floor 3.

Above the ash was a thin stratum of soft earth and small stones, with little pottery, and above this a tangled mass of fallen building blocks and sterile earth, extending upward to the ground surface. Evidently the building was finally abandoned after the roof burned and fell, and shortly thereafter the walls collapsed. A somewhat conventionalized profile of the several strata in room 4 is shown in figure 9.

Evidence of superimposed floors similar to that outlined above, but less convincing, existed in rooms 2, 3, and 5.

From the foregoing description a few inferences can be drawn. The house was probably constructed as a unit. Probably room 4, because of its commodious size, approximately 6½ by 24 feet, was the actual dwelling quarters. This inference is supported by the fact that it was the only room to contain a fireplace and also by the presence on floor 1 near the northeast wall of a large Tusayan Corrugated olla, which may have served as a water container. At any rate, it contained no grain at the time of excavation and was too large for use except as a storage vessel. This olla (No. RB 551–56, pl. 28, *a*), although badly crushed, was complete and had been set into a shallow depression in the floor and covered by a large flat slab of sand-

stone. It is the finest example of Tusayan Corrugated pottery found by the Expedition, and its thinness (from 2.5 to 4 mm.) and symmetry make it an outstanding ceramic achievement. Room 2 was clearly the workshop, where corn was ground, and rooms 3 and 5 may have been storage rooms.

At this point mention can be made of a small, detached structure, situated about 8 feet east of room 5. Although very little of this structure remained in position, it consisted of two very small compartments, with stone-paved floors. Apparently the walls had been formed by utilizing large vertical slabs for the lowest course with coursed horizontal masonry above (cf. room 2, surface structure 2, Site RB 1006). It may well have been used for the storage of food or other supplies (fig. 8; pl. 10, *b*).

The evidence of the three floors in room 4 points to the possibility of temporary abandonment of the site followed by one and perhaps two brief periods of reoccupation, although probably the entire duration of all occupations was not very great, since the pottery found is homogeneous.

KIVA

The kiva at Site RB 551 was a surprisingly large structure in relation to the dwelling. It was situated about 31 feet southeast of the dwelling (map 3). Its total original depth could not be determined exactly, for the upper part had collapsed, but its walls still stood to a maximum height of 7½ feet above the floor. A rough estimate of the fallen building blocks indicated a quantity sufficient to reconstruct the walls possibly 2 feet above this point.

The kiva was mostly subterranean, although probably not entirely so, for evidence of the original ground surface at the time of occupancy was found a foot or more below the present summit of the highest part of the wall. The maximum and minimum interior diameters were 21 feet, 9 inches and 20 feet, 9 inches respectively, and the entire structure was almost a perfect circle. Its interior arrangement was simple, the only major architectural feature being a banquette extending completely around the room. This varied in height from 2 feet, 8 inches to 3 feet. Its width was almost uniform, from 2 feet, 9 inches to 3 feet, 1 inch. The inner face of the banquette was constructed of well-coursed masonry and the upper surface may originally have been completely paved with thin sandstone slabs. These slabs still remained *in situ* over a part of the area, but it was not clear whether they ever extended over the entire surface (fig. 10).

The main outer wall of the kiva extended downward to a point only a few inches below the surface of the banquette. The masonry of both this wall and the inner face of the banquette was in all essentials exactly similar to that of the house unit, except that the external faces were not neatly finished, since they were subterranean.

The floor of the kiva was formed of hard-packed earth, carefully smoothed and almost perfectly level. Although the construction of the roof is conjectural, it was apparently supported by four main posts, the remains of which were found imbedded in holes as shown in figure 10. Three of these posts were set into the masonry face of the banquette, and stones were laid around them to provide added support; the fourth was situated in the banquette just behind its face. Fragments of the original posts were found in each hole, and varied at the butts from 5½ to 7 inches in diameter. All postholes extended at least 4 feet below the surface of the banquette. Clearly the kiva roof had burned, for there was found on the surface of the banquette as well as on the floor of the room a uniformly thick layer of charcoal, in which some of the beams could still be traced for 10 or 12 feet of their length. Plate

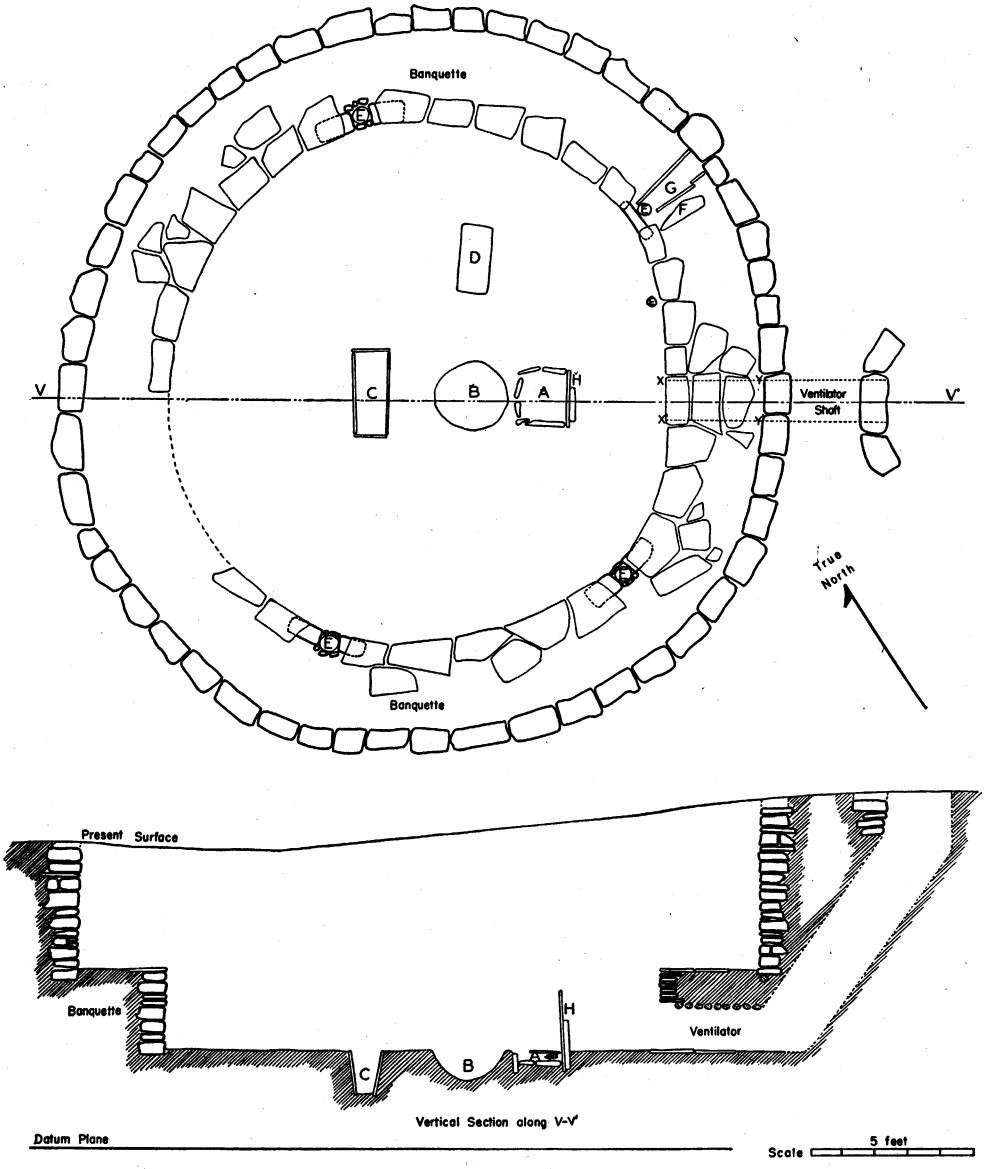


Fig. 10. Site RB 551. Plan and vertical section of the kiva. A, box containing rabbit burial; B, fire pit; C, slab-lined box; D, shallow pit; E, postholes; F, large polished stone; G, slab-sided box; H, deflector.

10, *a* shows some of these beams, partly cleared, on the floor.[39] One, a log of Douglas fir which showed a cutting date of 1078+, provided the only absolute dating available for the site. There was no possibility of a side entrance to the kiva, and entry was presumably through a hole in the roof. None of the charred timbers, however, could be identified as having served as a ladder.

Slightly to the southeast of the center of the floor was a fire pit, 2 feet, 4 inches in diameter and 10½ inches deep. It was filled with wood ash, and was outlined by

[39] In the hope of ascertaining a positive date from the timbers great care was taken in excavating them, and many sections were removed and catalogued. All specimens were sent to the Dendrochronological Laboratories of the University of Arizona, but only one yielded a reliable date.

a very slightly raised and rounded rim of hard-burned earth. About 1 foot, 8 inches southeast of the fire pit, and about 3 feet out from the face of the banquette, was a large deflector, composed of two standstone slabs, set snugly against each other and leaning inward at a slight angle. The largest of these slabs was 1 foot, 11 inches high above the floor, 1 foot, 9 inches wide, and about 1½ inches thick, with a carefully rounded upper edge.

The customary ventilator was placed at the southeast, in line with the fire pit and deflector. Its inner orifice was 1 foot, 6 inches high by 1 foot, 4 inches wide and it

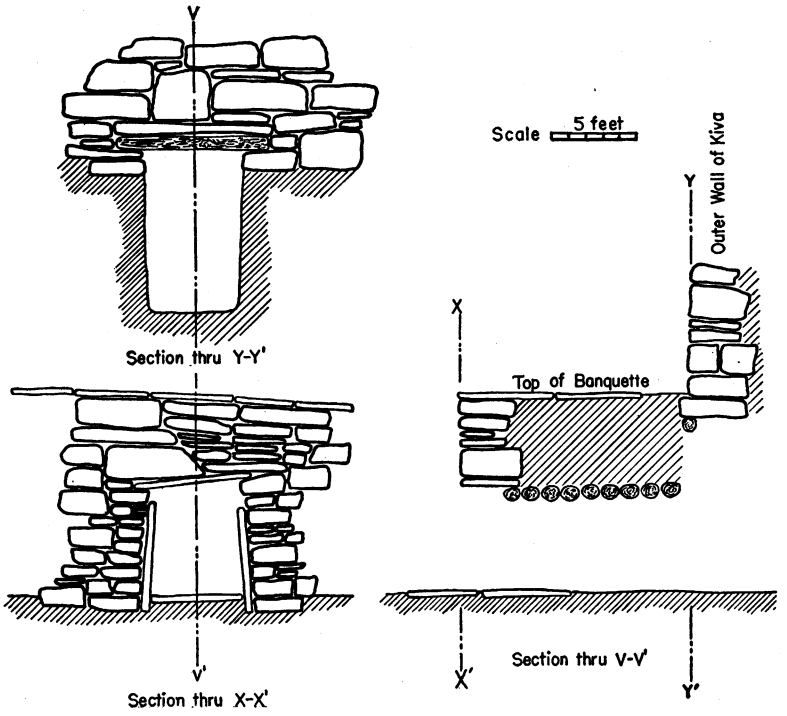


Fig. 11. Site RB 551. Details of various parts of the kiva ventilator.

was neatly constructed, with thin standstone slabs used as lining on both sides and bottom. It extended horizontally under the banquette and under the main outer wall of the kiva. The roof of the horizontal portion was supported by a series of poles, about 2 inches in diameter, laid close together across the tunnel and covered apparently with grass and brush with earth fill above (fig. 11; pl. 11, *a*).

The nature of the ventilator tunnel beyond the line of the main kiva wall could not be clearly defined. At a point something more than 2 feet outside the main wall, and just below the surface of the ground, occurred what appeared to be the remnant of a slightly curved masonry wall, 3 or 4 courses high and about 3 feet long. It is assumed that this represented the upper part of the ventilator, but thorough excavation of the area all about it and to the full depth of the kiva disclosed no clearly definable outlines of a shaft or tunnel. At several points well below the surface were found a few isolated stones of about the size and shape used in the wall construction, as well as a few fragments of wood. In all probability, therefore, there must once have been a shaft, into which the wood and stones had fallen, but its exact size and position could not be determined. It is postulated, however, as having sloped upward at an angle of about 45 degrees, and is so shown in figure 10.[40]

[40] Hargrave, 1933, p. 30.

Three other features in the kiva should be noted, two on the floor and one on the banquette. At a point a little northwest of the center of the room, and on the opposite side of the fireplace from the ventilator, was found a rectangular box set into the floor, 1 foot, 3 inches deep, 2 feet, 5 inches long, and varying in width at the upper margin from 10½ inches to 1 foot. The width at the bottom varied from 6 to 7 inches. This box was lined and paved with thin standstone slabs, but contained nothing except general debris. Whether it can be called a sipapu, or was for some other purpose, is entirely conjectural.

Between the deflector and the fire pit was another slab-lined box, approximately 1 foot, 6 inches by 1 foot, 3 inches in inside dimensions and about 5 inches deep (pl. 11, *b*). The tops of the slab walls were just about level with the floor of the room, and almost the entire interior area at this level was covered with irregularly shaped stone slabs. Directly beneath the largest slab and close to the deflector, which formed the southeasterly side of the box, lay the skeleton of a rabbit, the skull in contact with a one-handed mano (No. RB 551–76). It was obvious that the rabbit had been deliberately buried, probably for some ceremonial purpose, for its bones were in their natural relationship, indicating that it had not been eaten and then carelessly thrown away. Moreover, it lay directly upon a large, artificially rounded sherd of Tusayan Corrugated pottery.

On the surface of the banquette, at the easterly side, was a long box formed by upright standstone slabs running transversely across the banquette from the back wall to the main roof post, which rose from the banquette. The slabs were tangent to the post and stood almost exactly along radii of the room; they were thus about 8 inches apart at their outer ends and about 5½ inches at their inner ends. The top of one slab was 11½ inches above the banquette, the other 8½ inches. Inside the box was found a grinding stone and a bone awl 6.8 cm. in length.

Throughout the foregoing description this large circular subterranean room has been called a "kiva." Perhaps a few words should be added in justification of the use of this term instead of the more general term "pit house." Many writers prefer to apply the word kiva only to structures which can be indubitably regarded as having been used for ceremonial rather than for dwelling purposes. In accordance with this usage, the evidence here pretty conclusively justifies the use of the word kiva. First, it existed in close relation to and was obviously contemporary with the surface structure, which must have been a combined dwelling and storage house, large enough to shelter a population sufficiently numerous to require, or at least desire, a kiva. Second, no evidence that the circular room had been lived in was forthcoming; no pots, no metates or mealing bins, very few sherds, and almost no bones were found in it. Third, certain features suggestive of ceremonial use did exist. These were the rabbit burial, the rectangular box in the position usually occupied by the sipapu in most kivas, and the long box on the eastern part of the banquette. Moreover, its position, to the east and south of the surface house, is consistent with the usual orientation of kivas in the San Juan area.[41] A general view of the kiva after excavation is shown in plate 9, *b*.

REFUSE MOUND

Directly southeast of the kiva was a fairly extensive mound of general refuse, which rose near the kiva to a maximum height of about 3½ feet above the original ground surface and sloped off gradually toward the east and south. It measured approximately 75 by 150 feet in area (pls. 6, *b*; 12, *b*).

With the hope of finding burials and of developing a stratigraphic sequence of

[41] Kidder, 1924, pp. 50–51; Prudden, 1914, p. 33; Morris, 1939, pp. 33, 36; Cummings.

pottery types, a test trench was cut through this mound along the shorter axis. The trench was kept uniformly 6 feet wide, and stratigraphic sections were removed, each section measuring 3 feet long, 6 feet wide, and 9 inches deep. As shown on the profile (fig. 12), each section was designated by a combination symbol consisting of a letter and a numeral, the letters running sequentially from the lower or southeasterly edge of the mound and the numerals from the surface downward. As each section was excavated, every object of pottery, stone, and bone was saved and put into a container, appropriately labeled. All were taken back to the base camp, washed and individually labeled in India ink. Later, in the laboratory, an intensive study was made and table 4 was prepared. The pottery type designations used in compiling table 4 are those used in the study of the pottery from the region as a whole.

In the course of digging the test trench through the refuse mound, three human burials were encountered, only one of which contained a complete skeleton. The others either had been disturbed or were reburials. Few significant inferences regarding mortuary customs can be drawn from these burials.

Burial 1 occurred in sections G-2 and H-2. It consisted of a skull (without the mandible), one humerus, all the long bones of one leg, two vertebrae, six ribs, and an undetermined number of small bones and teeth, almost wholly without anatomical relation to each other. No pots or other objects were in association.

Burial 2 was in section I-2, and consisted only of a skull, so badly decomposed as to be impossible of salvage, two vertebrae, one rib, and a few unidentifiable fragments. Near the skull was a small gray ladle (No. RB 551–7).

Burial 3 was in section M-2 and extended mostly beyond the northeasterly boundary of the trench. The skeleton lay face down, the legs fully flexed, with knees just in the front of the jaw; the arms were folded across the breast inside of the legs. Just behind the head were three pots, a Tusayan Corrugated jar (No. RB 551–79) with a Sosi Black-on-white bowl (No. RB 551–80, fig. 26) inverted over it, and a miniature Sosi Black-on-white jar beside it (No. RB 551–81). Directly beneath the skull was a miniature Tusayan Black-on-red jar (No. RB 551–82).

ARTIFACTS

Other than pottery, a relatively small number of domestic artifacts and objects of adornment were found at Site RB 551, but a detailed description of certain specimens and a summary grouping of others are herewith presented. Most of the articles are of an obvious nature, but certain comments will be interpolated whenever this may seem desirable for clarity. In the paragraphs which follow, the objects will be treated in broad categories, based primarily on the nature of the materials from which they were made and secondarily on the uses to which they were adapted.

Objects of stone: Tools.—Among a corn-eating people, such as the Pueblo peoples of the Southwest, perhaps the most important and significant domestic tools are the metates and manos with which the women of the group are accustomed to grind their corn into meal. Because comparison of metate and mano shapes from various sites has seemed to indicate developmental cultural stages and local differences, a detailed statistical analysis of these features is valuable in the study of any site or area.[42]

Surprisingly and unfortunately, not one metate was found at this site. Although two mealing bins were present in room 2 of the dwelling house, the metates had evidently been removed before abandonment of the structure. Fifteen fragmentary or complete manos were recovered, however, and their general shape and form sug-

[42] Bartlett, 1930, p. 3; 1933; 1934, pp. 27–29.

gest the probable type of metate on which they must have been used. Nine of the manos, all fragmentary, were found in the refuse mound, four complete manos and one fragment in room 2, in close association with the mealing bins already mentioned, and one in the box beneath the floor of the kiva, which contained the rabbit skeleton. All the manos were of sandstone of various colors and textures, and may be grouped into five types, according to shape and apparent manner of use (fig. 15). All but two specimens seem to have been designed for use with two hands. None was noticeably beveled or rounded at the extremities of the long axis, a fact suggesting that they were used on plane rather than on troughed metates. If this inference is correct, then the type of metate used at Site RB 551, which, as stated above, was probably occupied during the latter part of the eleventh century, differed from that in use at contemporary sites in the region to the southwest near Flagstaff and the San Francisco Mountains, where the troughed metate seems to have been universal.[48]

TYPE I. (See fig. 15.) Of the manos recovered at Site RB 551 by far the most common type has the form of a long rectangle with slightly rounded corners, one face plane and not used as a grinding surface, the other face beveled and used for grinding. Ten specimens of this type occur, eight of them being beveled from one edge to approximately the mid-line of the grinding face (TYPE IA), the other two being beveled from both edges to the mid-line of the grinding face (TYPE IB). Of the latter, one (No. RB 551–37) shows the beveled areas intersecting at a sharp angle, whereas on the other (No. RB 551–67) the line of intersection has been considerably rounded.

TYPE II. In the two specimens of this type both surfaces are plane and approximately parallel without any appreciable bevel. One (No. RB 551–66) had apparently never been used and the other (No. RB 551–65) showed only one grinding surface. Perhaps both represent the beginnings in the development of the artifact, and with further use would have become beveled like those of Types I or III.

TYPE III. This type is represented by only one specimen. Both faces are beveled from the same edge and have been used as grinding surfaces (No. RB 551–23).

TYPE IVA. This type was apparently designed for use by only one hand; one face was plane and used as the grinding surface, the other face was markedly convex to fit the inner curvature of the palm of the hand, and was not used as a grinding surface. Only one specimen (No. RB 551–76) was found, which was with the rabbit burial in the kiva (p. 52).

TYPE IVB. This type was represented by only one specimen (No. RB 551–59), apparently also designed for use by one hand, for the length (15 cm.) would hardly be great enough to accommodate two hands. Both faces were gently convex and had been used as grinding surfaces; there was no clearly defined bevel.

One limestone (?) mortar was found. It was an irregular block, 33 by 26 by 10 cm., with a shallow circular depression pecked in one face, and perhaps never completed or used. The depression measured 8 mm. in greatest depth and 6.5 mm. in diameter.

Two hammer stones or mauls were found, composed of sandstone, each displaying a horizontal hafting groove entirely encircling the specimen and approximately at the center of the vertical axis. The groove had been formed by pecking and not abrasion. Measurements of these mauls were as follows:

Length	Breadth	Greatest thickness	Catalogue number
14	11	4.2	RB 551–2
9.5	8	5.2	RB 551–72

Two small stones, perhaps used as hammer stones or fire strikers, were No. RB 551–34 and No. RB 551–85. These stones measured 5.6 by 4.5 by 2.5 cm. and 3.5 by 2.6 by 2.0 cm. respectively, and each had a slight depression on each face, which exactly fitted the thumb and forefinger of the right hand. A thick, rounded portion on RB 551–34 showed slight abrasions as if used for light hammering or striking.

[48] Bartlett, 1933; 1934, p. 29.

One small quartzite pebble (No. RB 551–4) apparently was used as a polishing stone. It was originally a water-worn spherical pebble, which had been broken in half and the fractured face ground down to a highly polished plane surface. Dimensions were 3.7 by 1.8 by 1.6 cm.

In the refuse dump was found a red sandstone object (No. RB 551–22), possibly used as a stopper for the mouth of a large olla. It was circular with two plane parallel surfaces and slightly beveled edges, making one of the plane surfaces somewhat smaller in diameter than the other, exactly as would be required for the stopper of a flared-mouthed jar. This object was 7 cm. thick, 16.5 cm. in diameter on the larger face and 15 cm. on the smaller.

An awl or drill of stone (No. RB 551–36) may also be mentioned here. It represents an ingenious adaptation of a natural phenomenon occurring locally, for it had been manufactured from a specimen of the "cone-in-cone" crystalline rocks which occur abundantly in the Mancos Shale.[44] These formations occur naturally in the form of tapering cones and are fairly dense and hard. The tip of the specimen described here was merely ground down somewhat more finely to a neatly rounded point suitable for use as a drill or awl. Many awls of bone were found (described on p. 56), but this is the only example of a stone used for the purpose.

One sandstone artifact of undistinguished appearance but possibly of considerable significance was No. RB 551–33. This was an irregular fragment of sandstone, measuring approximately 5.3 cm. in diameter and 1.2 cm. in thickness. One surface was convex and shows no evidence of artificial manipulation, but the other surface was spherically concave, with the same degree of curvature in all directions. This inner concave surface was well smoothed as if it had been carefully rubbed over a large spherically rounded object. The degree of curvature was such as to fit approximately the surface curvature of a large pottery olla and the suggestion is made that this small object, which could be conveniently and comfortably held in the in the hand, may well have been used as a scraper or smoother in finishing the surfaces of pottery vessels before firing. The striations apparent on the surfaces of most vessels and sherds found at this and at other similar sites suggest the use of a stone smoother rather than a piece of wood or sharp-edged instrument or a wad of grass or reeds, as has sometimes been postulated.

Only one projectile point and one stone knifeblade were found at Site RB 551. The point, No. RB 551–69, was a very small milky white stone (chalcedony?) measuring 2.6 by 1.2 by 0.3 cm. It had a relatively long shaft with slightly convex edges, a somewhat blunt point, and a heavy convex base separated from the shaft by two lateral notches. All surfaces and edges were carefully worked with primary and secondary chipping by a pressure technique.[45]

The knife blade was an unusually fine specimen of a dull red stone (jasper?), well shaped and carefully chipped on both faces and edges, the latter rendered very even and sharp by means of pressure flaking. It showed no hafting marks and was therefore probably held in the hand for use. This knife measured 9.5 by 3.5 by 0.7 cm. and is illustrated in plate 13, *d*.

In addition to the stone smoother (No. RB 551–33) described above, nine pottery fragments were found showing evidence of use as scrapers or smoothers, probably in the process of finishing the interior surfaces of other pottery vessels. All these sherds displayed evidence of having been shaped to roughly circular or elliptical form and show a well-worn bevel along a portion of the edge. It may be that the sandstone smoother with its concave face was used to rub down the exterior surfaces of pottery vessels, while the flat sherds were used to scrape the interiors and to remove excess clay. For this they are ideally suited, having a convex edge which conforms to the inner curvature of a bowl or olla.

Objects of stone: Articles of adornment.—Few articles for adornment or similar use were found, and what few did occur were mostly small crudely formed pendants of a laminated mudstone (catlinite), which outcrops in the upper strata of the Mancos Shale at various places within a mile or so of the site. This stone is extremely fine-grained and of a rather soft reddish or orange color. It is not hard but takes a good polish. Apparently it was used for the manufacture of pendants

[44] Identification by Dr. F. B. Loomis, formerly of the Geology Department of Amherst College.

[45] For a system of arrowhead classification see Renaud. In Dr. Renaud's nomenclature, this point would be of Type III, A, c.

or beads, and eighteen examples of such jewelry were found. The shapes varied, but for the most part they were roughly circular disks, only four being rectangular or elliptical. The thickness, which was almost uniform in each particular specimen, was normally from 2 to 3 mm., with two specimens as thin as 1.5 mm. and two as thick as 4 mm. The circular specimens varied in diameter from 3 to 4 cm., one being only 2 cm. (pl. 13, *d*).

As a rule these articles were fairly carefully smoothed on both faces as well as around the edges, but, although they have been called pendants, only seven of them were actually pierced for suspension. Whether the others were unfinished or were designed for another purpose cannot be known. Of those which were pierced, each contained a single hole, four of them drilled entirely through from one surface forming a conical hole, and three drilled from both surfaces to form a hole in the shape of an hourglass.

Within the category of adornments may be included two stone beads. One (No. RB 551–75) was of gray mudstone, discoidal in shape and perforated by drilling through from one face. It measures 6 by 5 by 1.5 mm. The other was an irregular fragment of sandstone, drilled through from both faces and measuring 1.4 by 1.2 by 1.2 cm. (pl. 13, *d*).

Objects of bone.—Fourteen bone implements were found at Site RB 551, of which thirteen may be classified as awls and one as a needle. The needle differs from the awls only in having an eyelet drilled through the basal end and in being generally smaller in cross section in relation to length.

The awls were mostly made from the long bones of birds or small mammals; all were carefully ground down to a very sharp point and were usually well polished. In some the bone was split longitudinally, forming a trough-shaped instrument; in others the bone was used complete, making an instrument generally circular in cross section. Lengths of the awls varied considerably, but the extremes were 3.5 and 15.3 cm. respectively, whereas the needle was 23 cm. in length. Four of the awls were made from scapulae or other relatively flat bones and were thus wedge-shaped or roughly triangular, but nevertheless had a well-sharpened and smoothed point.

A small fragment of a bone finger ring, less than one-half complete, was found. It was a well-worked and highly polished section of a long bone of some mammal, with an inside diameter of about 1.2 cm. (pl. 13, *c*).

STRATIGRAPHY

A vertical longitudinal section of the test trench excavated through the refuse mound at Site RB 551 is shown in figure 12. From this drawing it will be seen that the trench was divided into seventy-five sections, each approximately 3 feet by 6 feet by 9 inches. From this trench were recovered slightly more than 8,000 sherds and on this material was based a careful stratigraphic study for the purpose of determining the superposition of various pottery types occurring at the site. The method of analysis and study has already been described in general terms (p. 10). The statistical results of that study are here presented in graphic form, together with a statement of certain conclusions drawn therefrom.

From an examination of the stratigraphic lines of deposition appearing in the profile of the test trench through the mound a hypothetical history of the growth of the mound was formulated. It was evident that the earliest beginnings of deposition occurred in the bottom of the mound and close to, but not quite at, its northwest side. This was the side nearest the house unit, where the first deposit of refuse might be expected. It was also found that in the five lowest sections of this area occurred by far the largest proportion of Kana-a Black-on-white and Lino Gray sherds, already known to be diagnostic of the Early Developmental or Pueblo I horizon, combined with the smallest proportion of later Black-on-white and Tusayan Corrugated sherds, which are diagnostic of Later Developmental or Pueblo II. Using these types as criteria, the statistical graph of each of the seventy-five sections was arranged in the order of a decreasing Pueblo I and increasing Pueblo II proportion. The sequence of sections as thus arranged corresponded very closely with the

sequence evidenced by the strata exposed in the side walls of the trench. Feeling that the directional hypothesis was thus reasonably well checked, individual section graphs were then combined into groups, as indicated in figure 12. As shown thereon, Group I is the earliest and Group XVII the latest in the series.

The type statistics of these seventeen groups were then formulated in a table, a simplified form of which appears as table 4. In the original sherd classification, thirty categories were segregated. Many of these are recognized pottery types. The

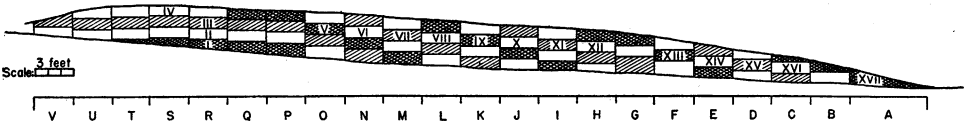


Fig. 12. Site RB 551. Diagrammatic profile through longitudinal axis of stratigraphic trench in refuse mound, showing manner in which sections were excavated and numbered.

others are not regarded as type groups in the strict sense but as representing special diagnostic features, utilized as laboratory categories for the purpose of determining whether or not they might prove to be chronologically significant. The categories recognized and tabulated at this site were :[46]

1. Kana-a Black-on-white.
2. Lino Gray.
3. Kana-a Gray.
4. Deadmans Black-on-red.
5. Undecorated sherds of Tusayan White ware.
6. Dogoszhi Black-on-white.
7. Black Mesa style black-on-white showing band decoration divided into repeated panels, but without pendent dots.
8. Same as 7, but with pendent dots.
9. Sosi wide-line style black-on-white, without pendent dots.
10. Same as 9, but with pendent dots.
11. Heavy solid black elements, without pendent dots.
12. Same as 11, but with pendent dots.
13. Black-on-white of indeterminate character, without pendent dots.
14. Same as 13, but with pendent dots.
15. Flagstaff Black-on-white.
16. Tusayan Corrugated, with coils wider than 5 mm.
17. Tusayan Corrugated, with coils 4–5 mm. wide.
18. Tusayan Corrugated, with coils less than 4 mm. wide. (16, 17, 18 include some sherds that may be Coconino Gray.)
19. Moenkopi Corrugated, with rough coils.
20. Moenkopi Corrugated, with flattened coils.
21. Corrugated sherds, without finger indentations but with coils partly obliterated by wiping while damp.
22. Tusayan Black-on-red.
23. Medicine Black-on-red.
24. Tsegi Orange.
25. Tsegi Black-on-orange.
26. Tsegi Red-on-orange.
27. Dogoszhi Polychrome.
28. Citadel Polychrome.
29. Tusayan Polychrome.
30. Kayenta Polychrome.

In the original analysis all these categories were included in a graph. Later, those that appeared not to be chronologically determinative were disregarded and combined into generalized groups, the distinctions within which seemed not to be

[46] For descriptions of the types previously published, see Colton and Hargrave.

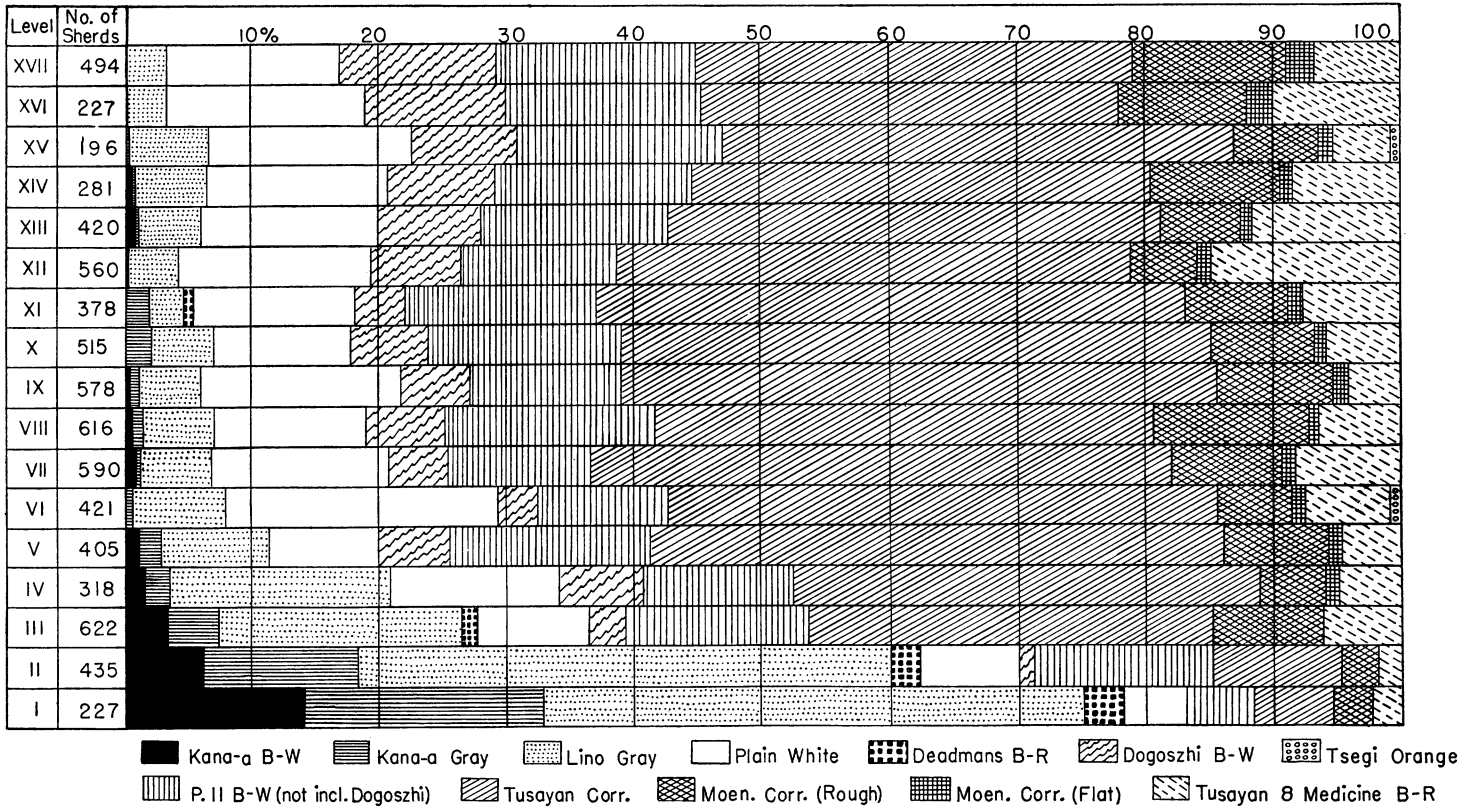


TABLE 4. This table indicates the proportions of sherds of all pottery types in the successive strata of the refuse mound at Site RB 551. The horizontal lines represent the strata as indicated in figure 14, the corresponding numbers of which appear in the first column. They are arranged chronologically from the bottom upward. The second column lists the total number of sherds found in each stratum, and the quantity of each type is shown on the right as its percentage of that total. Dogoszhi Black-on-white is separated, but all other Pueblo II black-on-white sherds are combined, in order to avoid confusion. This category is broken down in table 7, charts A to D.

significant. Table 4, therefore, is a composite chart, which requires only a few explanatory comments.

The striking facts that may be noted objectively by reference to it are:

1. The relatively large proportion of Kana-a Black-on-white, Kana-a Gray, and Lino Gray in the earlier strata and the virtual disappearance of the first two in and after level VI.
2. The concurrent and even more rapid decrease of Deadmans Black-on-red, which entirely disappears by level III except for a single sherd in level XI, which can be disregarded.
3. The very small proportions of Pueblo II black-on-white types in level I, and their consistent increase upward. This is especially noticeable in Dogoszhi Black-on-white, which is wholly absent from level I, and minute in quantity in level II, but fairly prolific in the upper strata.
4. The small percentage of Tusayan Corrugated in levels I and II and its sudden increase in level III, remaining fairly constant thereafter.
5. The small percentage of Moenkopi Corrugated with rough coils in levels I and II, its sudden increase in level III and fairly constant percentage thereafter.
6. The absence of Moenkopi Corrugated with flattened coils in the lowest three levels, and its constant, though small, proportion thereafter.
7. The small percentage of Tusayan and Medicine Black-on-red (which have been combined in the chart) and their increase in level III and later.
8. The very small sporadic occurrences of Tsegi Orange in levels VI and XV.
9. The total absence of polychrome types from all levels.
10. The total absence of Tusayan and Kayenta Black-on-white from all levels.
11. The total absence of Kiet Siel Gray from all levels.

In table 4 the Pueblo II black-on-white types, other than Dogoszhi Black-on-white, are shown as a single group, in order to avoid burdening the chart with too many small subdivisions. As a matter of fact, however, certain features within this group seem to have chronological significance. In another table, therefore (table 7, A, B, C, and D), an attempt has been made to break down this group into its significant features and to show their relation to materials excavated at Site RB 564.

Table 7 is constructed on a sequence of eight levels, derived by combining each two consecutive levels shown in table 4. Percentages shown for each subdivision are given in ratio to the total quantity of Pueblo II black-on-white sherds, exclusive of Dogoszhi Black-on-white, contained in the particular level indicated.

Significant features of table 7 are:

1. The relatively large proportion in the lowest levels of sherds displaying pendent-dot enrichment, and their rapid decrease upward.
2. The corresponding decrease of paneled-band designs from earlier to later levels.
3. A similar decrease of borders composed of repeated bold solidly filled elements from earlier to later levels.
4. The rather irregular increase of Sosi Black-on-white from the earlier to the later levels.

As is stated elsewhere herein (p. 10) none of these features apparently can be regarded as diagnostic of a definite style of design or as the characteristic of a separate type. But for the purposes of sherd analysis they are recognizable and can usefully be employed as the basis for chronological studies.

In the original classification of Tusayan Corrugated sherds at this site they were separated into twenty-one groups on the basis of the width of coil and the size of indentation, as has been explained elsewhere (p. 12). A careful analysis of these data when applied to the stratigraphic sections at Site RB 551 seemed to display no chronological significance, and has therefore not been included in any of the accompanying charts. On the other hand, a consideration of these data taken as a whole for this site, when compared with similar data from Site RB 564, did show certain very striking features that will be noted in connection with the stratigraphy of Site RB 564 (see p. 64).

Table 5 displays an analysis of sherds recovered from the debris filling the house unit and the kiva. It is constructed on the basis of the same categories used in the

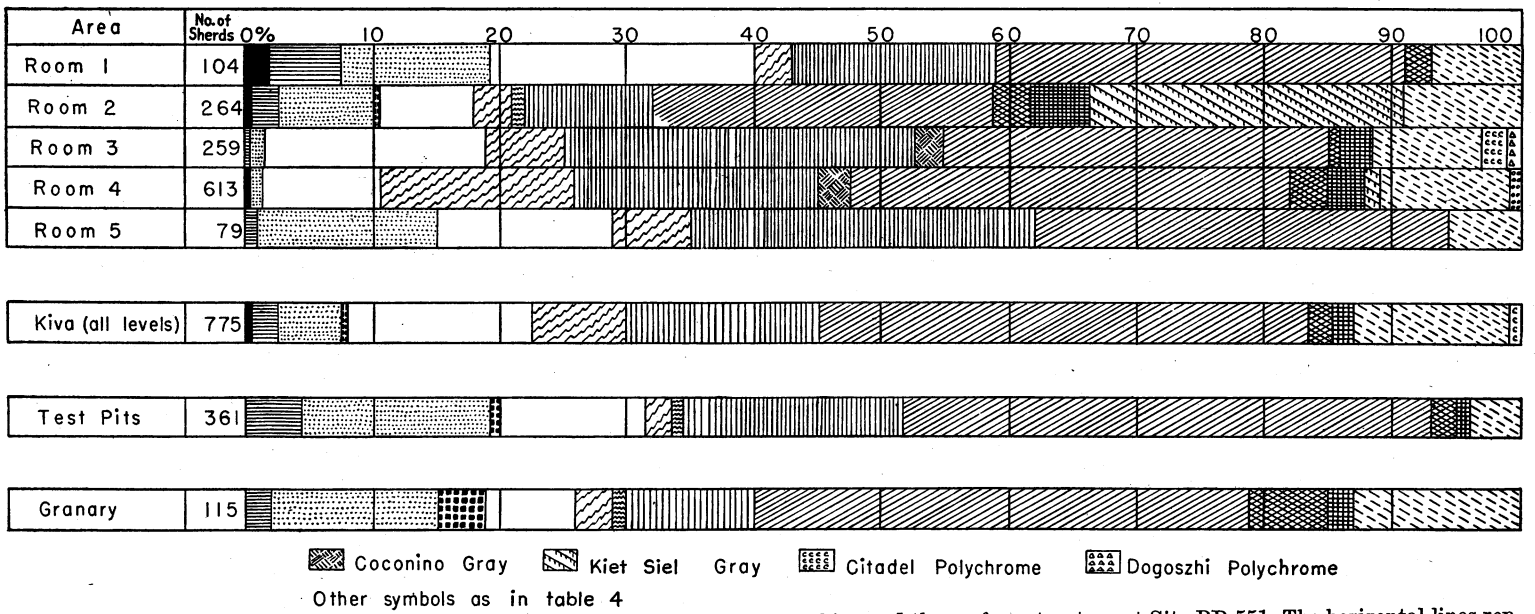


TABLE 5. This table indicates the proportions of all pottery types found in the kiva and the surface structure at Site RB 551. The horizontal lines represent the areas shown in figure 10 and map 4, as indicated in the first column. The second column lists the total number of sherds found in each area without regard to stratigraphic levels. The quantity of each type is shown as its percentage of the total collection from each area. Dogoszhi Black-on-white is separated, but all other Pueblo II black-on-white sherds are combined to avoid confusion. This category is broken down in table 7, in the second line of chart E.

other tables for this site, and can be directly compared with them. Several outstanding features may be pointed out, however:

1. The relatively small percentages of Kana-a Black-on-white and Kana-a Gray, except in room 1, and in two test pits dug just outside the walls of the masonry building.
2. The moderate percentage of Deadmans Black-on-red from one of these test pits, and its almost total absence from other areas and levels.
3. The small percentage of Dogoszhi Black-on-white in room 1 and the test pits, and its much larger percentage elsewhere.
4. The presence of small quantities of Flagstaff Black-on-white in the test pits and on the floor of room 2. This type is wholly absent from the refuse mound.
5. The presence of Citadel, Dogoszhi, and Kayenta Polychromes in the upper part of the kiva fill and in room 3.
6. The very large proportion of Sosi Black-on-white, in relation to other black-on-white categories, everywhere except in room 1 and in the two test pits.
7. The small percentages of black-on-white sherds with pendent dots, except in one of the test pits where they appear somewhat more abundantly.
8. The absence of black-on-white paneled-band sherds, except in room 1 and one test pit.
9. The very large quantity of wiped gray sherds in room 2.
10. The total absence of Tusayan and Kayenta Black-on-white.

From the data in these tables certain inferences seem to be warranted:

First, Site RB 551 probably represents a double occupation, first in Pueblo I times, and somewhat, though not much, later in Pueblo II times. The principal basis for this belief is found in the fact that the lowest level of the refuse mound is made up almost entirely of Pueblo I pottery types. The presence of relatively small proportions of Pueblo II sherds can easily be explained by the fact that the sections taken in sampling the mound were rectangular and therefore not exactly coincident with the actual strata of original deposition, so that they very likely intersected later depositional debris. This is noticeably different from the situation in levels IV and upwards, in which the ceramic complex is strikingly uniform and is almost entirely composed of Pueblo II types. Levels II and III, of course, may be interpreted in two ways. Possibly they represent a short transitional period, although this seems somewhat unlikely because of the rapidity of the change in comparison with the later stability of type proportions. It seems more probable that the mixed character of levels II and III results from the chance cutting by the test sections across the boundary between the earlier and later masses of debris.

The foregoing conclusion is strengthened by the presence of Pueblo I sherds in room 1 and the two small test pits, in distinction to their near-absence within the main part of the house unit. Room 1, from a consideration of its masonry, may never have been an actual room at all, but perhaps was only a stone windbreak, and might therefore be expected to contain in its debris a quantity of earlier sherds, especially since no definable floor could be discovered in it.

Second, rooms 2, 3, 4, and 5 were occupied together and during the period when the debris in levels IV to XVII of the refuse mound collected. There is also a possibility that room 4 was occupied somewhat later than any of the other rooms, as inferred from the existence in it of the uppermost floor level (see p. 46) and the presence therein of the only polychrome sherds in the entire site.

Whatever may be the validity, however, of the conclusions last presented, it seems clearly established from the stratigraphic study taken as a whole that, in this site, at least:

1. Dogoszhi Black-on-white and other Pueblo II black-on-white types may have originated slightly before the disappearance of Kana-a Black-on-white, and very quickly displaced it.[47]

[47] Attention should be called to the situation at Site RB 1006, however, where Black Mesa Black-on-white apparently replaced Kana-a Black-on-white before the appearance of either Sosi or Dogoszhi types.

2. Tusayan and Moenkopi Corrugated began slightly before Lino Gray and Kana-a Gray disappeared and rapidly supplanted them in the gray-ware group.

3. Kana-a Black-on-white, Kana-a Gray, and Deadmans Black-on-red occur together and disappear together.

4. The Pueblo II black-on-white types, Tusayan and Moenkopi Corrugated, and Tusayan and Medicine Black-on-red begin at approximately the same time and continue together in fairly constant proportions.

5. Tsegi Orange and the various polychrome types begin earlier than the Tusayan and Kayenta Black-on-white.

The kiva was apparently constructed in 1078 or very shortly thereafter, according to the wood dating. It seems a reasonable assumption that this date must also represent the date of construction of the house unit, and from the close correspondence between the character of the ceramic debris in the kiva and house unit on the one hand with that in the refuse mound from level IV upward on the other, it is probable that levels I to III were deposited shortly prior to 1078. While the chronology is not perfectly clear, it is indicated that, at this site at least, Deadmans Black-on-red, Kana-a Gray, and Kana-a Black-on-white disappeared prior to 1078, and that the various Pueblo II types began at or very near that date. The earliest dates for the appearance of Tsegi Orange and polychrome types are uncertain, but the amount of refuse present in the mound must have taken a considerable period in which to accumulate, considering the fact that it was deposited by a small group of people. It seems that a century or more would perhaps have been required, and since the polychromes occur only in the uppermost strata of the house unit, it may be reasonable to postulate their appearance as not earlier than 1200. This is admittedly inferential only, but is suggested as a tentative hypothesis.

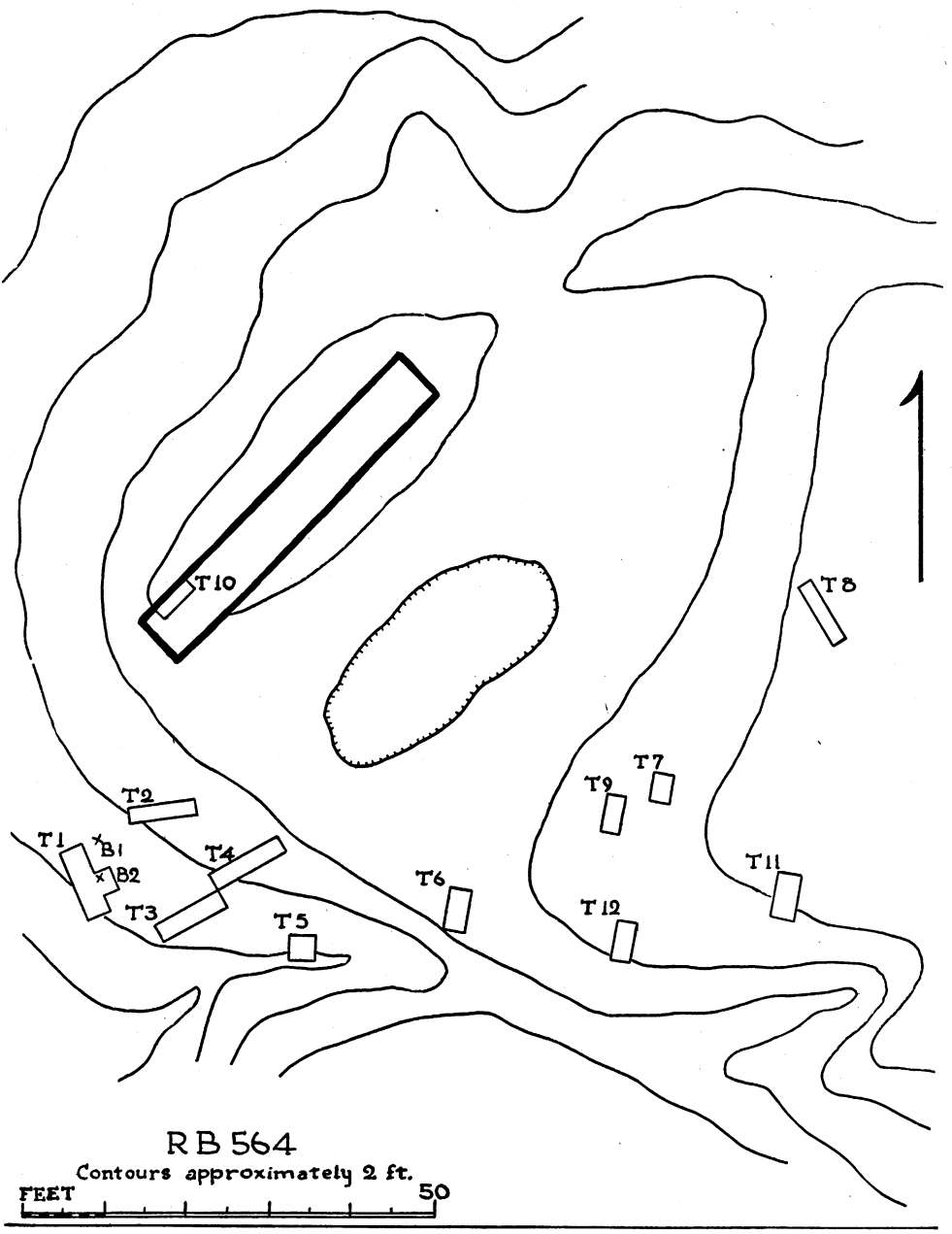
Site RB 564

A stratigraphic study of the pottery associations in the Marsh Pass area was undertaken during the season of 1935. Three sites, closely grouped and near the pass, were selected, because they seemed to present a relatively characteristic example of a period not investigated elsewhere, namely, late Pueblo II or early Pueblo III. None of these sites was fully excavated, but numerous test trenches were dug, and from some of these enough pottery material was recovered to provide the means for a significant study. The results of this study will be discussed at length, but before entering into them, a brief description of the three sites and the excavations carried on there will be given (map 4).

Site RB 564 is situated about three-quarters of a mile southwest of the Expedition's base camp near Marsh Pass, a short distance southeast of the road to Red Lake. It lies on the crest of a small ridge, among a good stand of juniper and piñon, near the foot of the escarpment of Black Mesa.

The site consists of a masonry structure containing a single row of about six rooms, approximately 40 feet long by 7 or 8 feet wide, the long axis running from southwest to northeast, and an accompanying refuse area to the southeast, roughly 70 feet in diameter, but partly eroded away by a small wash on its southeast slope. Immediately between the ruin and the refuse mound is a slight circular depression, which may indicate the presence of a kiva.

The ruin itself was not excavated, but a test trench was dug near the southwest end (trench 12) in order to ascertain the depth of the walls. At this point the base of the masonry was found at about 2 feet below the present surface. The masonry is massive, and is formed of heavy, even, rectangular blocks of sandstone, 14 to 23 inches long, 9 inches wide, and 3 to 7 inches thick, laid in a single tier, with few spalls. The faces of the walls are regular, and the ruin is generally similar to that



MAP 4. Site RB 564. Plan showing location of masonry surface structure, test trenches, and burials.

at Site RB 551, with which it might be thought to be contemporaneous but for very decided divergences in its pottery complex.

Comparison was made possible by the excavation of twelve test trenches at Site RB 564, from which the pottery was carefully saved and segregated according to strata, usually 4 inches in depth.

All trenches were dug to undisturbed earth, but many were only a few inches

in depth, so that no stratigraphic study of the material from them was possible. Trenches 1A, 1B, 9, 10, and 12, however, each provided from two to five strata, and the pottery from them was studied stratigraphically.

Two child burials were found, both very fragmentary and much decomposed, so that no data of anatomical value could be obtained from them. With one skeleton was a miniature black-on-white pot (No. RB 564–1). This pot was unusual, though not unique, in form, and was a double-bodied vessel with a single neck and a single vertical strap handle. It measured 8.0 cm. in height, 11.6 cm. × 6.6 cm. at the base, with an elliptical neck orifice 3.2 cm. × 3.5 cm. in its two diameters. The other burial was accompanied by two miniature unpainted white pots and a small quantity of piñon nuts. Both vessels were roughly spherical in shape, but somewhat squatty.

Near Site RB 564 were situated two other small ruins of similar character. These were recorded as Sites RB 565 and RB 566. The ruins themselves were not excavated, but eleven test trenches were dug in various places at the sites. In each test undisturbed earth was encountered at depths too shallow to permit stratigraphic study of the meager collections of sherds recovered.

Two complete miniature black-on-white vessels, one a seed jar (No. RB 566–1), the other a canteen (No. RB 566–2), were found on the surface at Site RB 566. They are not illustrated. These may originally have accompanied a child burial, but the burial itself was not discovered.

STRATIGRAPHY

In table 6 a graphic record is presented of the ceramic complexes of those test trenches at Site RB 564 in which stratigraphic tests were made. The same conventional symbols are used here as were applied in the chart of the stratigraphy of Site RB 551 and the two can therefore be directly compared (table 4). Broadly speaking, all the trenches at Site RB 564 display the same ceramic complexes and may be considered collectively. Several notable features appear:

1. The complete absence of Kana-a Gray, Lino Gray, and Deadmans Black-on-red, and the extreme rarity of Kana-a Black-on-white, only three sherds of the latter being found.
2. The fairly large ratio of Dogoszhi Black-on-white, in relation to the total amounts of all black-on-white types.
3. The fact that among the Pueblo II black-on-white categories (other than Dogoszhi Black-on-white), sherds of Sosi Black-on-white and sherds with heavy solidly filled elements account for nearly the whole identifiable collections, while sherds with pendent dots are rare and those showing paneled-band designs are totally absent.
4. The relatively smaller proportions of Tusayan Corrugated, when compared with levels IV to XVII in Site RB 551.
5. The very large proportion of Moenkopi Corrugated, especially of the flattened-coil variety, in comparison with Site RB 551.
6. The consistent presence of quantities of wiped corrugated in the upper levels of the trenches, and its absence from the lower levels. In Site RB 551 this type occurred only once in the upper stratum of one room of the house unit.
7. The very large proportion of Tusayan and Medicine Black-on-red.
8. The presence of large quantities of Tsegi Orange and various types of polychrome in all levels, with their tendency to increase in the upper strata.
9. The presence of Pueblo III black-on-white sherds in the upper strata and their almost complete absence in the lower. Upon reëxamination after a careful study of Pueblo III pottery of this region, the placing of this pottery in the Tusayan or Kayenta Black-on-white groups was found to be unwarranted (see p. 109 for a fuller discussion).

Unless, then, the divergences between Sites RB 564 and RB 551 can be explained on a regional basis, it appears that Site RB 564 represents a period of occupation later than that of Site RB 551. In fact, the two sites do not display an overlapping stratigraphic sequence. Site RB 564 appears to have had its beginning slightly later

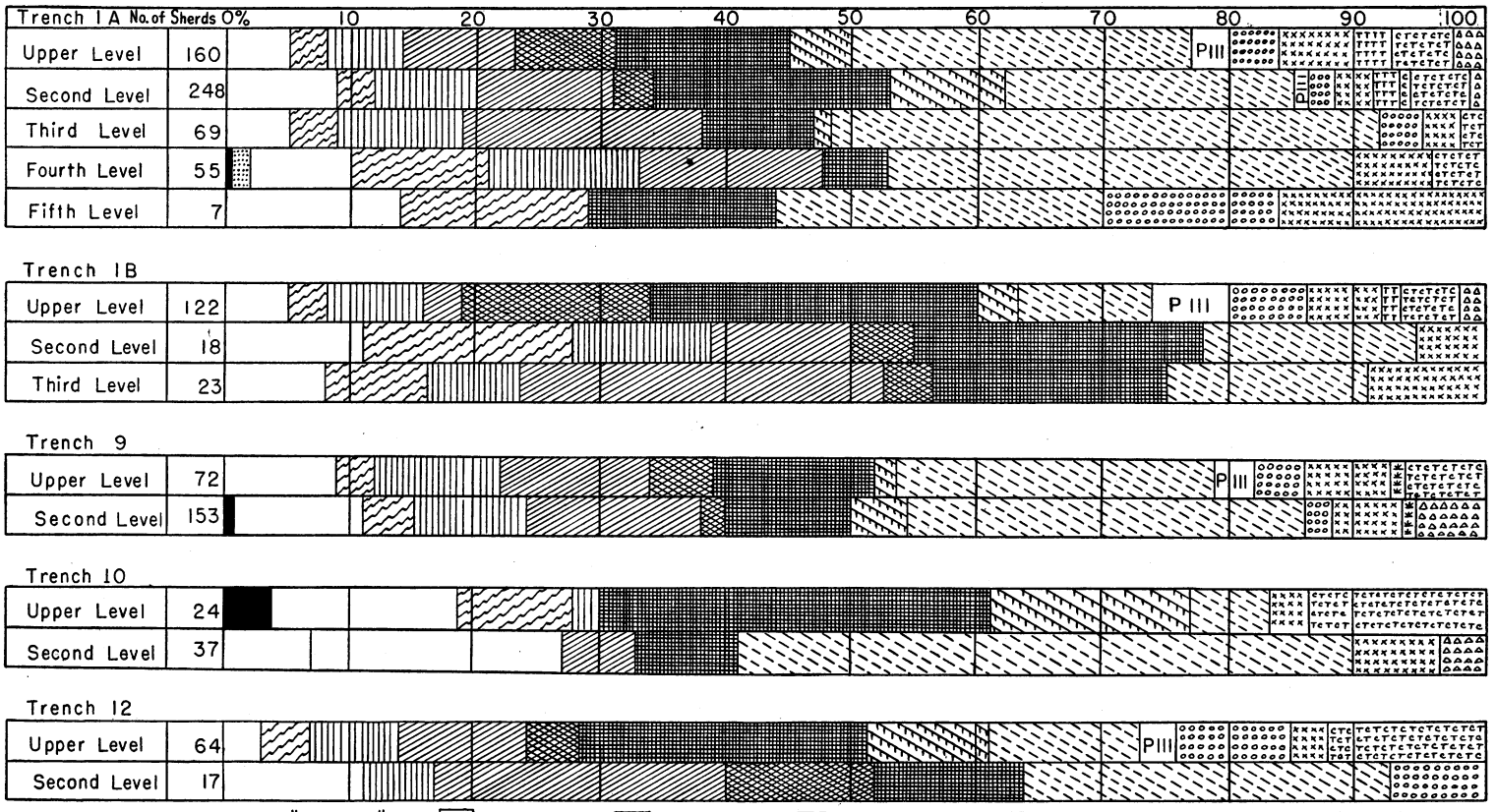


TABLE 6. This table indicates the proportions of all pottery types found in the test trenches excavated at Site RB 564. The horizontal lines represent the successive strata, arranged chronologically from the bottom upward in each trench. The second column lists the total number of sherds from each stratum, and the quantity of each type is shown as its percentage of that total. Dogoszhi Black-on-white is separated, but all other Pueblo II black-on-white sherds are combined to avoid confusion. This category is broken down in table 7, first line of chart E.

than the time of abandonment of RB 551, and can probably be regarded as representative of "late Pueblo II" or "early Pueblo III" as these terms are generally understood.

Unfortunately, the house unit and the kiva (if any) at RB 564 have not been excavated and no datable wood samples are available from the site. Hypothetically, however, its construction may have been in the first part of the thirteenth century. From surface indications, the architecture and masonry appear to be generally similar to that at Site RB 551, and the two sites together therefore suggest that this type of dwelling existed throughout Pueblo II and probably into early Pueblo III.

As to general chronological considerations, Site RB 564 confirms certain of the conclusions stated in considering RB 551 (p. 61) and, in addition, greatly strengthens the belief that Tsegi Orange and Tusayan Polychrome appeared here in quantity somewhat earlier than did Kayenta and Tusayan Black-on-white. In addition, Moenkopi Corrugated rapidly supplanted Tusayan Corrugated at about the same time.

Concerning Tusayan Corrugated a few further words may be said. The sherds of this type from Site RB 564 as well as from the refuse mound of Site RB 551 were originally classified in accordance with the system explained on page 12 and were separated into groups on the basis of width of coil and size of indentation. A study of these groups on the basis of size of indentation alone seemed to have little statistical meaning, but their grouping on the basis of width of coil alone did indicate certain apparently definite tendencies when the collections from the two sites were compared.

In table 7 two charts are shown (E and F), from which it can be seen that the relative proportion of narrow-coil sherds is tremendously greater at Site RB 564 than at Site RB 551. In fact the two narrowest categories, while existing in fairly large quantities at Site RB 564, are almost entirely absent from Site RB 551 and are included in the next smallest category there, as not being significant in themselves.

If it is true that Site RB 564 was somewhat later in its date of occupation than Site RB 551, these differences suggest, if they do not prove, a change during the existence of Tusayan Corrugated from broad to narrow coils, although of course this difference may be due to regional rather than temporal factors.

As has been said, these conclusions are hypothetical, but are presented for whatever they may be worth, with the realization that they cannot be regarded as fully established without further corroborative evidence.

Site RB 1008

Site RB 1008 is situated about one-third of a mile north of Site RB 1006, and was dug in 1938 in the hope that it would prove to show a stage of development immediately subsequent to that of near-by Site RB 1006. George W. Brainerd was in charge of excavations. The complete sherd collection is remarkably similar to that of Site NA 2630, which has an abandonment date of 1124–1130 as shown by wood specimens.[48] Thus the site belongs to the later Developmental Pueblo period and is approximately contemporaneous with the later occupations of RB 551. Percentage analyses of the surface collection made in 1937 and of the total collection from the site are given in table 1. No significant differences were found among the collections proceeding from various structures and areas. All indications from the pottery are of a short occupation of the site.

The site is located on a sand dune which fans out from cliffs to the west (map 1). The dune is sparsely dotted with juniper trees, and with occasional "islands" of

[48] Hargrave, 1935, p. 36.

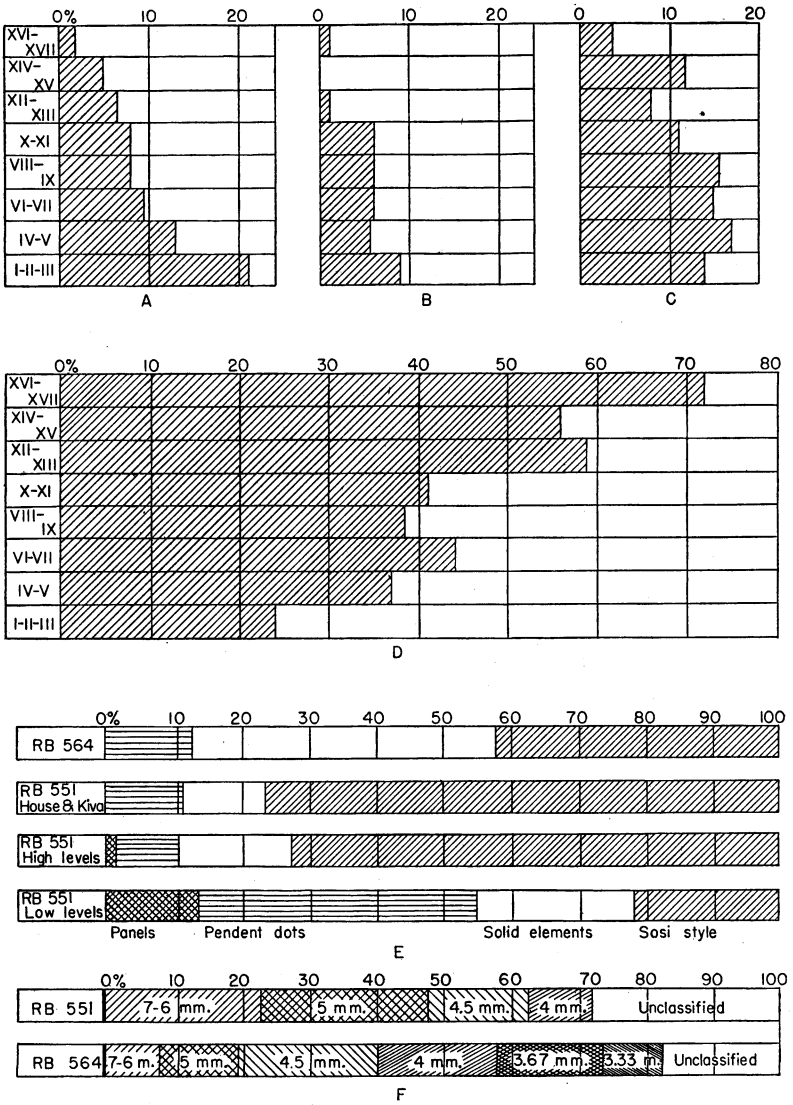
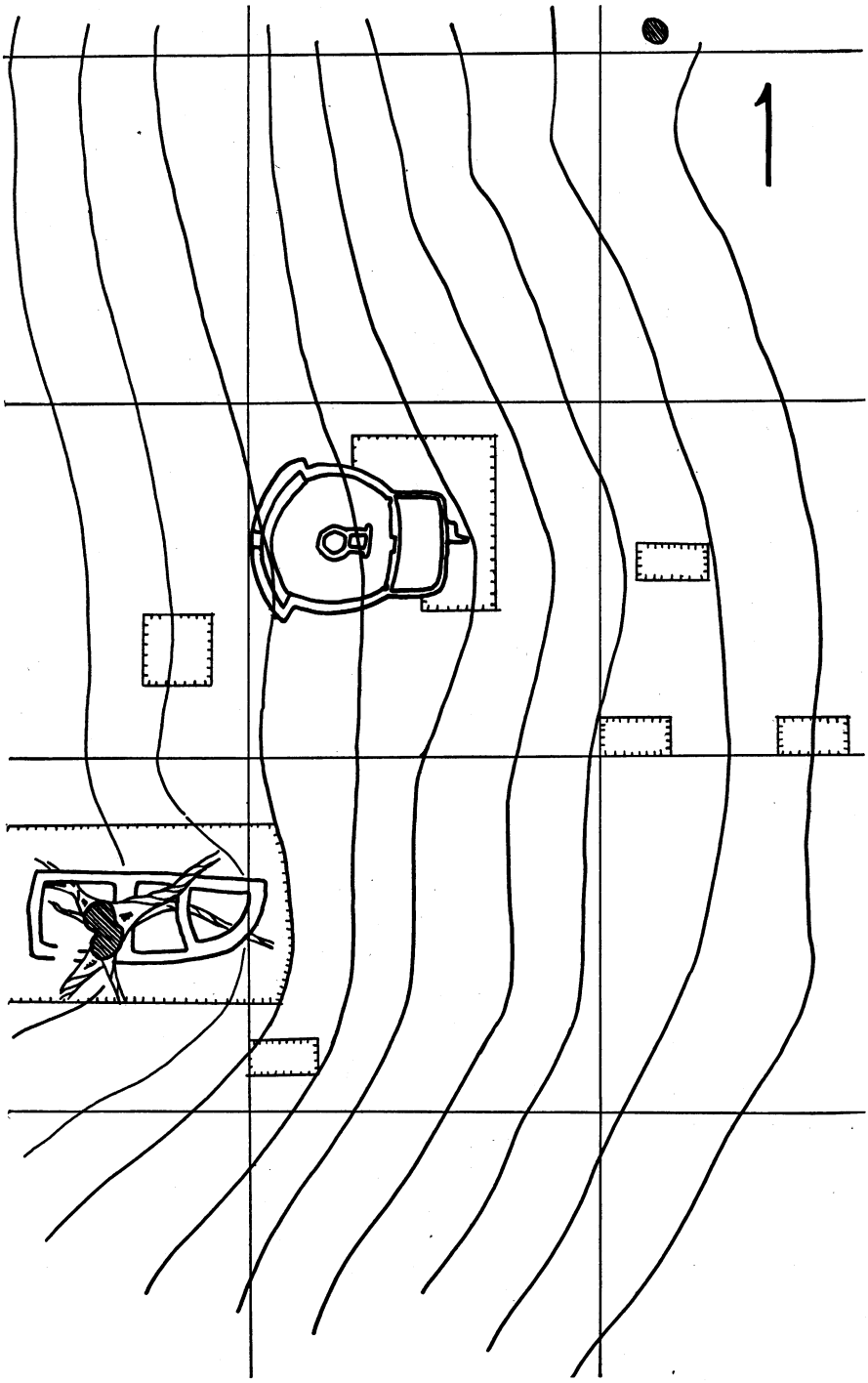


TABLE 7. In charts A, B, C, and D are shown the proportions in the stratigraphic levels at Site RB 551 of certain design elements found on Pueblo II black-on-white pottery types. The percentages shown for each are in proportion to the total amounts of identifiable Pueblo II black-on-white sherds (exclusive of Dogoszhi Black-on-white) from the stratigraphic levels indicated. A, sherds with pendent dots; B, sherds with paneled bands; C, sherds with solid-element borders; D, sherds with broad-line Sosi-style decoration. In chart E are shown the proportions of sherds displaying these same decorative elements from: (1), Site RB 564 (all sherds considered together); (2), Site RB 551 (rooms 2, 3, 4, and 5 and kiva, taken together); (3), Site RB 551 (five uppermost levels in the stratigraphic trench, combined); (4), Site RB 551 (three lowest levels in the stratigraphic trench, combined). In chart F are shown the proportions of sherds of Tusayan Corrugated having coils of different widths in relation to the entire amount of Tusayan Corrugated at Sites RB 551 and RB 564. Each width group is indicated on the chart in millimeters.



MAP 5. Site RB 1008. Plan showing surface structure, subsurface room, and test excavation. Contour interval is 5 feet, the slope being downward toward the east.

low brush. There are extensive evidences of recent wind erosion, and the site was littered with blown-out juniper roots. Piñon trees occur only at the lower margin of the dune, where there is more cover and presumably some water seepage. Before excavation the only visible architectural remains were a row of upright slabs, which proved to be the remains of the east wall of a subsurface structure.

The sherd-strewn area was divided into twelve plots; careful pottery collections were made which totaled 1,300 sherds. Test trenches were then dug at various points (see ticked areas on map 5), several of them to a depth of five feet, but occupational earth was found little deeper than eight inches in any spot explored. The

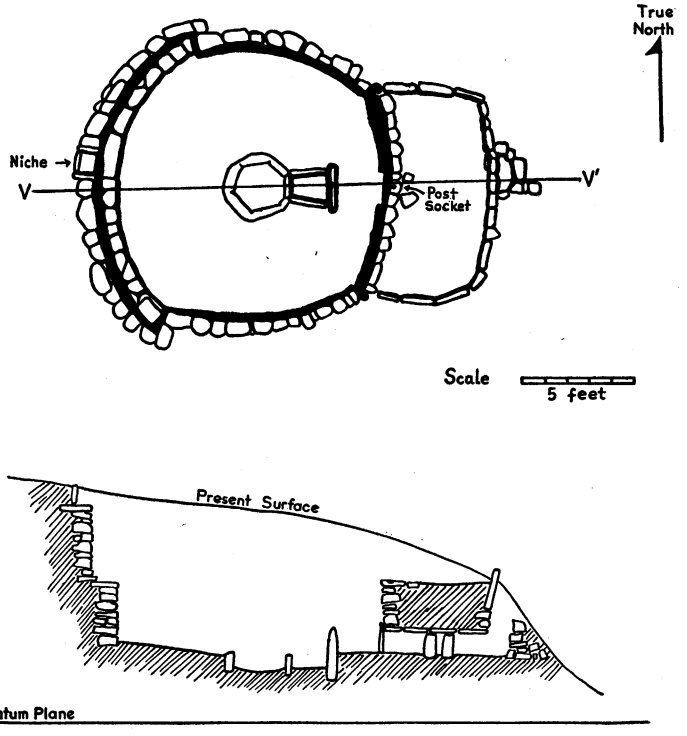


Fig. 13. Site RB 1008. Plan and east-west cross section of the subsurface room.

hypothesis is advanced, borne out also by other evidence, that the surface has been eroded by wind to a considerable depth since occupation. The rubbish pile lay chiefly on the area to the south of the subterranean room and east of the surface structure, and the sherds were concentrated there as erosion proceeded. This situation, common on sand-dune sites, is helpful in surface surveying, but makes stratigraphic work impossible.

The architecture consisted of a subsurface room and a group of three surface rooms. In surface rooms, upright stone slabs were used to form the bases of the walls; in the subterranean room, however, they were used only for the backing walls of the east bench.

The subterranean structure (fig. 13) was of a roughly circular shape commonly found in this area, and the masonry is of the "Kayenta" type[49] with the exception of the upright slabs, which have usually been considered characteristic of an earlier

[49] Kidder, 1924, pl. 20c.

period of Developmental Pueblo in this area.[50] Between the deflector and fireplace was a stone-lined trough which compares closely with some described by Roberts at Kiatuthlanna,[51] which he believes to be troughs for notched log ladders. The floor was of compacted sand, as was the surface of the east bench. The west bench was slab-topped. The east-west orientation of this room was in accord with others in the region. An interesting feature of the ventilator tunnel was the placing therein of two stone slabs, each contiguous to a side of the shaft and extending transversely part way across it, leaving a narrow, crooked air passage between them. The tunnel was topped by a series of stone slab lintels. There was a small niche in the west wall at the present surface level. No sipapu was found (fig. 13).

No evidence of the method of roofing and no postholes were found. The beams may possibly have been taken for use elsewhere. The room fill was of wind-blown sand with a faint layer of powdered charcoal over the benches and floor. The lower or eastern side of the room was probably enclosed by a wall which projected above ground level, for a considerable quantity of fallen stone lay down the hill from it. If it was walled, it may well have been banked with earth, or possibly by a rubbish pile, all of which has disappeared except for masses of sherds lying in the sand below the eastern extremity of the structure. Flanking the east bench, where it joins the main walls of the room, were two grooves running vertically the height of the wall. They were about four inches in width, very similar to the wall grooves in room P, Site RB 568 (fig. 17; pl. 20, *b*). These grooves, like those at Site RB 568, seemed too small to have held supports for a timber-and-mud roof, and their purpose is problematical. The room seemed certainly to have had stone walls to its full height, and posts set in the walls would not have been needed in such a structure. An additional feature was a depression ground into the surface of one of the slabs paving the east bench just above the opening of the ventilator. This depression may have been used for the anchoring of a roof post at this point.

The use to which rooms of this type were put has long been a subject of controversy among Southwestern archaeologists. Finds in this room suggested that it was used for both utilitarian and ceremonial purposes. On the south end of the west bench was found a metate, very evidently left there at the time of abandonment. In the so-called "ladder box" were found two fragments of a figurine bowl, No. RB 1008–10 (a reconstruction is shown in fig. 71, *b*). Bowls of this type are usually considered to be ceremonial vessels. Besides this bowl, a few other sherds and a few stone tools and bone awls were found on the floor.

The three-room surface structure showed several differences in construction from the underground room (fig. 14). The floors were slab-paved, in contrast with the earth flooring in the subterranean room. The masonry was different in appearance; instead of small, thin slabs, large squarish stones were used, many of which weighed more than a hundred pounds. The wall was begun by setting massive stones on edge. The uneven profile of the tops of these stones was leveled by the use of small irregular stones, and the upper part of the walls was made of heavy blocks in very haphazard coursing with many stone spalls of widely varying sizes and shapes. A dozen or so pottery spalls, which were of types characteristic of the general period of the site, were also found in the walls.

It is believed that the marked differences between these two structures is due to the difference of materials used in their building rather than to any temporal or cultural differences between their builders, although this is not completely proved by the evidence. Pueblo II and early Pueblo III ruins in this area normally consist

[50] Kidder and Guernsey, pp. 42–44; Guernsey, 1931, pp. 28, 30.

[51] Roberts, 1931, pp. 20–21, 22. Also comparison may be made with the corresponding trough in the kiva at Site RB 551 (see p. 52).

of a row of surface rooms with a sunken room in the near vicinity. It thus seems likely that the two structures were occupied by the same people at the same time. The pottery types found were all of the same period. On the other hand, the thin sandstone slabs of the subsurface room came from the Wingate formation, whereas the sandy limestone blocks of the surface structure came from the top of the Chinle formation. The contact between these two formations was exposed at about the level of the site at the south edge of the dune, about one hundred and fifty yards away. The sandy limestone pieces showed but slight lamination. They seemed to have been taken from the exposed surface of the bed; their corners have been heavily rounded by weathering. The stone itself, as well as its manner of use in the surface structure, was somewhat similar to that in Site RB 551 (pl. 6, *a*) on Black Mesa and was

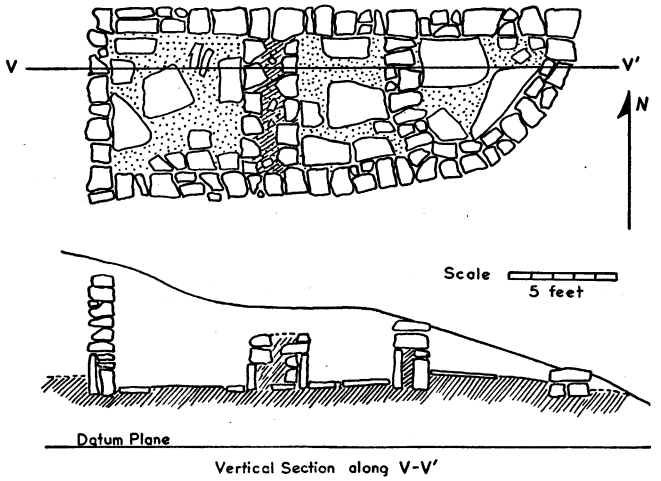


Fig. 14. Site RB 1008. Plan and east-west cross section of the surface structure.

markedly different from the "Kayenta type" as described by Kidder and others,[52] whereas the masonry of the subterranean room fits the Kayenta type.

Changes in the level of the sand dune were clearly apparent at the surface structure. A large juniper tree was growing immediately atop the house. Thick dead roots six inches above the modern ground level attested to the recent wind erosion mentioned above. On the ground level around the trunk of the tree lay scattered stone blocks from the exposed parts of the walls. Below the modern ground level was about two feet of sterile wind-blown sand, below that another jumbled mass of fallen rock, lying at what must have been the level at the time of building. The trunk of the juniper tree extended nearly to the floor, and there were many dead roots at that level. Thus, since the beginning of the collapse of the building, the dune level has risen more than five feet, then dropped back one foot.

Site RB 568

One of the most important elements in the chronology of the region, and one that heretofore has remained almost uninvestigated, was the early to middle Pueblo III horizon. Since the final phases of Pueblo III were moderately well known, represented by the great cliff ruins in the Tsegi which were occupied just prior to the abandonment of the region near the end of the thirteenth century,[53] one major

[52] Kidder, 1924, pl. 20, *c*.
[53] Fewkes, 1911; Judd; Kidder and Guernsey; Hargrave, 1935*a*.

objective of the Expedition was to investigate the transitional period immediately prior thereto.

As an example of this period, Site RB 568 was selected for a number of reasons. It appeared to be a large and rich site, and its extensive architectural remains were in the open, a fact that distinguished it from the much better-known cave ruins. Moreover, the discovery of an extensive burial ground gave promise of providing material for a comprehensive pottery study. Work was commenced on the burial ground in 1935, for the sand dune in which the burials were situated was moving under the strong wind action of the region and skeletons and artifacts were being continually exposed and scattered. Excavation of burials was continued each season through 1938. During 1937 the major part of the season was spent in the excavation of the architecture. The excavation of Site RB 568 was directed by George W. Brainerd.

Site RB 568 is situated outside the Tsegi drainage system, about seven miles northwest of Kayenta, in the relatively broad canyon of Kaycuddie Wash, an intermittent stream flowing east and south from Skeleton Mesa and debouching into Laguna Creek at a point about halfway between Marsh Pass and Kayenta (map 1). The architectural remains and the burial ground were excavated as separate projects, and presented different problems. They will, therefore, be considered independently.

BURIAL GROUND

The burial ground was situated in a sand dune which fills a depression in the Navajo sandstone immediately southeast of Kaycuddie Canyon (pl. 12, *a;* map 7). The sandstone underlying this area forms a gully among a group of sandstone buttes, draining into Kaycuddie Canyon. The total area drained by this gully is perhaps a square mile. After the initial erosion of this wide, shallow gully, a large linear sand dune drifted in from the west, and at present is several hundred yards long and eight to ten feet high. There is no surface drainage of water through the burial ground even after several days of heavy rains. Seemingly the water is all either absorbed into the surface of the sandstone that floors the country, evaporated from the surface, or absorbed into the large covering dunes. In dry summer weather the sand at the burial ground was never dry more than a foot below the surface, but standing water was never observed there.

The dune at present is practically bare of vegetation and is very active under the strong prevailing wind, which is intensified here by a natural "funnel" formed by the surrounding rock masses. During the 1937 season about one hundred cubic yards of top sand overlying the burial ground was removed from this dune and piled on the bare rock. The next summer the piles thus formed had completely disappeared, and the upper five feet of the long dune, the contour of which had been disturbed, were also blown away. A wagon track that provided access by automobiles to the site was also affected by wind. During one winter a deposit of sand, about four feet deep, blew across one hundred and fifty feet of the road, necessitating the construction of a brush runway the next season.

Sand dunes existed here at the time of occupation of the site. Perhaps their growth necessitated its final abandonment and the abandonment of several other large contemporaneous sites in the vicinity. The occupation of these sites apparently preceded that of the large cliff dwellings in the Tsegi, and conceivably the people moved from this area into the deep and sheltered canyon as conditions became worse during the great drought of the late thirteenth century.

It is quite possible that crops may have been raised by the inhabitants of Site RB 568 in the neighboring sand dunes as well as in the alluvial fill of Kaycuddie

Canyon. The modern Navajo and Hopi farm areas are not much different from this one. The secret seems to lie in the planting of seeds to a depth as great as eighteen inches. At this depth there is considerable water in sand dunes like those encountered at Site RB 568. This site is at present included in an experimental area reserved from grazing, and the ecologic changes now taking place may give clues to conditions at the time of occupation.[54]

When the burial ground was first investigated by the Expedition, several burials had been exposed by the movement of the dune. In the course of the 1935 season eleven burials were recorded and removed, seven of them being partly exposed when found. There is evidence, through scattered bones and sherds, that a considerable number of burials had been scattered previous to that time. In the summer of 1936 twenty-one burials were removed, in 1937 eight burials, and in 1938 ten burials, a total of fifty.

The skeletal material from these burials was very fragile as the result of soil moisture, leaving the bones with a rough fibrous surface. The bones were dried in place in the ground after clearing, usually under a sunshade, for too rapid surface drying invariably caused heavy warping and cracking. After drying for a day or so they were cleaned and packed. The more fragile bones were coated with dilute ambroid while in position or immediately upon removal; the rest were coated later at the laboratory, and all bones were labeled. A series of over thirty skeletons resulted, the rest being too far decayed for use. (For methods of excavation and important burials see plates 15 to 18).

The skeletal series has not yet been studied, and at present it is stored at the University of California, Los Angeles. No systematic work was done in the field on the age and sex of burials.

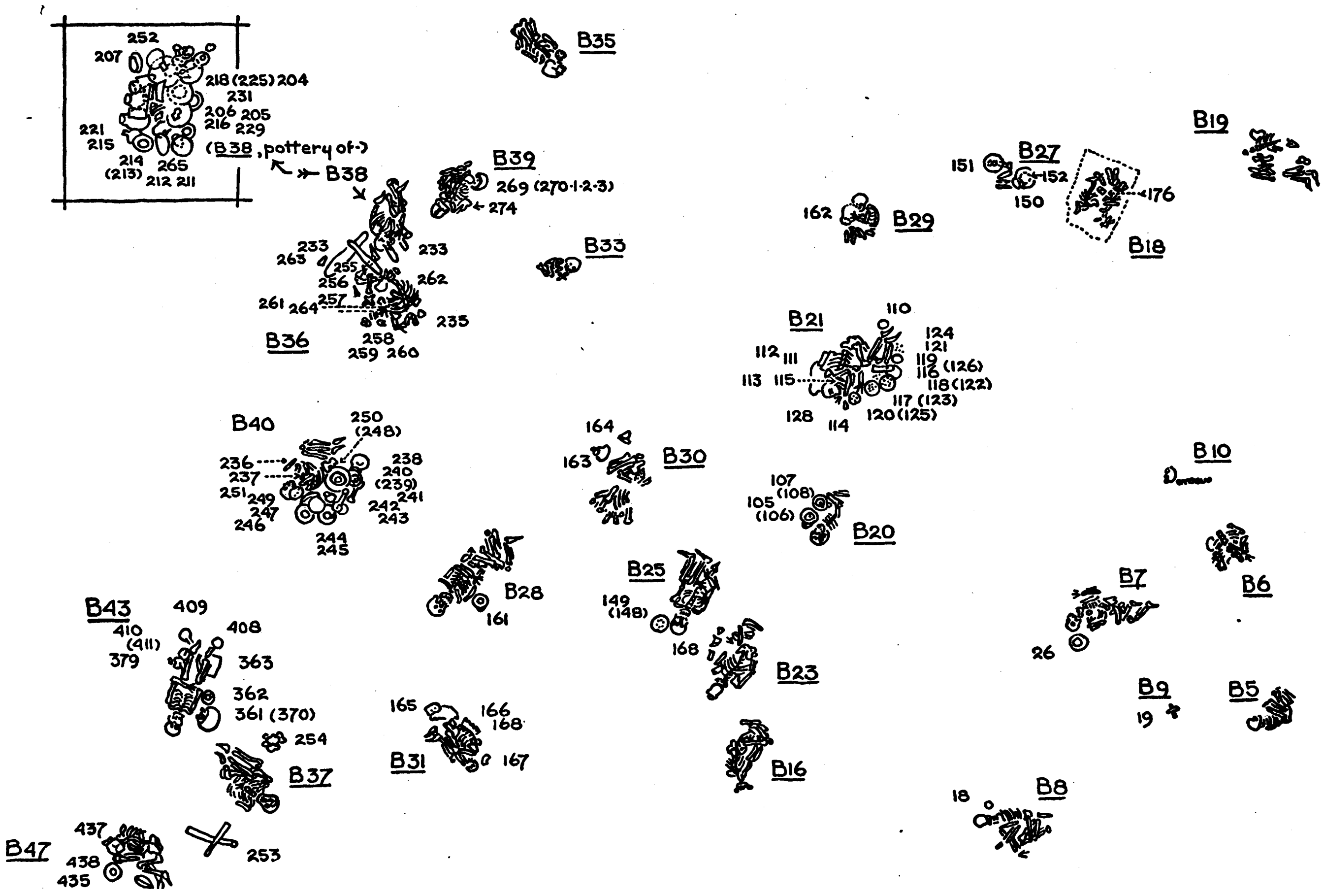
Mortuary gifts.—The mortuary gifts left in the burials were particularly rich. Several yielded as many as fifty objects (pl. 14, *a;* pls. 15–18). The site catalogue totals over five hundred entries, many of which include several similar pieces found together. The materials were mapped in position, measured, described, drawn, and photographed. Their bulk precludes complete publication, but all data are on file at the University of California, Los Angeles. A generalized map (map 6) shows their provenience. The finds are summarized on page 76.

In addition to these objects, about 4,200 sherds were recovered from the burial ground from which whole vessels or designs could not be reconstructed without prohibitive effort. These sherds were all taken to the laboratory and examined for unusual features. Percentage counts of them were used only when the data from whole vessels was considered insufficient (as it was for the gray ware). No stratigraphy could be determined in the sand dunes containing these sherds, as there was ample evidence of deep shifting of the sand.

Description of specimens.—The stone objects demonstrate well the difficulty of devising criteria for defining such objects made at different times and places. For example, many objects from Site RB 568 fit very nearly the descriptions of similar objects from Pecos.[55]

The characteristic arrowpoint was a long triangle with a flat or slightly concave base. The chipping was very delicate, the point light and thin. The length of the longer points was nearly constant at 45 mm. Some shorter points ranged between 20 and 30 mm. The material was a red-brown chalcedony or a very fine-grained quartzite. One of the points still shows traces of the haft, which was notched, and into which the point was set 8 mm. A front scraper, a longer spear or knife point of a blue-and-yellow veined chalcedony, and several other types were found (pl. 13, *b*).

[54] Hack, 1942. [55] Kidder, 1932.



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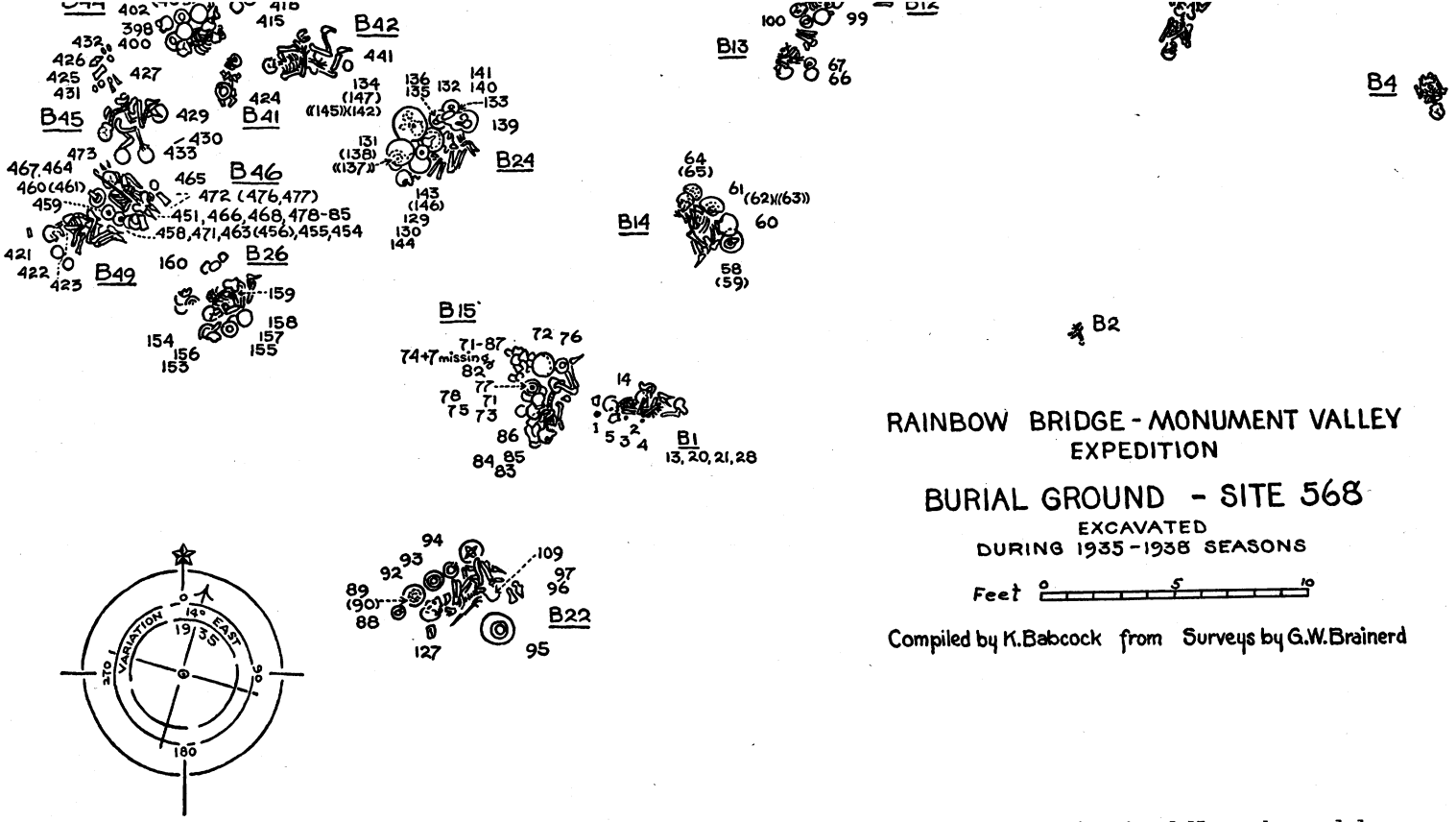


MAP 6. Site 568. Map of burial ground, showing orientation of each burial, and position of mortuary offerings found. Numerals preceded by the letter "B" indicate burial numbers; other numerals indicate field-catalogue numbers of accompanying objects.

Several pierced turquoise pendants were found, a string of some eighty cylindrical turquoise beads, and a turquoise mosaic pendant consisting of seventeen small oblong "tiles" backed by a perforated wooden plate 18 by 15 by 2 mm.

Red mudstone pendants were also found similar to those from Site RB 551 (pl. 13, *d*), as were a wristlet and a necklace of red and black stone beads, strung with occasional turquoise beads. Plate 13, *a* shows a mass of the beads from one of these strings. The two strings were unfortunately too badly disturbed in the sand to permit any reconstruction except for the fact that the red and black beads were

SUMMARY

	Number	Total	Percentage
Pottery Vessels			
Orange ware	127		
Gray ware	57		
White ware	87	271*	50
Other Clay Objects			
Reworked sherds	9		
Miscellaneous clay objects	7	16	2.9
Stone Objects			
Chipped implements: points, knives, scrapers	37		
Bead collections, pendants, rings, etc.	14		
Grinding tools: metates, manos, mortars, pestles	50		
Hammers and axes	19		
Fleshers	2		
Objects shaped from lamellar calcite	4		
Polishing pebbles	12		
Arrow-shaft polisher	1		
Large ovoid boulders	2		
Mineral specimens	19	160	29.5
Bone Objects			
Awls and needles	28		
Whistles	2		
Fleshers	3		
Bead	1		
Unworked bone	3	37	6.8
Shell Objects			
Bead collections	14	14	2.5
Vegetable Substances			
Food material	13		
Wood and charcoal	19		
Fabrics	12	44	8
Grand total		542	

* Of this number, 210 could be restored.

strung on separate strands. The beads were discoidal and averaged 0.8 mm. in thickness and 1.5 mm. in diameter. The two collections, found in separate burials, total about 100,000 beads. The method of manufacture appeared to be similar to that used for beads described from the Swarts ruin in New Mexico.[56] A part of a finger ring ground from hematite was also found.

The manos are illustrated in figure 15. Several metates were also found of types I, II, and III as illustrated in that figure.

Characteristic hammers, hoes, and axes are shown in figure 16. The hoes were crudely made of either lime- or iron-cemented standstone with full grooves for hafting (fig. 16, *i, g*). The hafted hammers (fig. 16, *e, h, m*) were made of a heavy,

[56] Cosgrove, pp. 62–64, fig. 12, pls. 69, 70.

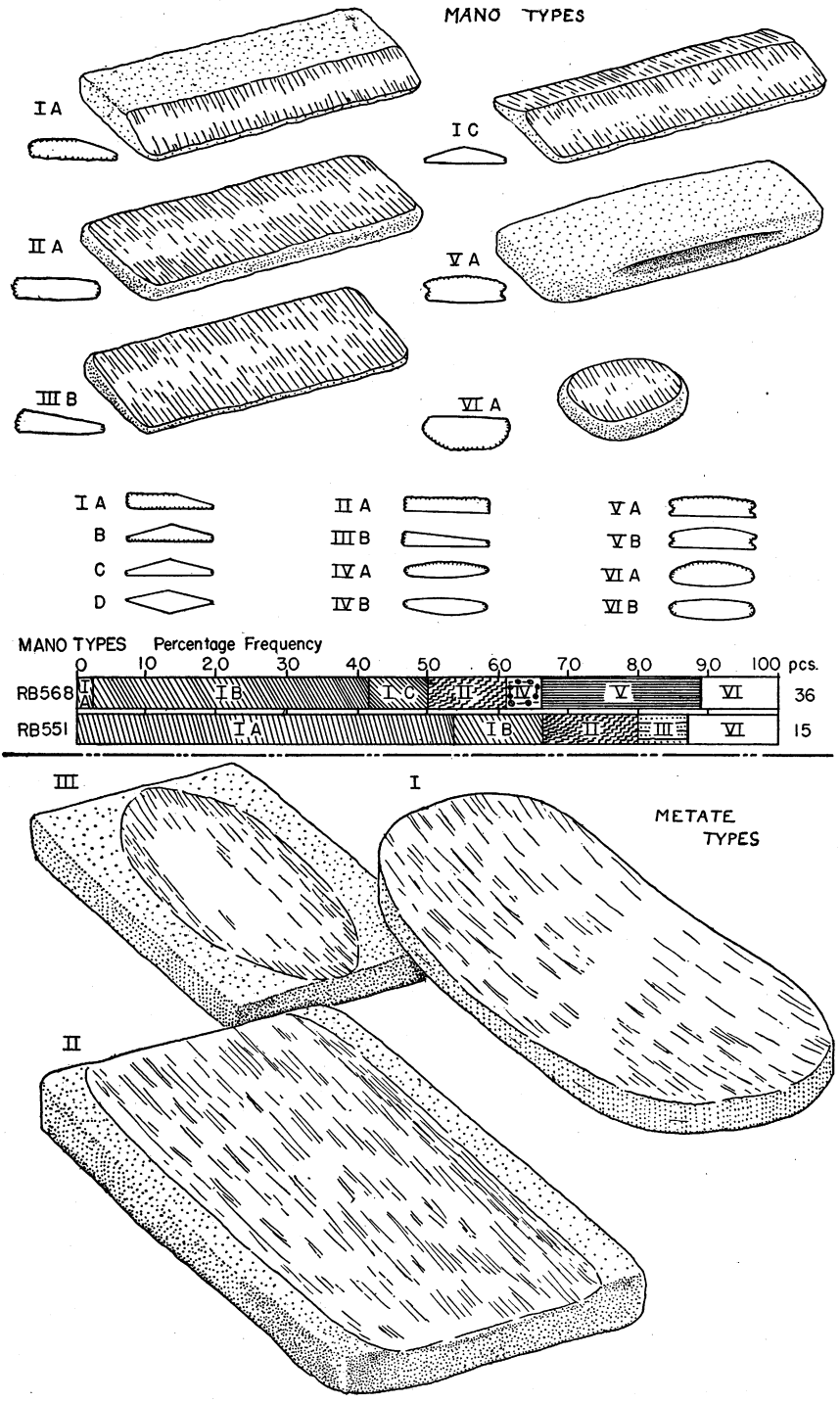


Fig. 15. Diagrammatic classification of the types of manos and metates found at Sites RB 551 and RB 568. In the sketches of mano cross sections, unshaded lines indicate grinding surfaces.

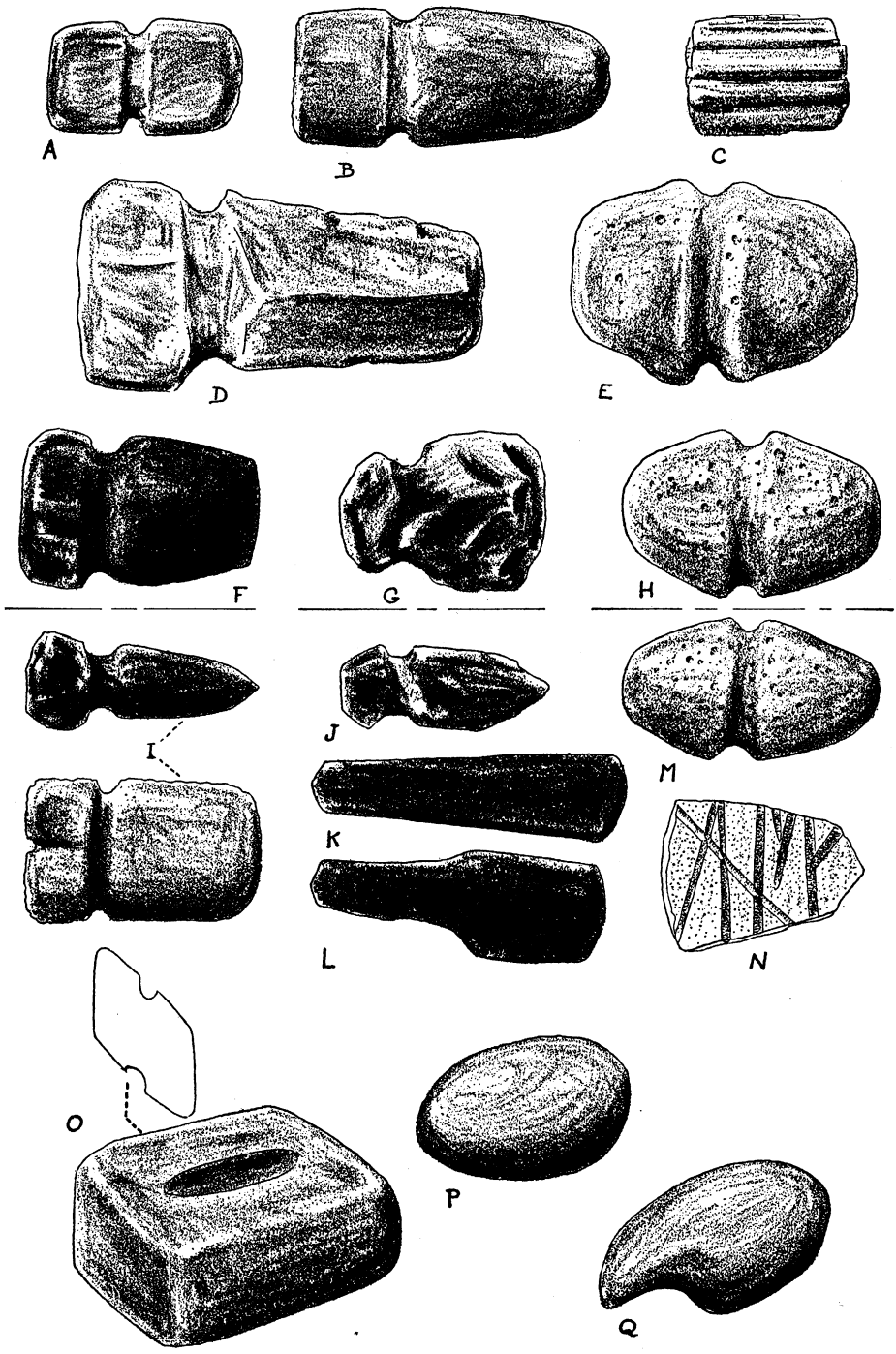


Fig. 16. Site RB 568. Hammers, axes, and miscellaneous stone objects found in various burials. (See text for particulars.)

light-colored sandstone. The Navajos still prize this stone for manos and say that it is brought in from somewhere near Navajo Mountain. These pieces show a characteristic ridge at each side of the hafting groove. The axes were made of a dark gray, fine-grained volcanic rock. They were full-grooved (fig. 16, *a, b, d, f*). The use of the object shown in figure 16, *c* is unknown. It was of gray sandstone, 120 by 95 by 57 mm., grooved along the two largest faces.[57]

The fleshers or chisels (fig. 16, *j–l*) are sharp on one end, and one well-preserved example shows a mirrorlike polish. They are made of a dark volcanic rock of granular texture with large platy inclusions that have weathered out on two of the specimens.

There are three objects shaped from a cloudy calcite (?) that shows laminations. One is an animal figurine, another is a sphere the size of a marble, and the third is a flat disk with a hole in the center.

Many polishing pebbles of chalcedony were found. Most of these are in their natural shape, beautifully polished. Two found together (fig. 16, *p, q*) are of a shape that would allow them to be gripped firmly by the thumb and two fingers, leaving a nearly flat working surface.

One sandstone fragment was found that could have been used for smoothing cylindrical wooden shafts (fig. 16, *n*).

Two smooth ovoid boulders were found (*ca.* 150 by 120 by 60 mm.). Kidder suggests that stones of this sort may have been used to smooth plaster.[58]

Several bowls containing limonite, pyrolucite, or malachite were found. The limonite and pyrolucite are in massive lumps and look like material from near-by deposits. The malachite is of the very sandy variety occurring near the Colorado River one hundred miles west of the site. Two "rolls" of pyrolucite were found. This ore occurs as a soft earth near Marsh Pass below the rim of Black Mesa. The fine-grained, pure earth seems to have been rolled between the hands, perhaps using a mucilaginous binder, into crude cylinders about 20 by 100 mm.

Several pounds of a very fine-grained white clay were found. This clay was buried in its original condition; it had not been mixed with water or molded. The ceramic properties of this clay are ideal for pottery decoration because of its extreme opacity when painted in a thin slip.

Two unfired four-color polychrome bowls (No. RB 568–28) were found crushed in burial 1, together with lumps of paint, large-grained white sand, smoothing pebbles and other pottery-making tools.

There is little bone found in refuse piles at ruins in the Kayenta area. This fact suggests that the bone must have been mostly imported. The Kayenta area supports few large animals at present; conditions probably were similar during the period of its heavy population.

The bone implements recovered from Site RB 568 show no scratches such as are made by flint tools. Although weathering has destroyed the surfaces of many of them, its agency alone is hardly sufficient to explain the absence of flint scratches. The alternative explanation is that the shaping of bone objects was carried on almost entirely through abrasion by sandstone.

The majority of bone implements found at Site RB 568 were made from deer cannon bones. The steps of the process used seem to have been much the same as those used at Pecos.[59] The first step was often the longitudinal splitting of the bone. This seems to have been begun by the sawing of grooves in the centers of the an-

[57] Identification of these materials is by Professor Cordell Durrell, Department of Geology, University of California, Los Angeles.

[58] Kidder, 1932, pp. 64–65; fig. 41.

[59] *Ibid.*, p. 200.

terior and posterior faces of the bones (see pl. 14, *b*). These grooves may well have been sawed by sandstone files,[60] although no such implements were found at this site. After the sawing of deep grooves through the shaft, the bone was split longitudinally, forming splints, which may themselves have been used as tools. These slivers, however, were usually further worked into pointed implements, sometimes after being sawed or broken transversely. Bones, other than deer metapodials, were usually not split longitudinally, but rubbed directly to the final shape.

Several smaller pointed tools were found made of rabbit tibiae, bird femurs, and the ribs of small mammals. None of them had pierced eyelets. There were also a few pointed tools worked from slivers of cracked long bones. Two whistles were found; each consisted of a section of bird ulna with a notch sawed transversely part way along the bone. When blown like a flute (across the notch) they give clear loud whistle tones. Other sections of bird ulnae found are very similar to modern "turkey calls."[61]

Several nearly identical tools were found which may be called "fleshers." They were made from deer humeri, with the distal epiphysis forming the handle of the tool. The proximal epiphysis of each has been removed, and the flaring proximal edge of the shaft worked into a smooth, round edge. The shape of the edge is so similar to that of the stone tools shown in figure 16 that they may well have been used for the same purpose.

Three mink or weasel skulls were found, complete with lower jaws. Unfortunately, laboratory identifications of these or of the rest of the bone material have not yet been made. They seem to belong to genus *Mustela*. Tarsal and carpal bones and organic material were found associated with these skulls in such a manner as to indicate that the bones, when placed in the burial, had been left in the pelts. For a considerable time fox pelts have been used by the Hopi as a part of dance costumes.[62] These mink or weasel pelts may have been similarly used. In another burial the skeleton of a turkey was buried beside a man. The bones as well as the crop stones were found in place.

Numerous shell beads were discovered, some in place in a burial in the form of a bracelet. The shells are all similar, elongated gastropods, genus *Olivella*, averaging about 10 mm. in length, pierced and strung longitudinally. They have not been further identified.

Seventeen wood and charcoal specimens, most of them juniper, were taken from the remains of wooden roofs which had been placed over bodies at the time of burial. Unfortunately, they have yielded no dates.

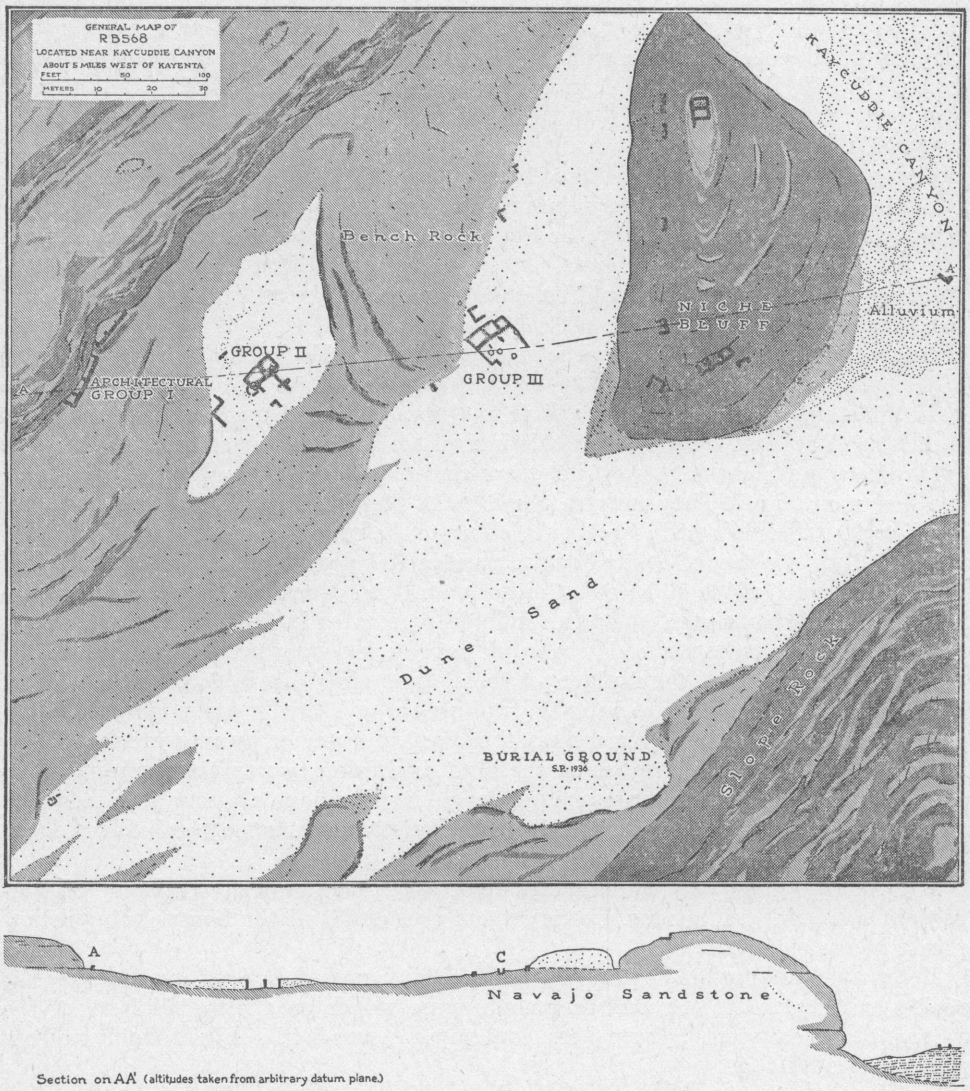
Organic materials from this site are discussed by Volney H. Jones in Appendix II. During the last season's excavations several fabric fragments were found which have not yet been studied.

ARCHITECTURE

The architectural remains at Site RB 568 were extensive but in a very poor state of preservation. In places they were covered with sand to a depth of 10 feet (map 7; pl. 19, *b*). Six weeks of the 1937 season were spent in excavating a sufficient portion of them to establish the relation of the architecture with the burial ground. Three major groups were examined, indicated on map 7 as I, II, and III. Group I was a line of rooms built snugly against the bluff at the west and, in some places, overhung by it. Some rooms were large enough for living quarters, others were probably used as granaries. Enough rooms were cleared to show a characteristic heavily spalled, sandstone-slab masonry. No fire pits were found in the two floors cleared.

[60] *Ibid.*, p. 82; fig. 58.
[61] Stephen, see Index, p. 1410, under "whistle, turkey bone."
[62] Stephen, see Index, p. 1355, under "foxskin."

The main village apparently centered on a rock ledge flanked by bluffs to the east and west, and by steeply rising rock behind. Thus the exposure was to the south, well protected from the prevailing southwest winds that blow heavily through the small pass in which the burial ground is situated.



MAP 7. Site RB 568. General map of the site, showing locations of the burial ground, the several groups of masonry structures, and the principal geologic features.

In this natural amphitheater most of the rock surface was bare at the time of excavation. In areas now without other evidence of building were numerous shallow depressions, apparently made to level the bedrock for the floors of rooms, or to anchor walls built upon sloping rock surfaces. This evidence indicates most of the rock was once built upon. Additional evidence is provided by groups of regularly spaced small holes in the bedrock. Similar holes are characteristic of cliff dwellings in this area, and are known as "loom holes" on the supposition that they were used

to hold down the lower beam of a loom. There is also a carefully ground cylindrical "pot hole" in the ledge near group III.

The Navajo sandstone on which this site is located weathers rapidly, the iron cement leaching out until large solid-appearing building stones will powder to sand when stamped upon with a boot. Although there was not much loose building stone on the surface when the site was first explored, it is quite possible, in view of the foregoing evidence, that a considerable part of the area (between architectural groups II and III for example) was once covered with rooms. The fact that all wall fragments found in groups II and III are oriented uniformly bears out this hypothesis. It is also probable that digging under the dune covering group III would expose many more rooms than have been excavated. Although it is at present impossible to determine accurately the original size of the village, an estimate of one hundred rooms is more likely to be low than high. The walls dug gave no suggestion of a structure of more than one story, nor of an integrated town plan; a constant orientation of rooms would be expected even in the addition of single rooms to a standing structure. There was also no evidence of the placing of contiguous rooms in alignments, as was characteristic in the Pueblo I, II, and early III sites of this region.

In addition to these areas, the bluff to the east showed unusual features characteristic of at least three sites of this immediate area and time period. There was evidence of ten niches cut into the steep sandstone slope of the bluff. Six of these are shown on map 7. They ranged from 6 to 13 feet in length, 2 to 4 feet in width, and 6 to 36 inches in depth. Footholds led up to the ends of some of them, and there was usually a roughened area of rock a yard or so below them on the slope. Two of them had groups of "loom holes" at either end. It is suggested that these niches are the remains of rooms perched on the cliffside, supported in front by a stiltlike wall. The ground below the niche shown in plate 19, *a* was strewn with rock fragments which had fallen from their place on the sloping cliff face in front of the niche. Such rooms occur elsewhere in cave dwellings dated shortly after this site.[63] The rooms at Site RB 568, however, were in the open, unprotected by an overhang. There were also several surface rooms on the bluff, including two on the summit, which rises fifty feet above the main ground level of the village and one hundred feet above the floor of the neighboring canyon. These two rooms may well have served as a lookout.

It is hard to guess why the inhabitants of the village built rooms in such inconvenient and windy locations. Pottery from the bluff and the houses below is apparently contemporaneous.

Below the bluff, on the floor of Kaycuddie Canyon, were several rooms under the rock overhang, and more wall fragments were visible on the higher level of the valley fill. These seem to have been contemporaneous with, and probably were a part of, Site RB 568.

Account of structures[64] *excavated.*—In architectural group II, rooms P and Q are of special interest. The floors of both were nearly on bedrock, and seem to have been sunk in a sand-filled depression. Their adjoining walls were built separately with about a foot of sand between them, which suggests that they were not built at the same time. Room S seems to have preceded room Q in construction, since the corner ventilator in room Q appears to have been located in a position made necessary by the existence of room S.

The walls of room P were plastered in sandy brown mud. The circular fire pit was cut from bedrock. The ventilator had two openings into the room, below and above

[63] Judd, pp. 48, 49, 51, pls. 9 *b*, 16 *b*. [64] See fig. 17.

a stone set into the ventilator (pl. 20, *b*). The use of the grooves in the side walls of room P is not clear. They may be comparable to the grooves in room 1 at Site RB 1008 (see fig. 13). The most obvious use would be as roof supports, but this probability is doubtful by reason of their small width of only four inches. A secondary occupation layer, marked by Pueblo III sherds and ashes, occurred fourteen inches above the floor. Room Q contained the burial of a child, resting in sand above the floor level and probably interred after abandonment of the room.

The masonry in this group was rather haphazard. The north wall of room S was solidly made of large slabs. The walls of P and Q were of small slabs, heavily spalled (pl. 21, *b*). Considerable mud mortar had probably leached out of these walls, lying as they did in very porous sand. The earth floors seem to have contained a little clay which must have been carried in to make the floor more smooth and solid. The outlying wall fragments had no mortar or spalls remaining, and ended in jumbles of stone. Enough loose stone was found in rooms P and Q to indicate that the walls extended to a height of 6 or 7 feet. No traces of roof materials were found, except one small beam (RB 568–197) that was undatable.

The architecture of group III (fig. 17; pl. 20, *a*) was very poorly preserved. In spite of long-continued and meticulous work, no certain wall lines could be found in areas E, F, G, K, and L, although the large quantity of rock strewn over the area suggested that walls must once have existed.

Rooms C and J (pl. 20, *a*) had adobe walls containing a few sandstone fragments. About half the wall adjoining area F was composed of large sandstone slabs, the remainder of adobe. No evidence of brick was found; the walls appear to have been built by a stamping or puddling method such as was used at Casa Grande.[65] The procedure in building such a wall was probably as follows: clay, sand, and water were mixed to as heavy a consistency as was possible to work, then laid, and modeled into a continuous strip the width of the wall, and of a height low enough so that the wall did not spread of its own weight. The consolidation of the clay was aided by tamping the top surface with hands, tools, or feet. The next layer was laid after a short interval had been allowed for the lower layer to "set up."

Rooms C and J each showed three or four floors each—closely superposed floors made of well-consolidated clay. The lowest floor of each room was partly composed of bedrock carefully cut down to level and smoothed. The northeast end of room J was formed of a rock niche, much like those above it on the bluff.

About five feet north of the north corner of room H (fig. 17), an ash lens extended downward through soft sand from a level at least a foot above the floor. At the level of its top, the whole area of group III was covered with irregular broken rock. Considerable charcoal and ash, irregularly distributed, was also found at this level, as well as a group of stones showing ax-sharpening grooves. The stones, showing signs of having been originally used for building, were lying at all angles, with the markings up (pl. 21, *a*). Thus, it is evident that axes were sharpened on them after the house had fallen and that this group of rooms was in ruins before the site was completely abandoned.

It will be noted that the clearly defined rooms in this group had no fireplaces, but that there were two fire pits in the other areas. It is possible that at least a part of this undifferentiated area was an open-sided shelter, although no postholes were found for roof supports. Plate 22, *a* shows a clay-rimmed pit built against the north wall of area L in architectural group III. A black-on-white olla (No. RB 568–187) filled with a clean white sand not characteristic of the area was found in a stone-lined box in group III (pl. 22, *b*).

[65] Pinckley, quoted in Gladwin, 1927, p. 9.

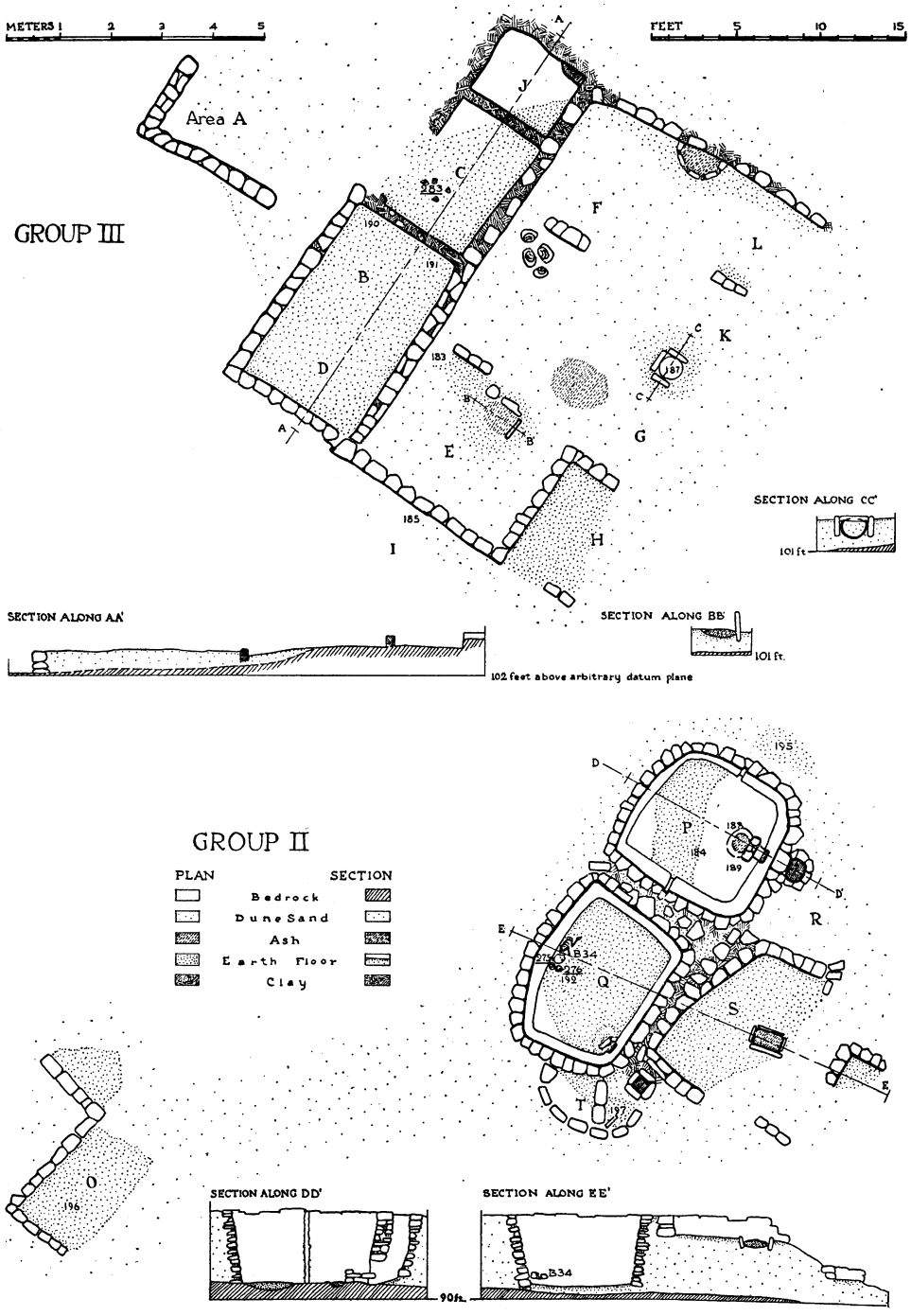


Fig. 17. Site RB 568. Plans and elevations of architectural groups II and III. Numerals preceded by "B" indicate burials; underlined numerals indicate the field-catalogue numbers of pottery vessels; ordinary numerals indicate elevations above the arbitrary datum plane.

Masonry.—The masonry of this site was very casually laid up. According to Roys's proposed classification,[66] it is classified as "indeterminate combination of stone and mud" with some of the walls falling in the neighboring classifications to either side. Both "true bearing spalls" and "false spalls" were used. Bonded walls of the same room were often dissimilar, one being built of larger, better slabs with smaller quantities of mud and fewer spalls than another. When thin, flat slabs were used, less mortar was used and often no spalls. False spalls were used wherever a large mud mass might cause trouble through shrinkage. Whether they were inserted before or after the stone above them was placed is not clear. The size of the spalls varies in a continuous series from pebble size up to the normal size of a building block. In other words, the mason used any stones available with little selection or discarding of odd pieces. What imperfections there were, he filled with mud mortar. In room P, and perhaps in other rooms, plaster was used to cover the masonry. In room P an even surface was achieved by a profuse use of spalls and mud rather than by working straight faces on the building stones. The masonry corresponds closely with the Kayenta type as figured by Kidder.[67]

A comparison of the wall construction of this site with that of the Pueblo I, II, and early III sites excavated, demonstrates the fact that Site RB 568 showed a considerable divergence from the rather conservative series preceding it. In the first place, the only adobe walls found in our work occurred here; in addition, the stone masonry was poorer, utilizing smaller pieces which showed fewer signs of selection or of preliminary shaping. A closer parallel existed between the masonry and details of the subterranean room of Site RB 1008 and those of RB 568 (rooms P and Q) than in the masonry of the other sites excavated. It is unfortunate that we do not have data on the underground room of Site RB 564, since it is the excavated site closest to RB 568 in our chronological sequence. There were larger stones used in the surface rooms at Site RB 568 than in the subterranean rooms, a situation true even to a more marked degree at Site RB 1008. The use of smaller stone for walling sunken rooms is understandable, since only a facing rather than standing wall was needed, and large stone would only increase the amount of excavation necessary. Site RB 568 was the only site excavated by the Expedition where the loosely consolidated, only faintly stratified Navajo sandstone was used in building. The poor quality of this material may have had its effect on the masonry. The marked change in house arrangement, the increase in number of rooms compared with the earlier sites, the introduction of adobe walls, and rooms set into niches cut into the bedrock are the major architectural innovations demonstrated in Site RB 568.

CHRONOLOGY

Although the pottery chronology definitely places Site RB 568 in the middle of Pueblo III, geological forces have effectively invalidated stratigraphy throughout the architectural site. For the most part the sherds found have been deposited by moving sand into concentrated pockets containing impersonally and rigorously prepared random samples. Pottery taken from the rooms was segregated into three groups: (1) in the dune sand overlying the architecture; (2) among the fallen rock covering ruin floors; (3) at or just above the floor level of the rooms. Tabulations and comparisons of these collections by types and by the more closely drawn classifications evolved from the design study showed no significant differences. Comparisons of collections from the various areas of the extensive site and burial ground likewise proved the mass of material to be homogeneous.

Some examples of pottery obviously found in its original position were mislead-

[66] Roys, pp. 123–128. [67] Kidder, 1924, p. 20, *c*.

ing. Widely scattered on the floor of room O were fragments of a re-used portion of a large black-on-white olla. This large sherd, the edges of which had been ground smooth, as was commonly done on re-used sherds found in the burial ground, had very evidently been broken on the floor of the room before its abandonment. The design (fig. 24, *u*) is clearly a Pueblo II panel form, and nothing else comparable to it was found at Site RB 568. The implication is either that of an early dating for the room or of a family heirloom. The architecture itself, however, is typically Pueblo III, probably post-1200. Less than 1 per cent of the sherds found in excavating the architecture were classed as Pueblo II material. Moreover, sherds of ruled black-on-white pottery (Kayenta Black-on-white), which it is believed were made only during the latter part of the occupation, were found on or near the floors of several of the near-by rooms.

Six inches above the floor of room Q was found the burial of a child carefully covered with rocks. Two small pots accompanied the burial, a black-on-red jar (No. RB 568–275, fig. 61, *e*) and a Moenkopi Corrugated jar. The design on the black-on-red jar was of a character usually identified with Pueblo II. This jar, too, may have been an heirloom, although it is evident from other pottery of this site that Pueblo II black-on-red design in Dogoszhi style existed well into Pueblo III.

Study of the materials found in the fifty burials afforded no more indication of chronological sequence than did the architecture. This fact is not surprising. The number of objects found in a single burial is so small as practically to preclude a treatment on the basis of statistical frequencies, and only one or two "presence-absence" criteria are available for use as time determinants. The definite criteria for a chronological study of the period of occupancy of this site all involve changes in the decoration of black-on-white pottery. Whether "Tusayan framing" was used from the beginning of the occupation of this site it is impossible to say; its nearly universal presence on room floors suggests that it was. The distribution of fine parallel-line ruling, however, seems significant. It occurs in considerable proportion among sherds from the architecture of the site as well as in a considerable percentage of the miscellaneous sherds from the burial ground. Many of the burial-ground sherds were reconstructible into vessels. They must have come from burials blown out before excavation of the site, and were probably later in time than those excavated, since designs of this type are commonly found in the large cliff houses abandoned at the close of the thirteenth century. On the other hand, no line-ruled vessels were found among the seventy-five white-ware vessels definitely associated with the burials. Consequently, it seems possible that before RB 568 was abandoned the sand dune had grown in height, thus causing late burials to be placed at a higher level which has since blown out.

The absence in Site RB 568 of certain other characteristics present in the design of the black-on-white pottery found at Betatakin (see p. 123) establishes the end of occupation of Site RB 568 as preceding the last quarter of the thirteenth century when the major building period at Betatakin occurred. The absence of Tusayan serration from Site RB 564 and its use during all, or nearly all, of the occupation of Site RB 568 argues against the contemporaneity of occupation of these two sites during any of their time span. The virtual absence of Tusayan Polychrome at Site RB 551 and its presence in the lowest levels at Site RB 564 demonstrates an exceedingly slim overlap between these two sites. Thus the founding of Site RB 568 follows the construction date of the Site RB 551 kiva (1078 A.D) by the sum of nearly the whole occupation spans of Sites RB 551 and RB 564; 120 years does not seem to the authors a long estimate for this time span. If the estimates just given are allowed, Site RB 568 must have been occupied from about 1200 to 1275.

PAINTED POTTERY DESIGNS OF THE KAYENTA AREA

INTRODUCTION

SCOPE OF PROBLEM

The designs used on prehistoric pottery of the Kayenta region, though long admired, have been very little studied. Archaeological pottery studies in this area, as in most of the region occupied by the Basketmaker-Pueblo culture, have been limited to characteristics visible upon sherds, such as surface finish and color, rim form, line thickness and spacing, and the smallest of the so-called "design elements." Using these criteria, numerous descriptions of pottery types characteristic of various areas and time horizons have been published.

This method of classification has been highly successful in this area as well as in others in determining the general chronology of sites and, to a lesser extent, the trade relations which existed among them. Pottery fragments gathered from the surface of a small site are often sufficient for relative dating, thus allowing large numbers of sites to be surveyed rapidly and at slight trouble or expense. In the work of the Expedition the typology for the Kayenta area as given in Colton and Hargrave has been used as the basis for the dating of all the sites studied, and has proved invaluable.

Pottery typology on this basis is a simplification of the situation, justified because it facilitates the use of sherds as dating fossils. Properly applied, it permits an objective, statistical treatment of an unwieldy mass of material. But such a system cannot adequately deal with the close analysis of ceramic material, nor with its study from the viewpoint of a historical sequence. An attempt to pursue typology into such a detailed study would lead to an unending multiplication of typological terminology that would require a huge literature to name, and to a group of descriptive criteria that would be too cumbersome and detailed for the average worker to use even if such minute subdivisions could be described objectively. Furthermore, although the individual classification of specimens in biological taxonomy forms the framework of evolutionary study, a similar exact pottery taxonomy is not analogous.[68] In the field of zoölogy a very intricate system of typology has been created, based on the genetic relationships of living organisms; yet it merely describes animals that inherit from two parents of the same species, usually from the same locality. A pottery vessel may receive its constituents of design and technique from a much more variable group of immediate forebears, some coming from a considerable distance. Also "interphylum breeding" takes place; for example, the copying of basketry designs on pottery. Thus, although pottery types as they are at present defined form useful norms or standards in the initial classification of a mass of material, they are certain to become involved and misleading if genetic implications are given them in historical or developmental studies.

Approach to the problem.—The study here presented is an attempt at delineating the history of pottery design in the Kayenta area. The relative dating of the specimens described has already been determined by pottery typology, architecture, and other normally used chronological determinants (tables 1 and 2). In addition, the large mass of dated design material thus made available has been studied as a related whole, and the chronological changes in it defined with particular attention to the transitional phases now well covered by type descriptions. Although chrono-

[68] In this connection, see J. O. Brew's Alkali Ridge report (in manuscript).

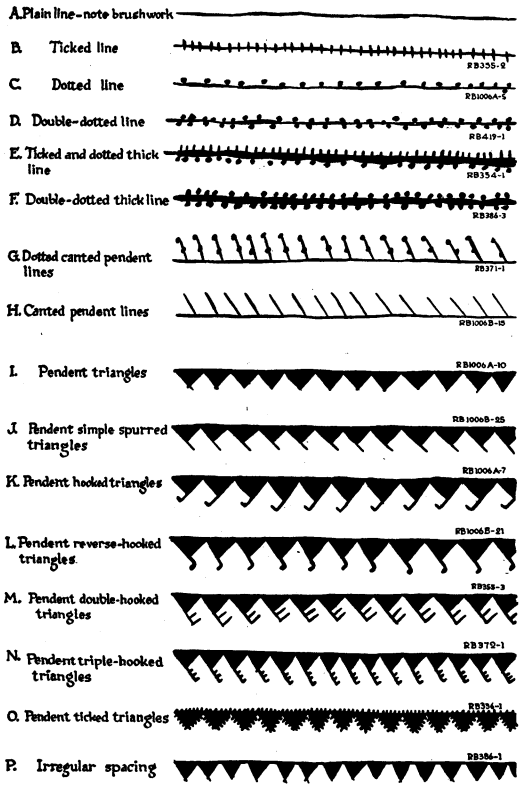


Fig. 18. Examples of Kana-a Black-on-white borders based on a single line, with various forms of enrichment. Numerals indicate sites and field-catalogue numbers.

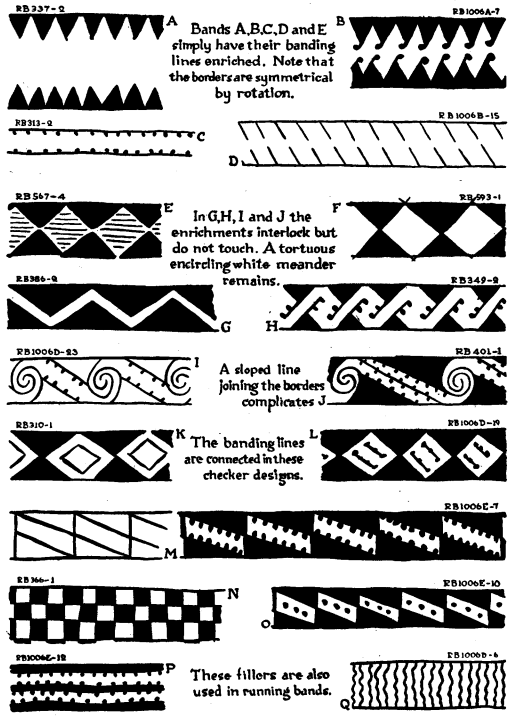


Fig. 19. Examples of Kana-a Black-on-white borders, based on two framing lines with various enrichments. M is analyzed at the left to show the manner of laying out this form of design.

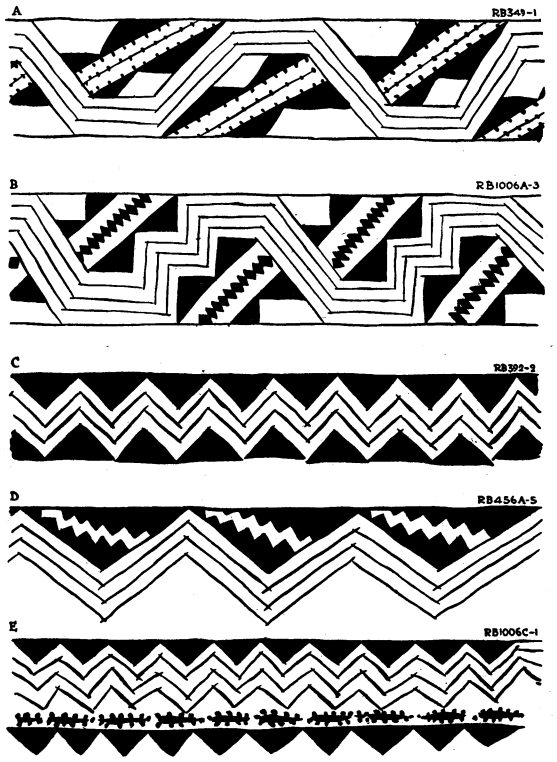


Fig. 20. Examples of Kana-a Black-on-white borders formed by zigzag lines within the area of straight horizontal bands.

logical and ware divisions have been held to in the presentation of material, the interaction among such factors as design elements, layouts, styles of drawing, and symmetry types in design will now be discussed in relation to types, wares, and time horizons. An attempt will be made to recognize foreign elements as they impinge upon local traditions. The results make more understandable isolated type criteria already proved valid and suggest new criteria valuable in sherd-dating work. Less easily applicable to field archaeology, but of deeper eventual interest, are the inferences which may be drawn concerning the historical development and intercultural exchanges among the people who made the pottery. Kayenta pottery design, however, is elaborate, varied, and sensitive, and seems to have followed a definite evolutionary course over a six-hundred-year span without an overwhelming amount of outside influence. A similarly homogeneous development in decorative style obtains in other Pueblo areas in which chronological studies have been made.

The usefulness of the material presented here in the tracing of cultural influences through the travels of design among related peoples must, to a large extent, come later when comparable groups of data have been assembled from other areas.[69] The pottery design of the Pueblo area provides an excellent means of "trait comparison" among the various cultural centers therein. The intricacy of the motifs and arrangements used minimizes the possibility of their independent invention, and there is enough variety in the design of the various cultural centers to allow a statistical treatment of the elements isolated. Such a study, so far almost untouched, could profitably be carried on with already excavated material. Aided by the accurate dating now available on many sites, it should be a peculiarly sensitive means of tracing cultural interchange.

SCOPE OF MATERIAL

Pottery was probably first made in the Kayenta area in Basketmaker III times (before 750 A.D.).[70] During the entire history of the region, pottery of three major groups was used. Gray wares, some plain, some textured, were made during the entire history of the Kayenta pottery industry. Since gray wares normally bore no painted designs they will not be treated here. A second ware involved the use of red or orange as a base color. The third ware was white.[71]

The base of the red pottery of Basketmaker and early Pueblo I times was an orange clay, to which a red all-over slip was applied before the black painted decoration was put on. It appears to differ in general character from the contemporary white and gray pottery as well as from the later red and orange wares and may have been imported.

During Pueblo II times (approximately 900–1100 A.D.) a native orange ware was made. A red slip covers most of the vessel, upon which designs are painted in black (Tusayan Black-on-red and Medicine Black-on-red, which are distinguished on the basis of design differences).

During the course of Pueblo III this orange ware was elaborated. Red was used, not only as a slip, but for painted designs. Later black and finally white paints were used in addition to red. Thus, at the height of technical development, a four-color polychrome was produced, using orange, red, black, and white in the design. The typology of this pottery, based on color combinations, is complex (Tsegi Orange, Tsegi Black-on-orange, Tsegi Red-on-orange, Tsegi Polychrome, Tusayan

[69] An excellent selection of design material from the La Plata district of Colorado has been published by Morris, 1939, pp. 145–245. See also Kidder and Amsden; Amsden; Kidder, 1936; Martin and Wills, 1940.

[70] Morris, 1939, pp. 20–23.

[71] See discussions by Kidder and Guernsey, pp. 208–209; Guernsey, pp. 84–92, pls. 18, 19.

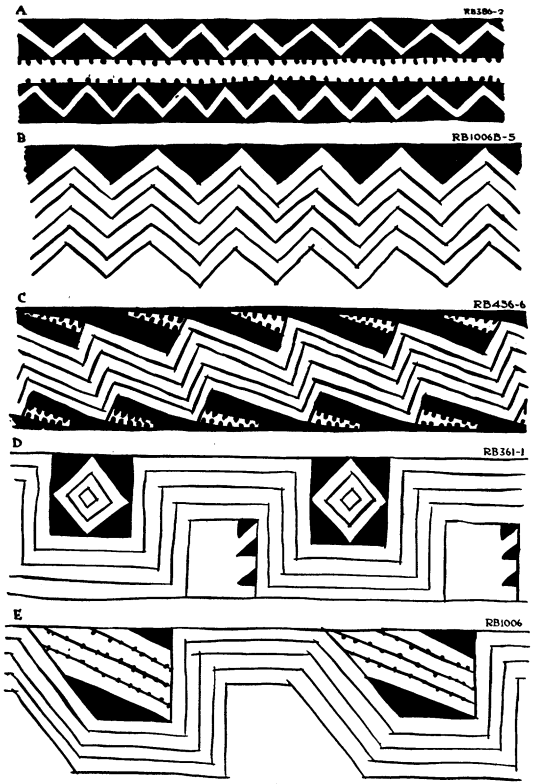


Fig. 21. Examples of Kana-a Black-on-white borders formed by zigzag lines within straight horizontal bands.

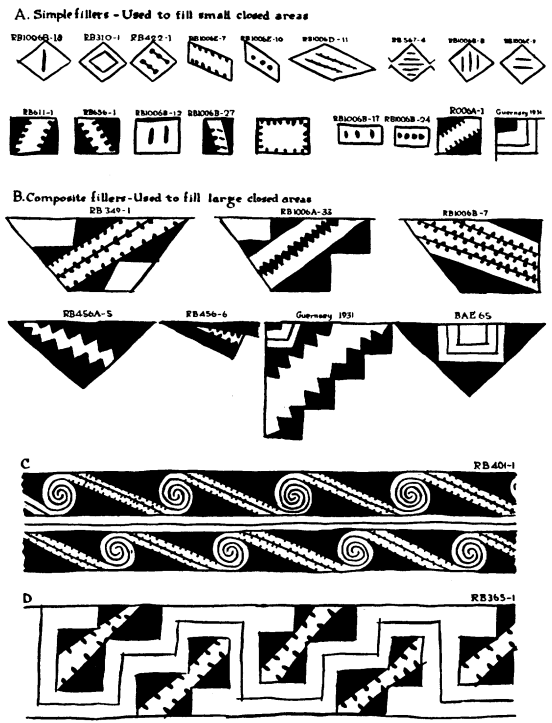


Fig. 22. Examples of Kana-a Black-on-white borders, showing various devices used as fillers for the closed areas within the border. Several examples are taken from other publications, as is indicated, but all came from the Tsegi area.

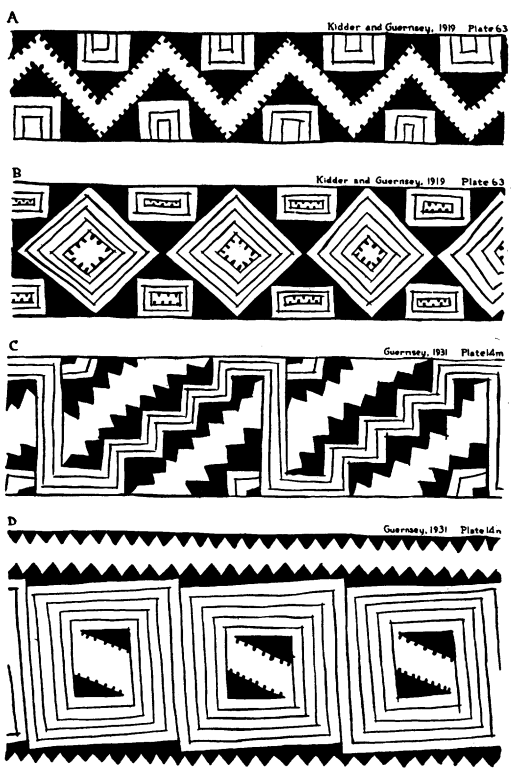


Fig. 23. Examples of Kana-a Black-on-white borders, showing various devices used as fillers for closed areas within the border. All are taken from other publications, as is indicated, but all came from the Tsegi area.

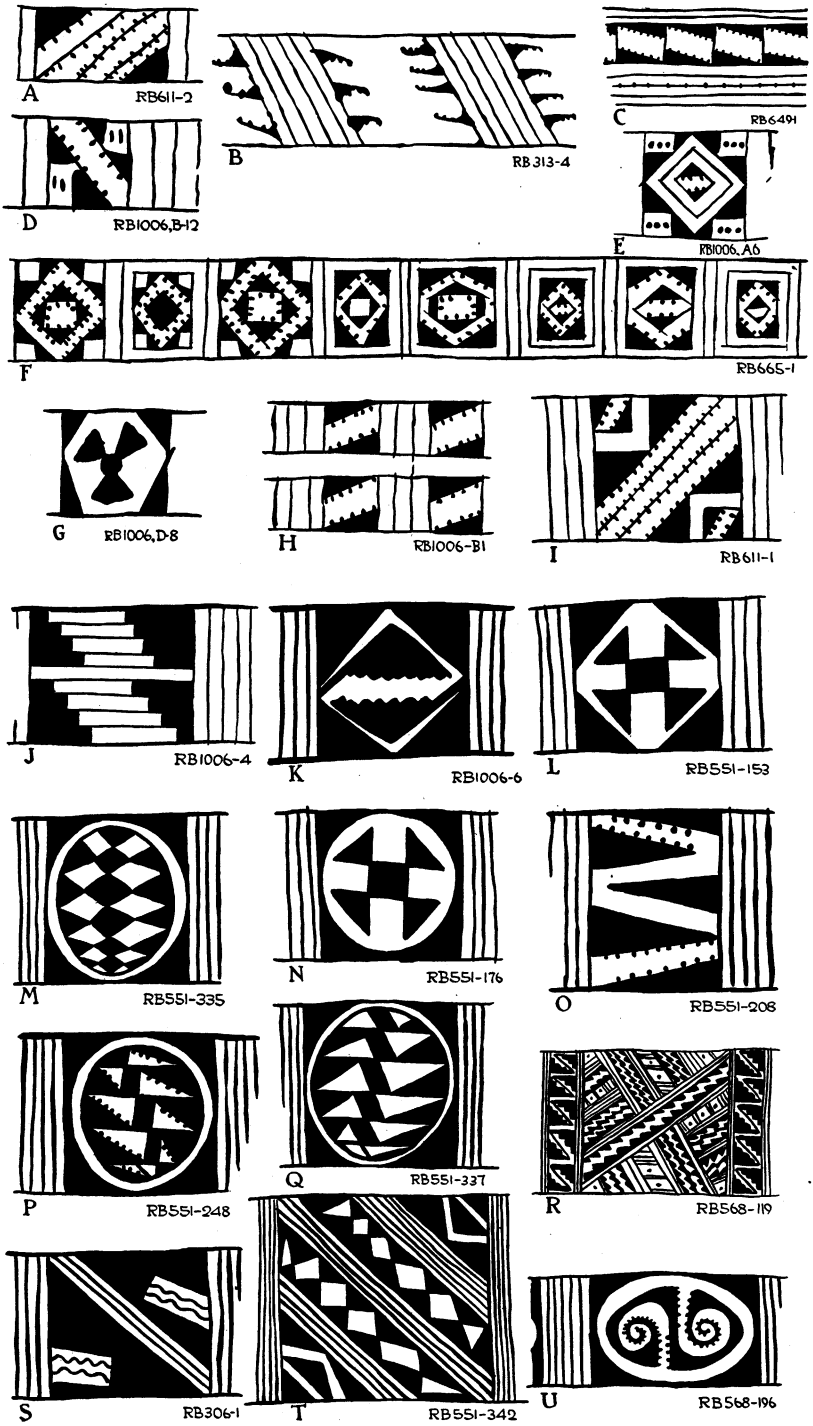


Fig. 24. Examples of panels used in horizontal bands on black-on-white vessels. A to I, Kana-a Black-on-white; J to Q, S to U, Black Mesa Black-on-white. R is unusual and does not exactly fall within any traditional decorative style.

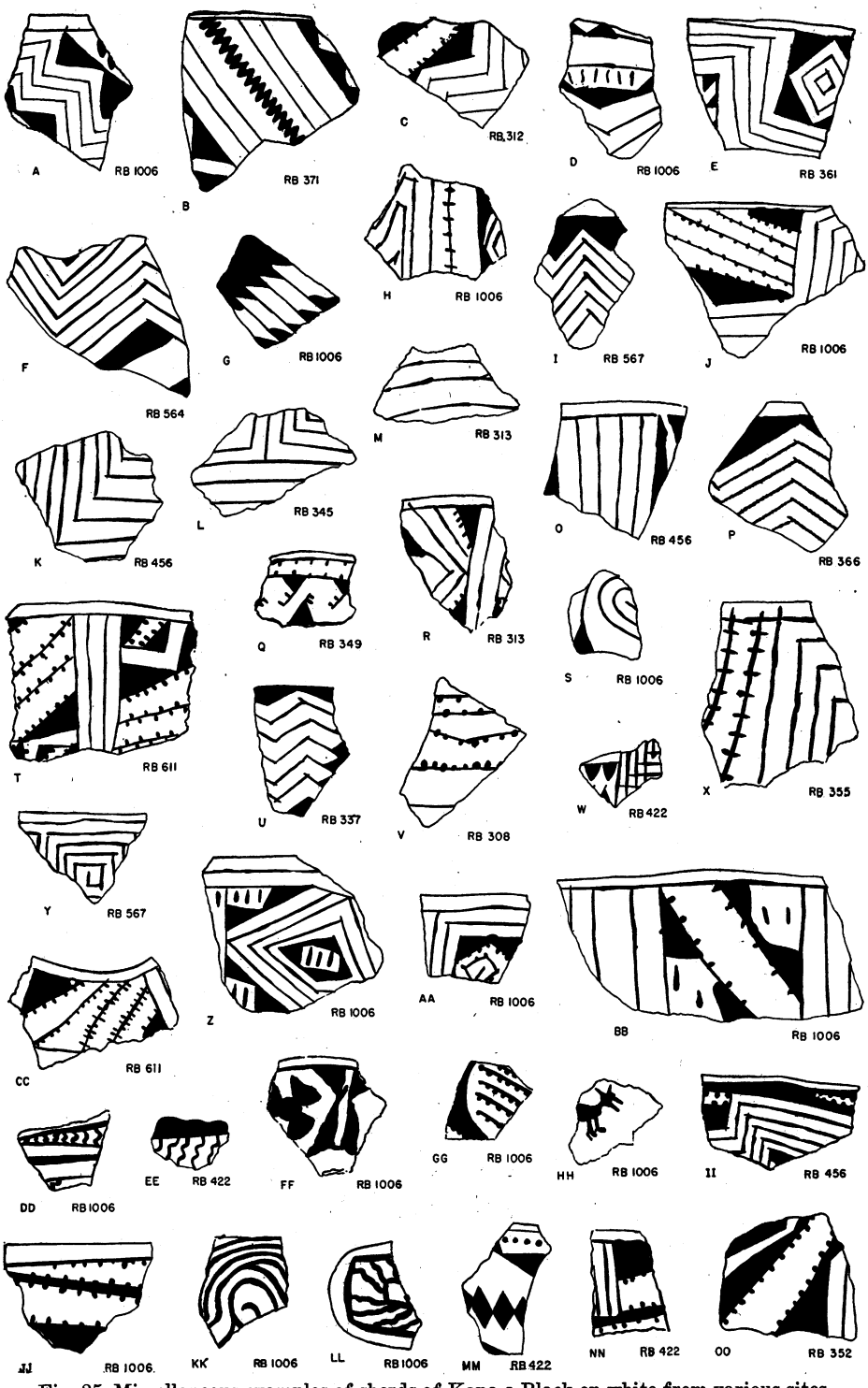


Fig. 25. Miscellaneous examples of sherds of Kana-a Black-on-white from various sites.

Polychrome, Dogoszhi Polychrome, Kayenta Polychrome, Kiet Siel Polychrome).[72] It is doubtful whether most of these types had much temporal or areal significance. Nearly all possible combinations of these types have been found in a single site.

White pottery, decorated in black paint, was the most abundant decorated ware of all periods. Lino Black-on-gray displayed the crude beginnings of black-painted decoration during late Basketmaker times, and possibly developed into the relatively well-made Kana-a Black-on-white characteristic of Early Developmental Pueblo, although no transition has been adequately traced. During Later Developmental Pueblo times, black-painted pottery became more complex and has been classified under several types (Black Mesa, Sosi, Flagstaff, Dogoszhi Black-on-whites) which were most clearly distinguished by the styles of design.[73] These types, described as they originally were from sherd material, have not proved to be mutually exclusive on whole vessels of this area, and probably a redefinition of them is desirable. Flagstaff Black-on-white may have been imported into this region, and then locally copied.

The black-on-white pottery of Pueblo III underwent marked stylistic changes and attained much greater intricacy than anything that had preceded it. This intricacy was not only organized in accordance with a rigidly formalized convention, but to us seems to have been applied with considerable aesthetic judgment. Distinctions between types already named from the area (Tusayan, Betatakin, Kayenta Black-on-whites) were based on differences of decorative detail which, at least in some measure, are chronologically significant.

METHOD OF PRESENTATION

In the remainder of this section the decoration of black-on-white ware and orange ware will be discussed separately, each in terms of its apparent chronological development. The date and provenience of any specimen referred to can be ascertained by reference to tables 1 and 2, and map 1. In most instances verbal descriptions of decorative features have been kept to a minimum, and the accompanying illustrations must be considered to be an integral part of the text, not merely corollary thereto.

In the drawing of these illustrations, the limitations imposed by the plane surface of the paper were felt keenly by the authors. The unusual design layouts used in this area allow nearly all of the structural lines of the designs on the pottery to be drawn sweepingly along a great circle of the more or less spherical surface of the pot. Much of the quality of the design is due to the complex curvature lent to straight lines by the curved surface on which they were drawn. In our illustrations of whole designs, or whole specimens, many of these lines have been conventionalized to appear straight. Such conventionalization allows the design on a hemispherical bowl interior, for example, to be shown clearly and completely, but only at the expense of considerable distortion.

No glossary of terminology is given here, since it is believed that the constant use of illustrative examples makes the meaning of terms self-evident. In all respects, however, the terminology corresponds to that developed by F. H. Douglas of the Denver Art Museum. An effort has been made to use few terms and to use these consistently throughout. For the nomenclature, previous pottery design papers have been drawn upon heavily, and crystallography has been used for symmetry terminology in discussions of layouts.

Many of the designs presented have been restored from fragments. Several recon-

[72] Colton and Hargrave, pp. 92–101.
[73] Colton and Hargrave, 1937, pp. 207–213, 225–227.

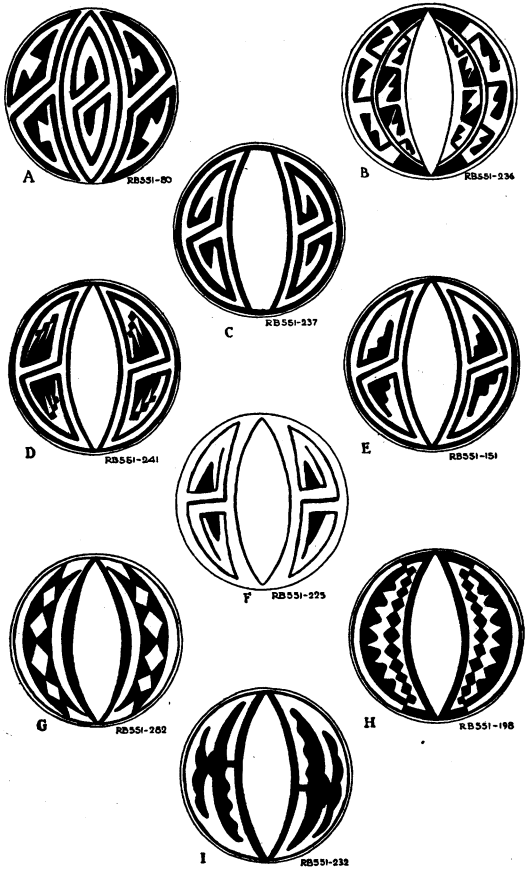


Fig. 26. Site RB 551. Interiors of late Pueblo II black-on-white bowls.

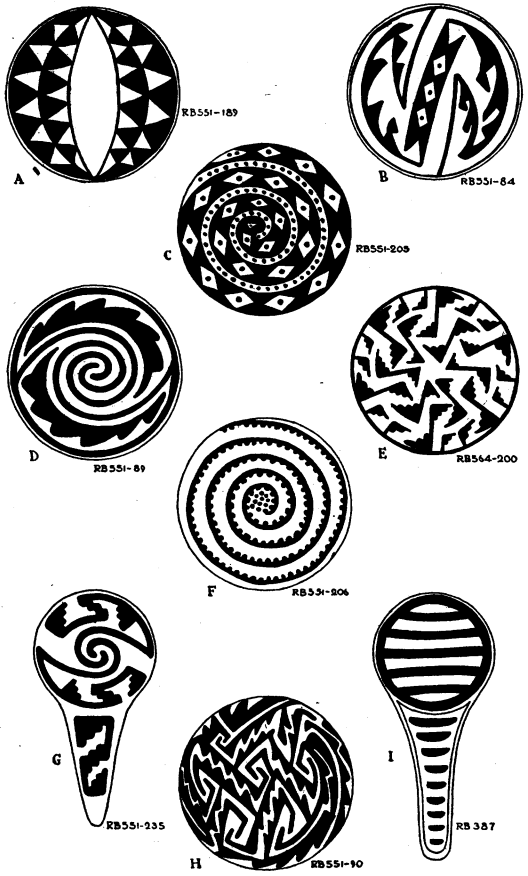


Fig. 27. Site RB 551. Late Pueblo II black-on-white bowls, mostly Sosi; interiors of bowls and dippers.

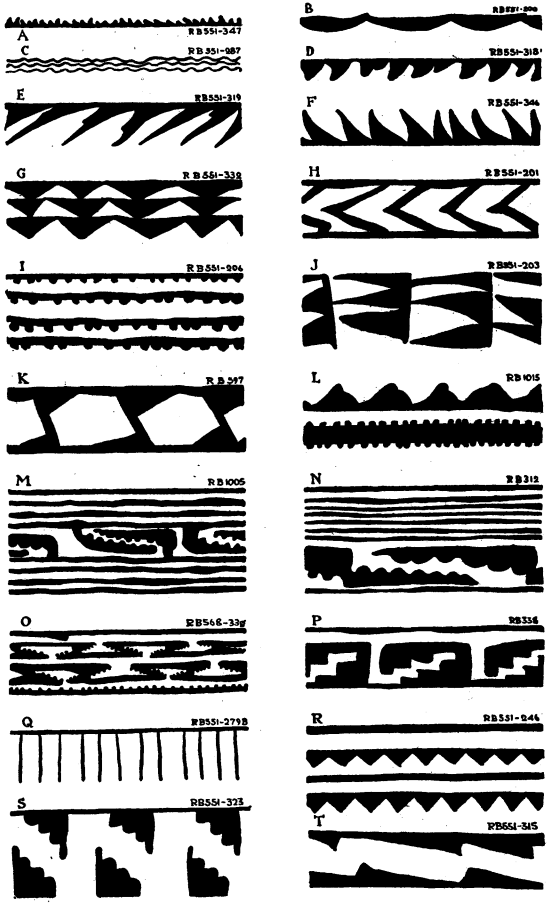


Fig. 28. Site RB 551. Examples of late Pueblo II black-on-white border designs. Many of these might be found around the necks of ollas with Sosi-style body decoration.

structions are based upon photographs of some two hundred and fifty whole vessels from the Kayenta area which we were allowed to take through the courtesy of the several owners.[74] Restored portions of designs are not indicated in the drawings. Although this practice may be open to criticism, the increased legibility thus given the drawings must be its own justification. No reconstruction contains an element or arrangement not found in the contemporaneous series. Moreover, no designs have been restored in which two alternative possibilities suggest themselves. The brushwork on the original pottery is faithfully followed. About two thousand preliminary brush drawings of the fragments, most of them full size, were made before any of the final illustrations were drawn. Very few fragments in the collection will not fit into one of the illustrated designs: the design repertory shown is therefore nearly complete. Figures 34 and 35 show the sherds which do not fit into reconstructed designs. Figures 33 and 57 show sherds from the ridge of Black Mesa. Since these are peripheral to the primary area of study, they have not been restored or considered in the design study.

Black-on-white Ware

PUEBLO I

The majority of the Kana-a Black-on-white pottery described and illustrated comes from Site RB 1006 (see p. 24). Scattered specimens bearing design were found in other sites covered by the reconnaissance. Pueblo I decoration, as found on the Kana-a Black-on-white pottery of the Kayenta area, may be distinguished most easily from later styles by the thinness and irregularity of line work. Lines were made by short independent strokes of a brush carrying little paint, which often left frayed terminations and underlying scratches, such as the end of a chewed plant stalk or yucca leaf might do. Few single strokes were more than 5 cm. long. New strokes were crudely joined to preceding strokes without much effort at blending or smoothing the contact. Each stroke tapered from a thick beginning to a thin ending, the width varying from 2 to 0.5 mm. Where lines joined at angles, they were usually completely connected and often crossed each other, sometimes by as much as a centimeter. The drawing was usually careless. The paint was viscous, as is evidenced by the "blobs" often found. The designs were open, with the area of white background much greater than that covered by paint. The lines are straight and well spaced, and seem to have been put on rapidly, with a good deal of freedom in execution.

Designs on all Kana-a Black-on-white pottery from the Kayenta area were built up on the framework of a line or series of lines encircling the bowl or jar horizontally.[75] The designs were elaborated by the addition of elements pendent from the original banding lines, by the insertion of groups of parallel zigzag lines, or by the subdivision of the area between the banding lines into closed areas by the use of vertical or sloping partition lines (figs. 22; 24, *d*; 25, *a*, *c*).

The elements used as elaboration of the basic layout may be classified under two general headings: "line enrichments" and "fillers." These terms will be used in discussion of all designs presented in this report. "Line enrichments" are devices attached to a line (fig. 18). They range from simple ticks or pendent dots to such intricate devices as are shown in figures 26 to 31 and figures 42 to 45. A series of them as they occurred in Kana-a Black-on-white is shown in figures 18 to 24. As can be seen, these enrichments were often used upon the facing sides of two or more

[74] John Wetherill; Arizona State Museum; Museum of Northern Arizona; University of Utah Museum.

[75] This layout is not the only one used in the Southwest in the Pueblo I period. See Roberts, 1931, pls. 18–23, figs. 21–27; Morris, 1939, figs. 47, 48.

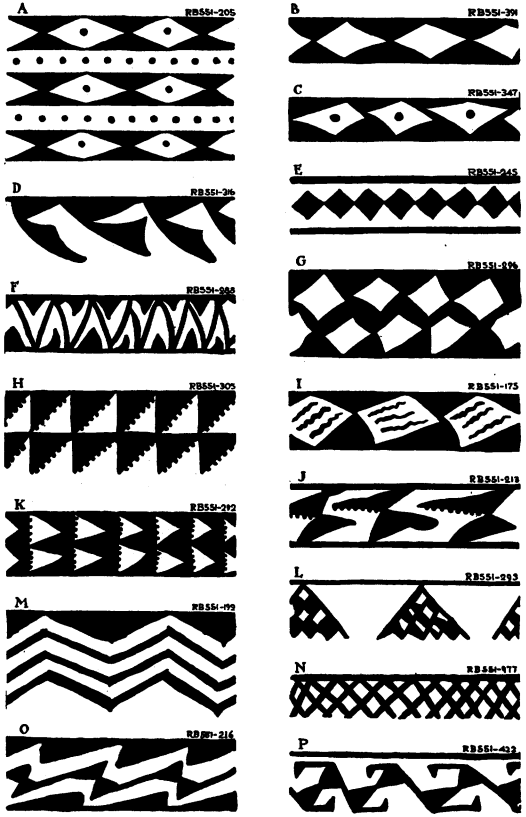


Fig. 29. Site RB 551. Examples of late Pueblo II black-on-white borders. Many of these might occur in combination with Sosi-style designs.

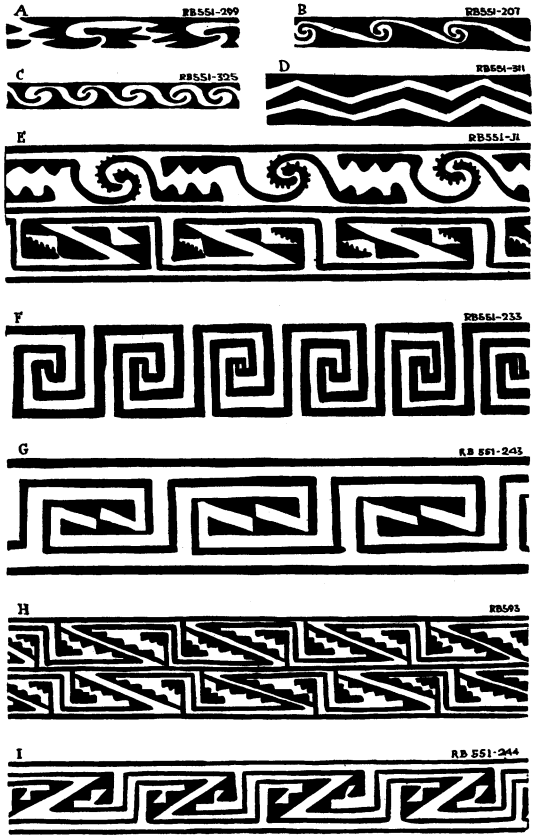


Fig. 30. Site RB 551. Examples of Sosi and other black-on-white borders. E has the pendent dots characteristic of Black Mesa style.

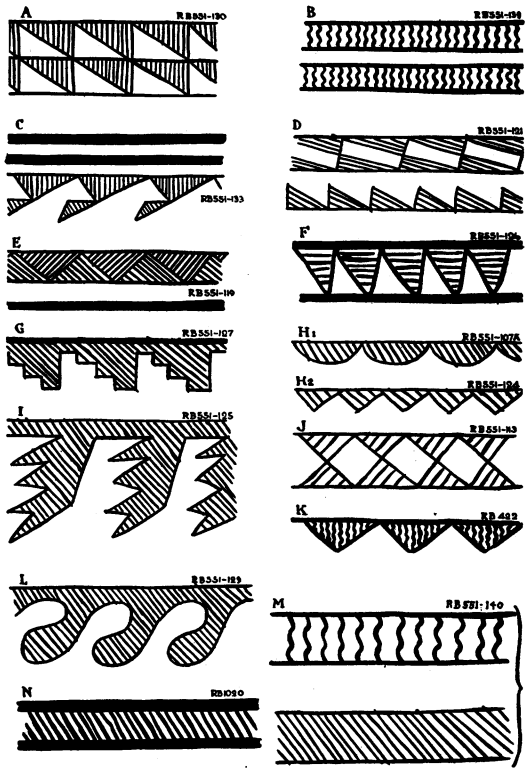


Fig. 31. Sites RB 551 and others. Examples of Dogoszhi Black-on-white border designs.

parallel encircling lines. By this means the area enclosed by the encircling lines formed a running band (fig. 19, *a–d*). When asymmetric pendent figures, such as spurred triangles (fig. 18, *j*), were used, they were drawn so that the two enriched lines were in twofold rotational symmetry, and never in mirror symmetry with each other (fig. 19, *b, h–j*). This rotational symmetry is common in all Indian design and was almost the only type used on Kayenta pottery in this and subsequent periods. Such symmetry is not found in any life forms, plant or animal. Whatever the origin of this type of symmetry (and why may it not have been abstract?), its continued use argues a strict tradition and convention.

Spurred triangles are the subject of special interest since they are the basis of a major part of the Pueblo III black-on-white pottery design, and the beginnings of their use on Kana-a Black-on-white are provocative. When two banding lines were related by spurred triangles, so placed that their spurs interlock to a greater or less degree but do not touch, the white area remaining formed a continuous meander of more or less constant width encircling the pot (fig. 19, *h, j*). This combination of elements, already evolved in Pueblo I times, became the backbone of later design. The "birds" characteristic of later Hopi and other pottery design[76] may well have had their prototype in the Kana-a spurred triangle (see figs. 42–45 for intermediate Pueblo III forms), providing a documented example of evolution from a simple geometric form to a life form.

"Fillers," as distinct from the line enrichments described above, were not connected branchlike to the framing lines of the design area (figs. 22, 23, 24). They were often contiguous to them along a major part of their perimeter, as when an area enclosed by lines was filled with paint, or they were unconnected with the framing lines. They were normally used to fill enclosed areas. This general arrangement is far more common in the field of design throughout the world than the line-enrichment system, to which, of course, meanders, frets, and certain floral and leaf designs may be said to belong.

Common forms of fillers occurred in checker designs (fig. 19, *k–o*), the filled areas being contiguous to bordering lines as in the dissection shown in *m*, while figure 19, *k* and *l* show fillers not connected to their bordering lines. The panel designs shown in figure 24 contain excellent examples of fillers (*a–i* are in Kana-a style). Several of these designs show line enrichments on facing lines (*a* and *c* are good examples). Figure 24, *f* shows a remarkable variety of filler decoration done by two methods. In these panels, the area was progressively delimited by inscribing either a figure with its corners bisecting the framing lines, or a "nesting" figure with a white area of constant width around it. The inscribing and nesting processes were alternated, and the black triangles formed by the inscribing process are sometimes relieved by inscribing a white square in them. It is noteworthy that the panels were finally broken up into areas not exceeding one centimeter in their largest dimension.

The procedures described above were followed in the decoration of all large enclosed areas (figs. 22, 23, 24). A group of fillers used in large and small areas of various shapes is shown in figure 22, *a* and *b*. Occasionally simple life forms were used in the bottoms of bowls in addition to the band (fig. 25, *hh*), although as a rule the bottoms were left undecorated. Never was a design formed on a radial pattern, and the use of curved lines was very rare. The examples of interlocking scrolls shown in figure 22, *c* and 25, *s* were unusual.

Pueblo I pottery, throughout the Pueblo culture area, shows little regional variation when compared with the distinctive regional styles which developed later.

[76] Mera; Kidder, 1924, p. 65; Fewkes, 1919, pp. 233–236.

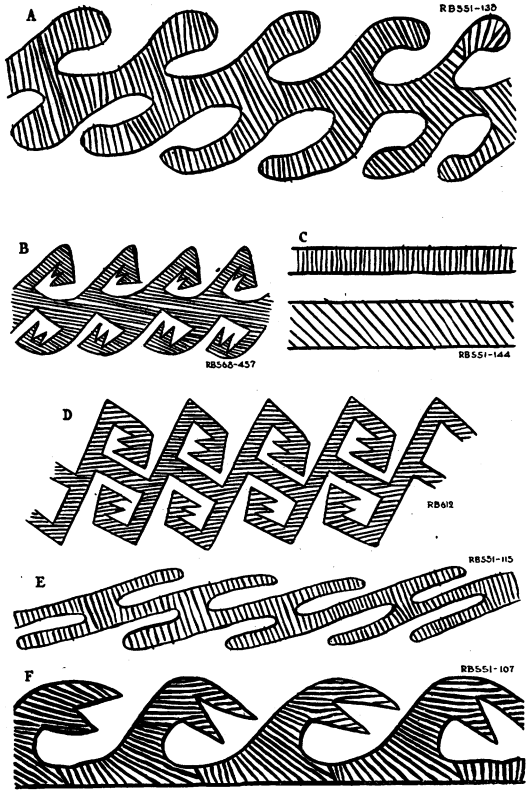


Fig. 32. Sites RB 551 and others. Examples of Dogoszhi Black-on-white border designs.

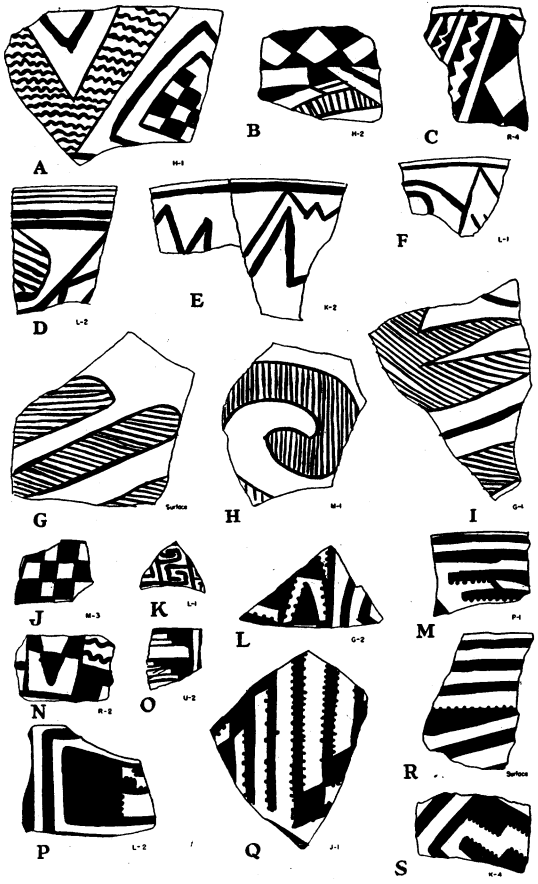


Fig. 33. Site RB 551. Miscellaneous black-on-white sherds. Reference symbols at the lower right indicate the sections of the stratigraphic trench from which individual sherds were recovered.

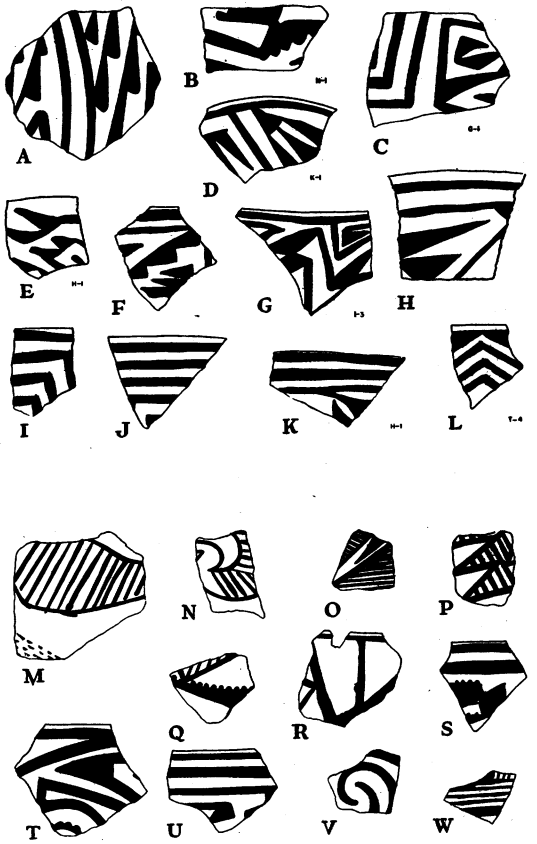


Fig. 34. Miscellaneous black-on-white sherds. A to L are Sosi Black-on-white sherds from Site RB 551. The reference symbols at the lower right indicate the sections of the stratigraphic trench from which the sherds were recovered. M to W are of various types from Site RB 564.

Our material presents no evidence showing change or evolution in design during the period; figures 18 and 19 show a series merely arranged from simple to complex, not based on any chronological arrangement.

PUEBLO II

The design of the Pueblo II black-on-white pottery of this area presents a much more complicated problem than that of any other period. It lacks the close-knit quality of earlier and later times. Several groupings may be isolated, however, from the more or less heterogeneous mass. This mass of material had within it considerable variation, and was undoubtedly the result of a much more marked cultural intermingling than occurred in Pueblo I or Pueblo III times. The Pueblo II period seems to have developed slowly from Pueblo I (table 1), whereas Pueblo III seems to have been a sharply marked, short period, showing rapid flowering under a much more closely restricted design system than that of Pueblo II. As yet, much less is known about Pueblo II pottery design than about that of other periods.

The design criteria used in delimiting Pueblo II sherd types have not been very successful in dating the pottery within that period, but some provocative indications have been noted. It will be noticed that the types listed in table 1 were roughly contemporaneous, but their relative proportions to each other changed somewhat. The distinctions between Black Mesa, Dogoszhi, and Sosi Black-on-whites have been based on style of decoration. Yet the decoration was so complex that it is difficult to define "styles" in the manner employed by Colton and Hargrave[77] without frequently finding a sherd representative of two styles (for example, in neighboring bands on the same vessel).

Most of the material dating from Pueblo II came from two sites, RB 1006, section 1, and RB 551. Site 564, although within the Pueblo II period, produced few sherds large enough for design study. Site RB 564 contains Pueblo II types as a majority of its black-on-white pottery, although the orange-ware types present undeniably classify it in Pueblo III as we have defined the period (see p. 17). The position of various sherd collections from these sites in the general chronology may be seen on table 1. A great deal of design material came from Site RB 551, less from the other two sites mentioned above, and a little from other sites, surveyed but not excavated.

Early Pueblo II.—Very broadly, the changes that occurred in the development of black-on-white design in the beginning of Pueblo II were characterized at first by a gradual modification of Kana-a style in the direction of a heavier, coarser treatment. The basic layouts and most of the elements persisted, but the thin, segmented lines and the small, fussy embellishments and fillers disappeared. This was logical, for it accompanied an increase in the size of vessels and in the thickness of vessel walls.

This heavy-line version of what was in essence a continuation of the Kana-a style is represented by the material from Site RB 1006, a few examples of which are illustrated in figure 24, *g, j, k* and figure 49, *e* and *h*. In these examples it is evident that the lines were thicker and the black-filled areas larger and more elaborate than in the earlier Kana-a vessels. For the first time the fillers were embellished by stepped or serrated edges (figs. 24, *k;* 49, *e, f*) and the pendent dots used on Kana-a vessels became much larger and bolder (fig. 49, *g* and *h*), while the delicate ticking disappeared entirely. The spurred triangle persisted, usually having a heavy key appended to the spur. Certain new types of fillers appeared, based on the concept of the cross and circle (fig. 24, *g, m, n, p, q, u*), as did the suggestion of radial layouts

[77] Colton and Hargrave, pp. 14–18.

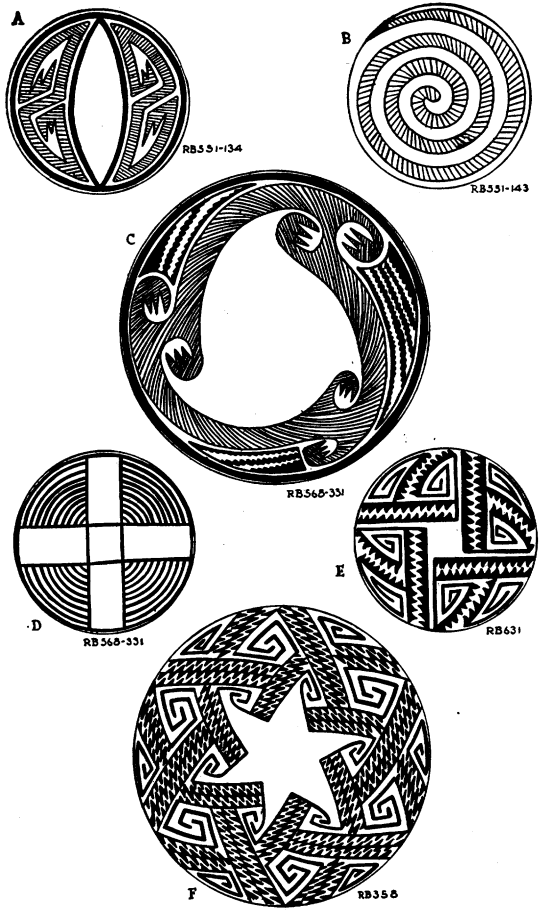


Fig. 35. Interiors of various types of black-on-white bowls, showing Dogoszhi style in simple spiral form (B) and in combination with Sosi style (A) and with Tusayan style (C). E and F are Flagstaff style. D is unusual.

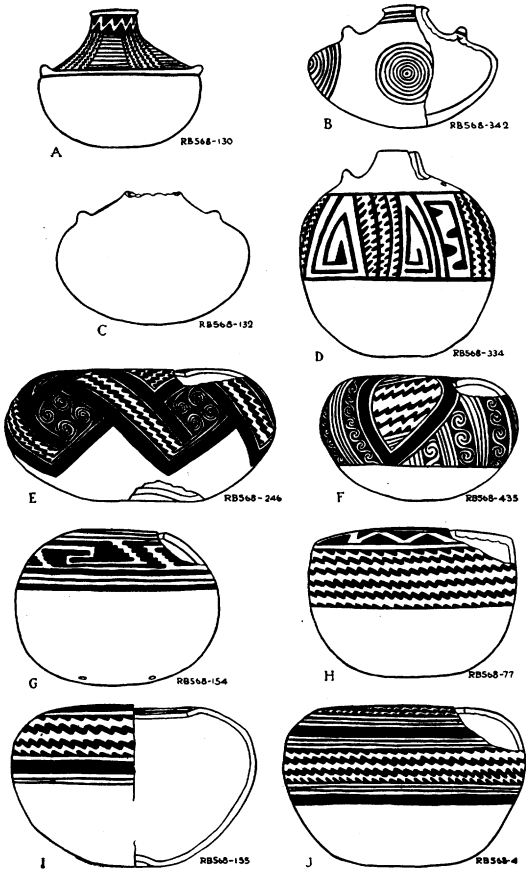


Fig. 36. Site RB 568. Pueblo III black-on-white canteens and seed jars. C was unpainted white.

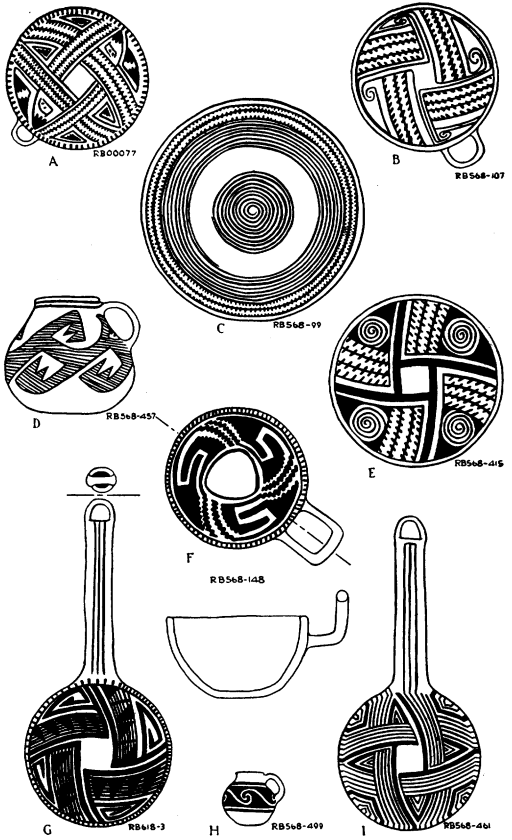


Fig. 37. Black-on-white bowls, pitchers, and dippers from various sites. D is Dogoszhi Black-on-white. G is Kayenta Black-on-white. All others are Tusayan Black-on-white.

for the entire design (fig. 49, *f*). The latter was, actually, merely the widening of the old encircling band, subdivided into panels, to embrace almost the entire inner surface of a bowl; but the effect was to suggest, by a difference in emphasis, a circular rather than a linear pattern. Layouts actually based on the circle did not appear until later in Pueblo II.

Figures 24, *s*, 33, *j–s*, and 56, *s* are examples that are essentially Kana-a in arrangement, but belong clearly to the Pueblo II transitional period by reason of their thick, heavy manner of execution.

As in Kana-a Black-on-white, the paneled band was also characteristic of this modified style, the panels often being separated by series of vertical or sometimes diagonal lines. The central open areas of the panels were frequently circular or elliptical, however, thus introducing in our collection for the first time the use of closed curves; in Kana-a style the only curve had been the scroll or spiral. The circular or elliptical areas of Pueblo II designs were filled by several novel devices, such as the triangular check pattern of figure 24, *q*, the "propeller" device of figure 24, *g*, the "Maltese cross" of figure 24, *l* and *n*, and others. On bowls the open circle in the bottom was often filled by one of these same panel fillers.

The jars of this period had spheroid bodies and relatively tall vertical "stovepipe" necks (fig. 51). The belly and neck of such a vessel afforded two separate fields for decoration that were treated independently. Around the neck was usually painted a simple continuous band, composed of one or more heavy horizontal lines, usually embellished with pendent triangles, lunes, or some similar element (fig. 49, *e, h*). The body was decorated with a more elaborate paneled band of the sort already described.

In general, the proportion of black to white increased considerably. Whereas in Kana-a style the attention of the potter was directed primarily to the application of lines and masses of paint without concern for balance between painted areas and the unpainted background, in the later vessels it was apparent that some thought had been given to the relationship between design and background. The black areas had a tendency to be spaced fairly constantly apart, thus often producing white meanders, and perhaps foreshadowing the "negative" designs of Pueblo III (see figs. 24, *l, m, o, q, s;* 49, *e, f, h*).

That the change in style during this period was gradual and not occasioned by sudden exotic influences is attested by the large number of sites listed in the Expedition's survey that contain appreciable quantities of both styles. Sixty-nine sites in the Tsegi drainage fall into this category—about twice the number of pure Kana-a sites.

Although the thin-line style of Pueblo I only very gradually lost its popularity to the thick-line Deadmans or Black Mesa Black-on-white,[78] there were no startling innovations in either layout or in the design elements used. The old, unified tradition of Kana-a Black-on-white remained but slightly disturbed. The design described for Black Mesa Black-on-white during this early Pueblo II period is somewhat more limited than in Colton and Hargrave's description, but the other criteria given by them apply to our material.

Site RB 1006, section 1, is a typical site illustrative of Black Mesa Black-on-white. No examples of any other Pueblo II black-on-white style were found. No date was determined for this site, but Site RB 1008 seems to have followed it by a considerable period in the occupational sequence of Cobra Head Canyon. In its pottery complex, Site RB 1008 is very nearly identical with Site NA 2630 in Dogoszhi Biko, for which an extreme end date of 1130 ± 3 was determined from a beam, cut but

[78] Colton and Hargrave, pp. 207–209; Colton, 1941.

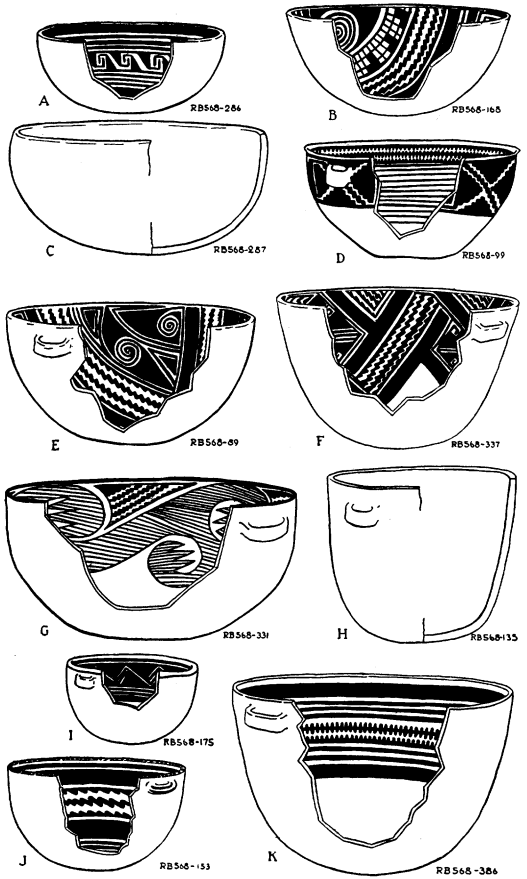


Fig. 38. Site RB 568. Pueblo III black-on-white bowls. G is combined with Dogoszhi hatching.

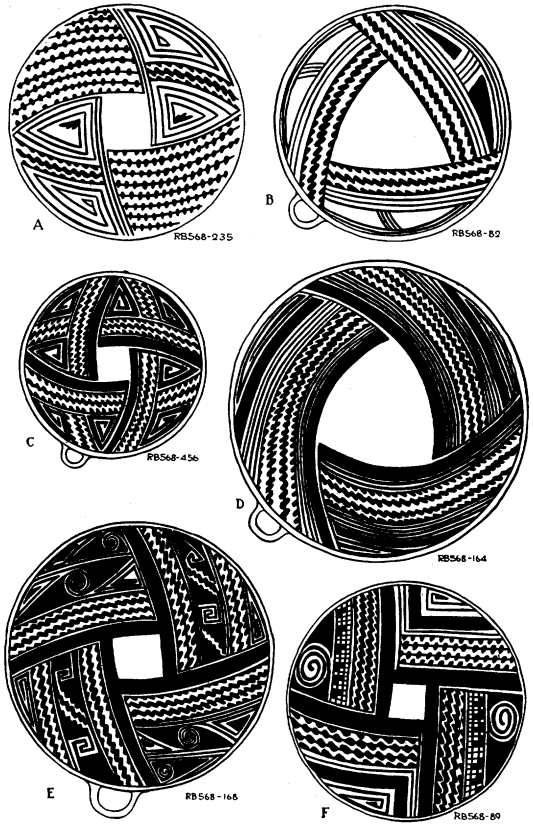


Fig. 39. Site RB 568. Pueblo III black-on-white bowls.

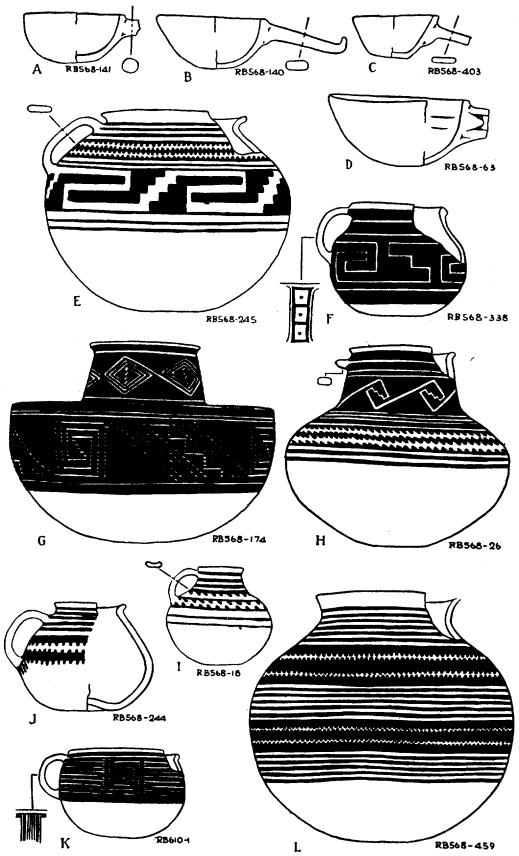


Fig. 40. Sites RB 568 and 610. Pueblo III black-on-white jars, mugs, and dippers. G and K are Kayenta Black-on-white. A to D are unpainted white-ware dippers.

never actually used in construction.[79] The pottery complex of Site RB 1008 is also not very different from that of the earliest levels at Site RB 551, and a building date in the kiva there was determined at 1078 +. An approximate date for Site RB 1008 may therefore be postulated as about 1100. If Site RB 1006, as seems evident, was considerably earlier than Site RB 1008, then it may have been occupied in the early part of the eleventh century or earlier.

Late Pueblo II.—The black-on-white pottery of Pueblo II embraced several decorative styles in addition to Black Mesa Black-on-white, which apparently itself died out during the period, or perhaps was metamorphosed into later types. These later types can best be considered from the material recovered in the excavation of Site RB 551. The pottery from that site displays several characteristics distinguishing it from the pottery of Site RB 1006. Among the chief of these is the presence of a style of decoration already designated Sosi style.[80] It was characterized by the use of wide, compound lines, that is, lines executed with at least two strokes of the brush, so that each edge of the line was sharply defined by separate strokes, care being taken to keep the width nearly constant at from about 5 to 7 mm. Moreover, the ends of the strokes were not visible but were neatly blended with the succeeding strokes. Angles were neat and sharp and no overlapping corners were permitted. The whole appearance was meticulous and clear, evidencing a much greater degree of virtuosity than was present in either Kana-a or Black Mesa styles.

Two entirely distinct layouts were utilized in Sosi-style vessels. Simple circumferential bands were normally used on the exteriors of large ollas, often independently applied to the neck and to the convex belly of the vessel. In such treatment the band encircling the neck was much simpler than that applied to the body. Neck bands were usually compounded of one or more horizontal lines, embellished with pendent triangles, very often long and sharply pointed (fig. 28, *d–g, j*). Often, stepped triangles or lunes were used pendent from the lines, as well as two rows of opposed triangles forming, in effect, a solid band with diamond-shaped white areas within it (fig. 29, *b, g*). Often, these open diamonds contained a single dot in the center (fig. 29, *c*); rarely, rows of dots were employed between lines or bands (fig. 29, *a*). Many examples of these neck bands were similar to those used on necks of Black Mesa Black-on-white ollas; if found on sherds, neck bands of the two styles often could not be distinguished. The use of dots differed, however: in Black Mesa style they were ordinarily pendent to a line or solid area; in Sosi style they were independent.

Often, in the more elaborate bands encircling the bodies surprisingly complex frets and single or interlocking scrolls were devised. Occasionally, very complicated meander patterns were introduced, almost always composed of vertical and horizontal, but sometimes also of sloping, lines (fig. 30, *h, i*). The white intervals between lines were usually from 1½ to 2 times the width of the lines themselves. Where the frets or meanders involved diagonal elements across the central part of each unit, the triangular areas left on opposite sides of the diagonal were usually filled with branch lines parallel to the rectangular borders of the fret unit. Further, the diagonals and branches were enriched by the attachment of pendent right triangles or stepped elements (fig. 30, *g–i*).

Less frequently, curvilinear scrolls, usually interlocking, were employed instead of the angular meanders (fig. 30, *a–c*). Other forms of line enrichment, such as pendent dots or ticks, were never used, nor was the paneled band ever found on Sosi-style vessels. These latter features are a diagnostic of Black Mesa style and appar-

[79] Hargrave, 1934*a*, p. 36.
[80] Colton and Hargrave, pp. 211–213.

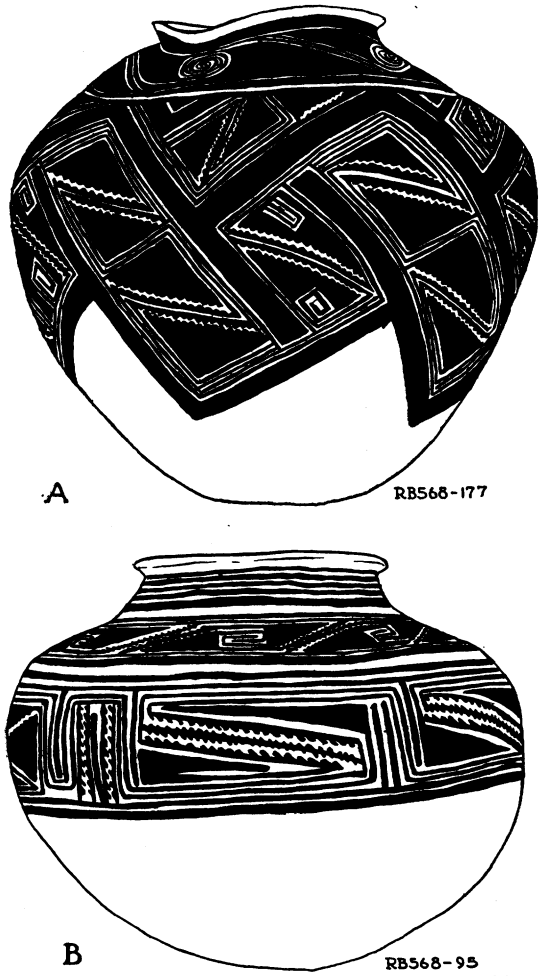


Fig. 41. Site RB 568. Pueblo III black-on-white large ollas.

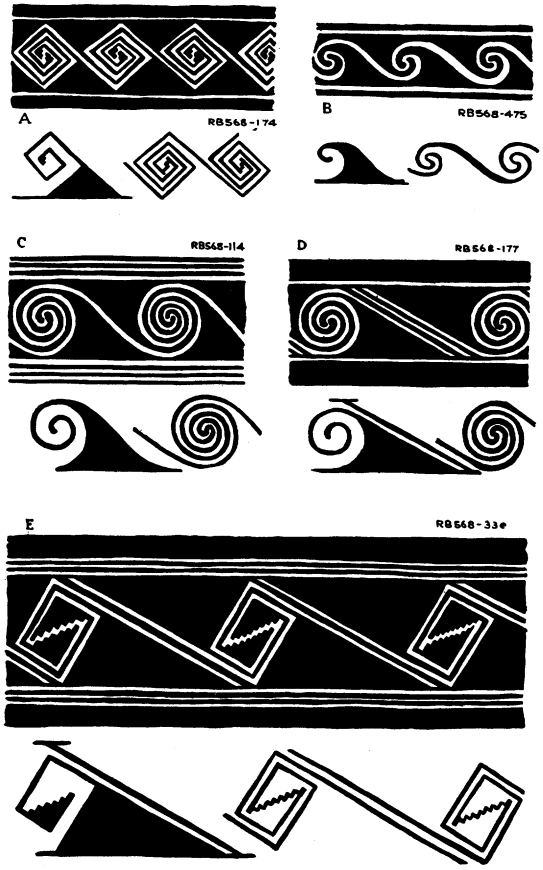


Fig. 42. Pueblo III black-on-white band designs, all built on variations of the spurred triangle. Each of these illustrations is composed of three parts: at the top, an exact reproduction of a section of the original design; at the left below, a single unit, repetitions of which formed the complete band; at the right below, a diagram in black of the areas that were left white in the original, showing the continuous nature of the negative pattern.

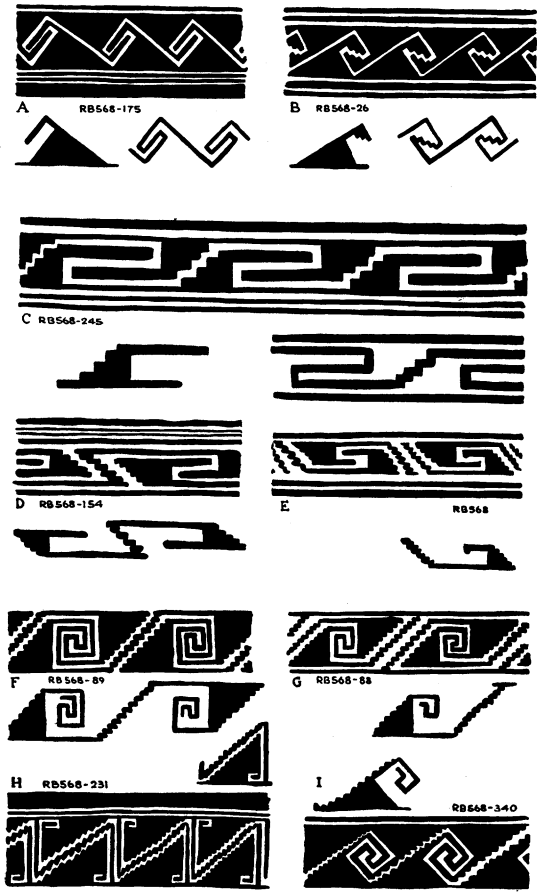


Fig. 43. Pueblo III black-on-white band designs built on variations of the spurred triangle. Illustrations A, B, and C are each composed of three parts, like the illustrations in figure 42. In D to I, only the single black units are shown separately, and no breakdown is made to isolate the white negative pattern.

ently serve as reliable chronology indicators. In the stratigraphic study of the refuse mound at Site RB 551 sherds with heavy paneled bands and pendent dots existed in considerable quantity in the earlier strata, whereas they almost completely disappeared in the later strata. Sosi style, on the other hand, was rare in the earlier deposits, and rapidly increased to more than 75 per cent of all black-on-white sherds in the upper portion of the mound (table 4). The transition was not sudden, however, and a number of sherds were found on which occurred elements of both styles (fig. 30, *e*).

On bowls the basic characteristics of Sosi style were employed in layouts quite different from those applied to the large ollas, and in a manner entirely new on black-on-white pottery in this area. Instead of a band running around the bowl, the area was often subdivided into three parts by two lines following the course of great circles and converging at the rim on opposite sides of the bowl. Almost always a single line encircled the bowl just below the rim. In the two lunettes thus formed bordering the rim, fillers were inserted, most frequently in the form of an angular **S**. The elementary lines of these figures were embellished in the characteristic Sosi manner (see fig. 26, *a–f*). Sometimes the lunettes were filled with tapering bands of the simpler Sosi style compounded of triangles and squares (fig. 26, *g, h;* fig. 27, *a*). Other layouts utilized single or interlocking scrolls in all-over patterns not previously used on any of the local pottery (fig. 27, *c, d, f, g*). Various odd examples also occasionally occurred, such as those illustrated in figure 26, *i* and figure 27, *b, e*.

Normally the ovoid central area of this "orange peel" pattern was left undecorated, but rarely it was filled with an adaptation of the angular **S** figure, as in figure 26, *a*. In all examples of the orange-peel layout, the same characteristics of execution and line-embellishment obtained as described above for the olla band designs.

Designs in Sosi style were bolder than any other designs from the area, although the pottery bearing them was technically among the finest produced in the whole sequence. The finish was highly polished, and the paint was of a clear black without tendency to spall or rub off. The paste of this pottery was thinner and of a finer texture than that of the preceding Black Mesa Black-on-white. Unfortunately, much of the material was obtained from refuse containing relatively small sherds, and the large scale of the design makes reconstruction difficult. Figures 33 and 34 give an idea of the appearance of sherd material of this type.

Hatching of a characteristic type was also a major decorative feature of Pueblo II black-on-white pottery of the region. It began apparently after Black Mesa Black-on-white had all but disappeared and continued in considerable popularity even into early Pueblo III times, although it became modified and combined with other features peculiar to the later horizon. This hatched pottery has been described under the name Dogoszhi Black-on-white.[81] The layout was usually very simple and correlated with the continuous-band decoration of Sosi style, with which it was contemporaneous. The bands were usually based on one or more lines embellished with pendent triangles, lunes, or key elements, executed in outline rather than in solid black (fig. 31, *a, c–j*). Often a peculiar pattern suggestive of a continuously repeated swastika was used, both with curvilinear and angular outline (fig. 32, *a, b, d–f*), and it was this design that lasted into Pueblo III times. Both bounding lines and hachures were ordinarily of the same thickness, usually about 3 mm., and were formed by single brush strokes. Execution was ordinarily crude and vastly inferior to the deftness of the Sosi style. Rarely, the hatched area was bounded by heavy, compounded Sosi-style lines (fig. 31, *f, g*).

[81] Colton and Hargrave, pp. 209, 211.

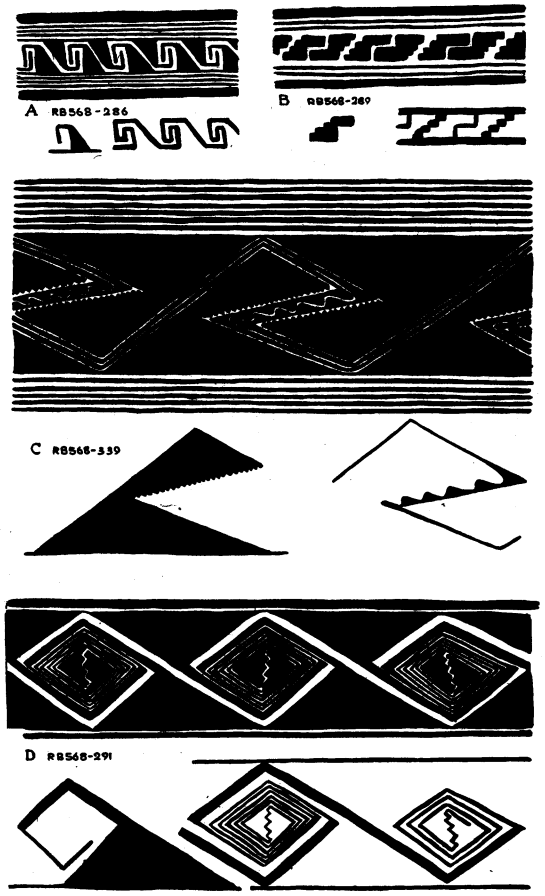


Fig. 44. Pueblo III black-on-white band designs. Illustrations A, B, and D are each composed of three parts—for signification of which see legend of figure 42. In C, the two primary black elements are shown separately; no breakdown is made to isolate the white negative pattern.

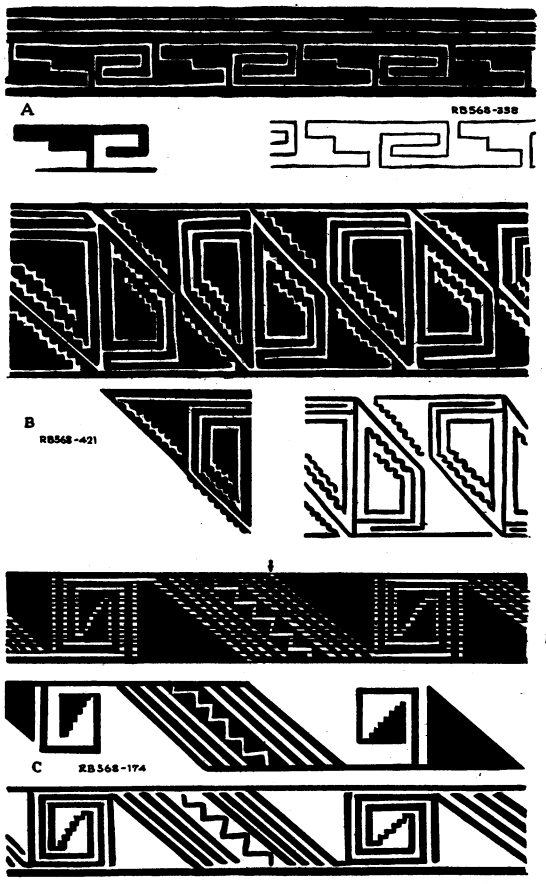


Fig. 45. Pueblo III black-on-white band designs, based on the spurred triangle. Each illustration is composed of three parts—for signification of which see legend of figure 42.

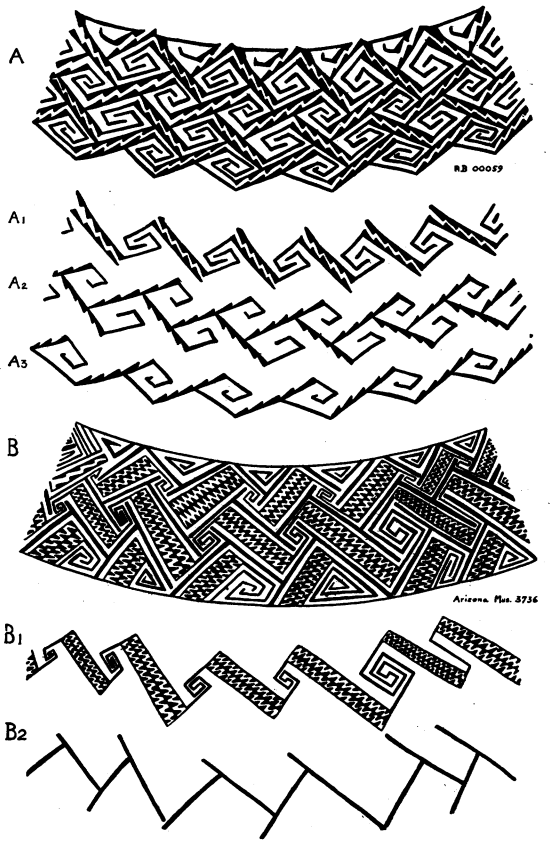


Fig. 46. Flagstaff and Transitional Black-on-white olla designs, with analytical breakdowns showing development of the layout. A is from Kaycuddie Canyon; B, from Tachini Point, near Kayenta. The original of B is in the Arizona State Museum, Tucson, Arizona, and is reproduced here by permission.

In addition to the clear-cut, easily definable designs described above, there were also vessels displaying Sosi designs with an admixture of other styles. Most of these designs were based upon lattice ruling of one kind or another. For the original layout of such designs, the area to be decorated was subdivided by lattice ruling done in single strokes, and the closed areas thus formed were filled alternately with solid color, producing a check design (fig. 29, *a, b, d;* fig. 28, *g*). Such checker work was also used (as in Kana-a style design) by itself in bands (fig. 29, *a, b, g, l*). Lattice work was drawn with horizontal, vertical, and slanting lines often used in the same area, thus producing a complicated pattern. Figure 35, *a* illustrates a bowl from Site RB 551 in which the layout and heavy dividing lines were executed in Sosi style, whereas the **S** figures filling the lunes were carried out in Dogoszhi hachure. Hachure was used in combination with solid black in nearly all the design patterns of this period. It was used both as the only type of filler in a design and in conjunction with solid black fillers. However, no examples were found of solid and hatched areas used as balancing elements in interlocking scroll and other designs, as they were used in some of the upper Little Colorado and Mimbres pottery.[82] Figure 35, *a* and *b* shows hatching used in typical Sosi-style patterns. Occasionally the hatched lines were wavy (fig. 31, *b, k, m*).

Summary.—In summary of the Pueblo II black-on-white pottery types found in Site RB 551, it may be well to emphasize again the extreme fluidity with which the mass of widely variable design was used. Black Mesa, Sosi, and Dogoszhi Black-on-whites have been sorted on this site solely by their design. Paste, color, and form, as far as we know, had the same range for all of them. Although bands of design recognizable as distinctive of each of these types were abundant, much of the material can be sorted only by drawing arbitrary lines between the "types." Furthermore, several vessels bore adjacent design bands done in the design characteristic of different "types." Thus, at Site RB 551, if the variability of Pueblo II black-on-white pottery design could be shown in a distribution curve, Black Mesa, Sosi, and Dogoszhi would show only as peaks amid a general mass of heterogeneous design. Each of these styles was an integrated system of design elements in a definite arrangement, drawn and ornamented in a definite manner. Elements and groups of elements from these styles were often mixed indiscriminately and other elements added in the decoration of a single piece of pottery.

Black Mesa Black-on-white, unmixed and coherent as it occurs at Site RB 1006, suggests itself as the prototype of the series of designs classified under the same name at Site RB 551. The Black Mesa Black-on-white of Site RB 1006 in our opinion constitutes a type in the usual sense of the word. Perhaps the Sosi and Dogoszhi designs found at RB 551 evolved from similar prototypes which we have not found in the Kayenta area. In seeking such prototypes, the Colorado drainage seems a likely origin of Sosi, the Chaco area of Dogoszhi designs. Although a considerable influence from the Mesa Verde area is suspected in the RB 551 design, our lack of familiarity with such material allows little definite comparison.

PUEBLO III

As a general rule, the paint of the Pueblo III black-on-white pottery was not so constant and deep in color as that of the preceding period, although there were striking exceptions. There was an advance in the execution of black linework; the thickness and spacing of lines were beautifully uniform. The designs became much more elaborate, and at the same time more closely limited by convention.

[82] Colton and Hargrave, pp. 240–241; Cosgrove, pls. 107 to 190; Gladwin, 1931, pls. 34, 36, 37; Kidder, 1924, pl. 44; Fewkes, 1924, figs. 70, 71, 72, 77, 78, 81, 88, 94.

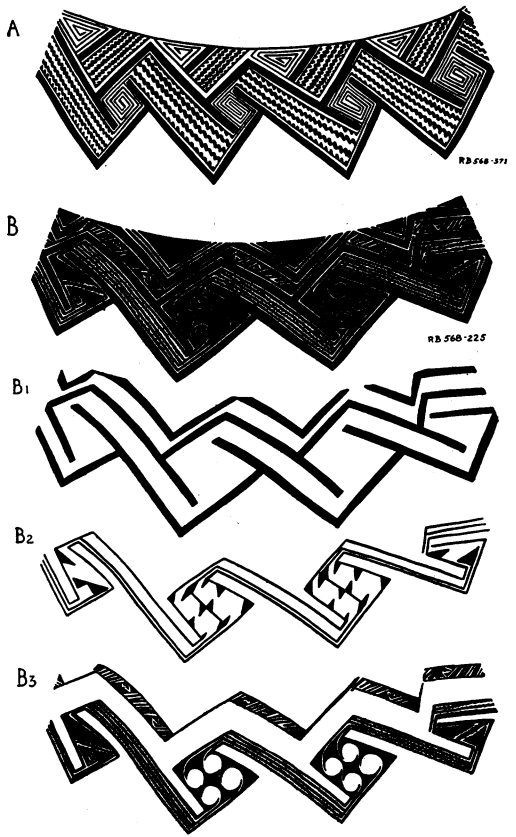


Fig. 47. Tusayan Black-on-white olla designs in diaper style. The analytical breakdown of B indicates the steps in laying out and building up the complete design.

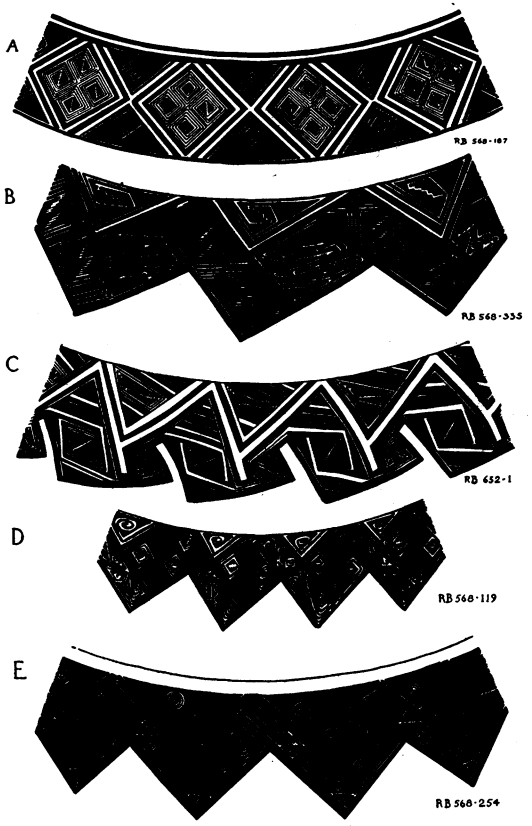


Fig. 48. Sites RB 568 and 632. A, B, and C are Kayenta Black-on-white olla designs. D and E are Tusayan Black-on-white.

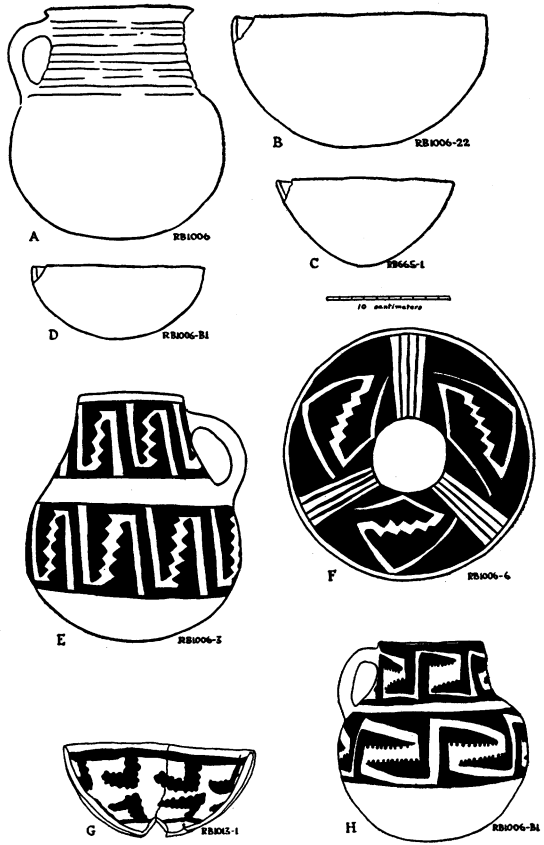


Fig. 49. A, Kana-a Gray pitcher; B, C, and D, Kana-a Black-on-white bowl shapes; E to H, Black Mesa Black-on-white pitchers and bowls.

General design description.—The method by which Pueblo III black-on-white could most easily be recognized in sherd collections containing Pueblo II material was by the relative proportion of black and white and their disposition in the design. White areas within the design were normally no wider than their neighboring black lines. These areas occurred in the form of straight, curved, or zigzag lines, or sometimes (in Kayenta Black-on-white) of small parallelograms. The width of the astonishingly evenly drawn black lines, which composed the main body of the design, ranged from 1.5 to 4 mm. The use of black-filled areas was common, as was the use of black bordering lines (Tusayan framers) of about 20 cm. width. These black bordering lines were sometimes accompanied by correspondingly wide white areas (fig. 48, *c*). The rule given above was not broken, however, and the white areas, though sometimes smaller, were never wider than the black lines which bordered them.

In the upper levels of Site RB 564 a few of the black-on-white sherds recovered were classified as of Pueblo III type by the foregoing criteria. These sherds all showed fine, even series of horizontal bands. The only recognizable design was a spurred triangle interlock like that shown in figure 43, *a*. The occasional occurrence of such banding (fig. 28, *m, n*) and of somewhat similar spurred interlocks (fig. 30, *b, c*) at Site RB 551 suggests that the black-on-white sherds classified as Pueblo III at Site RB 564 may actually have been nearly contemporaneous with Site RB 551 material. There was no evidence of the occurrence at Site RB 564 of black-on-white pottery bearing the elaborate enrichments and arrangements typical of Tusayan and Kayenta Black-on-whites.

The absence of definite Pueblo III black-on-white sherds in Site RB 564, supported by the material furnished in the survey (table 1), evidences the fact that the Pueblo III types, Tusayan Black-on-white and Kayenta Black-on-white, did not appear until a considerable time after the appearance of polychrome ware found here (tables 1 and 6).

Tusayan and Kayenta Black-on-whites were the distinctive Pueblo III types in the Kayenta region and comprised a majority of the white ware found at Site RB 568. The two types were closely related and their designs were limited by a logical and rigid series of conventions, a marked change from the fluidity of style characteristic of the Pueblo II black-on-white pattery of this area.

Tusayan Black-on-white.—The diagnostic feature of Tusayan Black-on-white was the use of characteristic types of either vertical ticking or of serration upon the facing sides of two or more black lines or areas. The vertical ticking (fig. 38, *d, k;* fig. 39, *a, f;* fig. 40, *e, j, l*) was relatively rare. It was done in a stroke about 2 mm. wide on a line which may be as wide as 20 mm. Serration was the commoner decorative feature. It was formed by the drawing of diagonal ticks through or abutting on the line which bore them. The appearance of this serration varied greatly, depending on the angle and spacing of the ticks and the occasional practice of connecting them into a zigzag by a light cross stroke of the brush. When most successfully executed, the serrations appeared to be right triangles with heavily rounded points, the altitude nearly the length of the base (fig. 36, *e, h, j;* fig. 38, *b*); when worst executed, they appeared as separated ticks (fig. 37, *a, e;* fig. 38, *d, k*). The lines bearing these serrations were usually thinner than the cross stroking, which averaged 4 mm. in width. Flagstaff Black-on-white, from which, we have reason to believe, Tusayan Black-on-white either evolved or at least received strong influences, utilized serrations in much the same manner as they were used in Tusayan Black-on-white design. Although some intergradation existed between Flagstaff and Tusayan serration, the Flagstaff serrations were usually much larger,

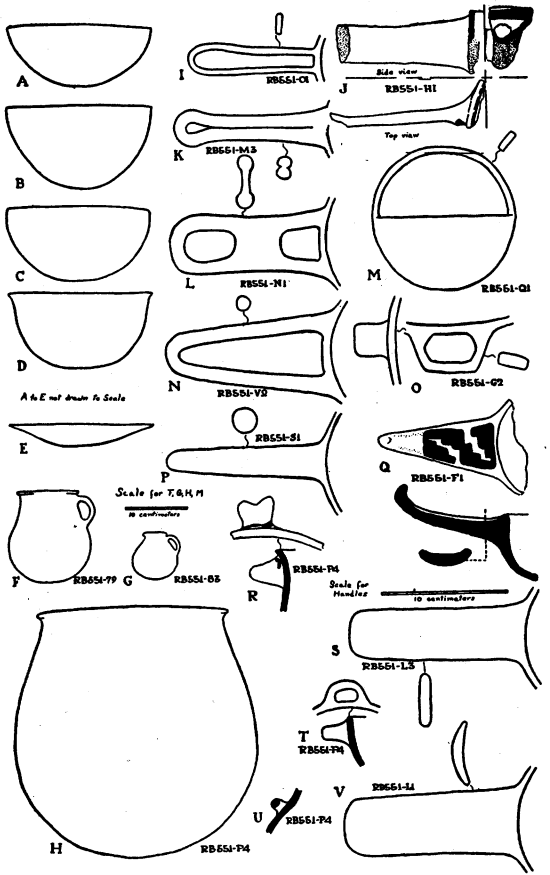


Fig. 50. Site RB 551. Typical vessel shapes and handles. F, G, and H are Tusayan Corrugated; others, black-on-white.

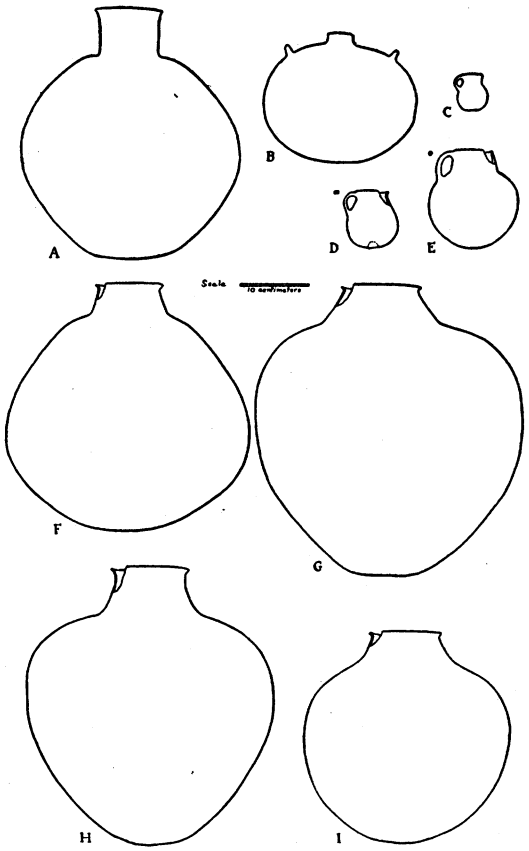


Fig. 51. Site RB 551. Sosi and Black Mesa Black-on-white olla shapes.

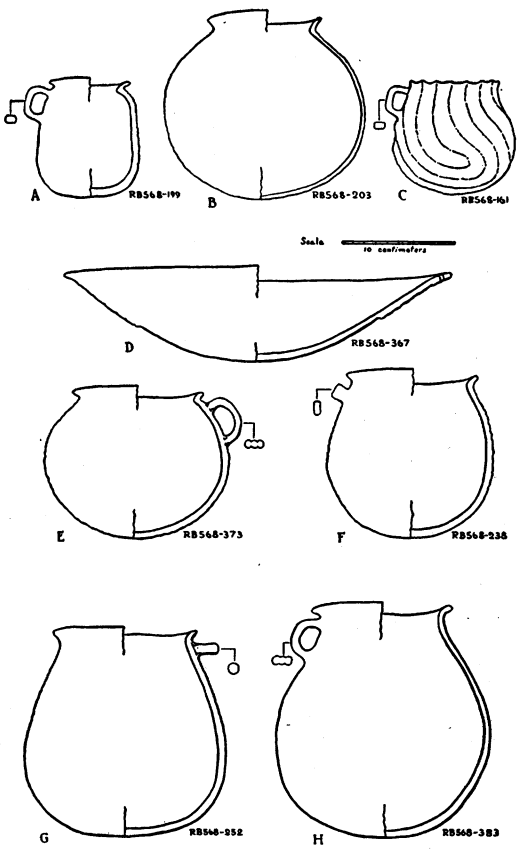


Fig. 52. Site RB 568. Typical Moenkopi Corrugated shapes. C is a unique piece formed by pinching out spiral ridges between the thumb and forefinger.

more pointed, and were made by filling in an outline rather than by single-stroke ticking (fig. 35, *e, f;* fig. 46, *a*).

Although the simple ticking was typologically precedent to triangular ticking in the Kayenta area, appearing in Pueblo I and II pottery, there seems no ground for inferring any chronological difference between the two styles as they occurred on Tusayan Black-on-white vessels. At any rate, both types were found in the same burials at Site RB 568 and sometimes even on the same vessel (fig. 39, *e, f*). The lower right-hand quadrant of figure 39, *e* actually displays both types on the same base line, clearly indicating the manner in which one style metamorphoses into another.

Kayenta Black-on-white.—Kayenta Black-on-white was distinguished by the use of a fine, evenly spaced series of horizontal lines upon which the design was produced by filling in certain of the spaces between the lines (figs. 40, *g, k;* 45, *c;* 48, *b*). This method of design construction seems correlated with certain other features as late Pueblo III developments in black-on-white pottery. A fuller discussion is given later (p. 121). Because the same design layouts were used for both Tusayan and Kayenta Black-on-whites, they have been considered together in the following discussion.

Layouts.—Several design layouts were used in Pueblo III Black-on-white, all, however, employing the same characteristic elements and motifs and executed in the same manner. Despite their superficial appearance of variety, they were all clearly part of the same decorative tradition, obviously different from anything that had preceded them in the Tsegi region and from contemporary pottery in other regions.

Band.—The simplest of these layouts, and the one most nearly reminiscent of black-on-white decoration during earlier periods, was the horizontal band used mostly on bowls, seed jars, and smaller ollas. The bands were broad, covering usually at least half the entire available surface of the vessel and, except rarely, the arrangement of elements within them was continuous and not broken up into panels. In this regard, as well as in the type of symmetry and elements used, these designs followed the general tradition of Kana-a and Sosi Black-on-white meander designs.

Within the area of the band, several parallel horizontal lines were often drawn, enriched by ticking or serration, with the enrichment on both sides of the line in bifold rotational symmetry.[88] When the serration was used in this manner, the original line was usually obscured by the triangles, giving the effect of a fine zigzag or a sawtooth line (figs. 36, *h–j;* 38, *b, e, f, j;* 39; 40, *h*). Subdivided bands, both checkered and paneled, were rare. Examples are shown in figures 24, *r* and 36, *a, d*. These are in the Tusayan tradition, although figure 36, *d* is somewhat reminiscent of Sosi Black-on-white in its use of angular, heavy scrolls of "Sosi-style" lines, and in the large amount of white left in the design area.

Interlocking Spurred Triangles: Interlocking designs in running bands were common. A series of them is shown in figures 42 to 45, dissected to indicate their elements and sometimes to emphasize the "negative" or white pattern. In all these examples, the black part of the designs shows coherence and logic in form, whereas the white areas, conspicuous as they seem, are merely the background spaces. For this reason these should not be designated as true "negative design," designs where the primary emphasis and structural coherence belong to the unpainted areas.

A remarkable feature of the Pueblo III black-on-white group of designs is the variety attained under a rigid convention. All the designs shown in figures 42 to 45

[88] At no time in the Tsegi region was the broken "life-line" used, as in the Little Colorado drainage. Fewkes, 1919, p. 270, figs. 104, 106; Bunzel, pp. 38, 69.

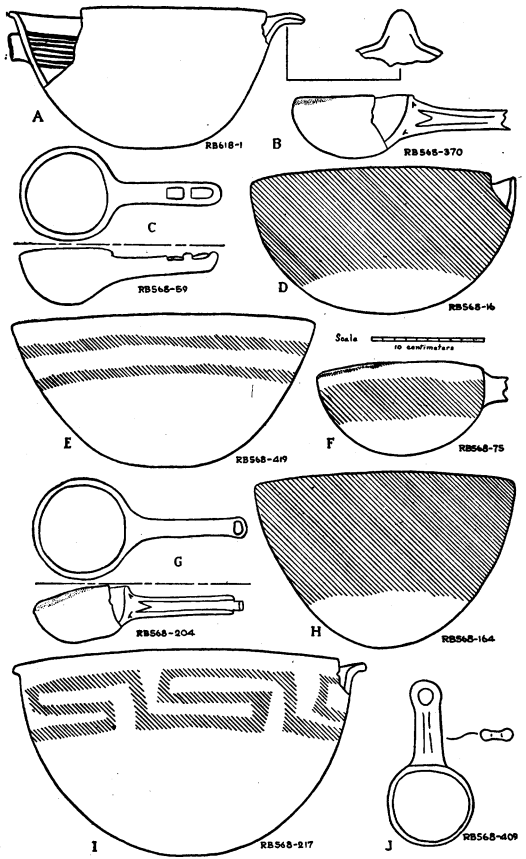


Fig. 53. Sites RB 568, 618. Typical Pueblo III orange-ware bowl and dipper shapes. A and B are Tsegi Black-on-orange; C is Tsegi Orange; all others are polychromes. Shading indicates the red-painted exterior decoration.

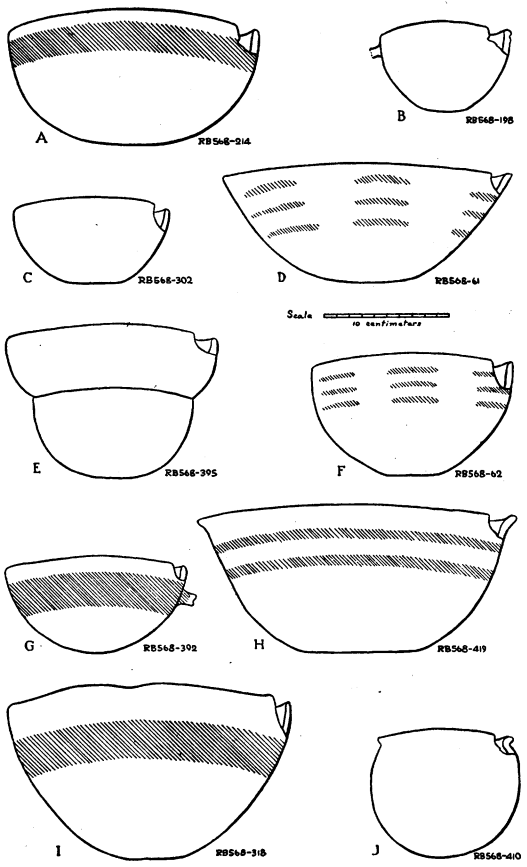


Fig. 54. Site RB 568. Typical shapes of Tsegi Orange-ware bowls. Shading indicates the red-painted exterior decoration; all unshaded surfaces are orange.

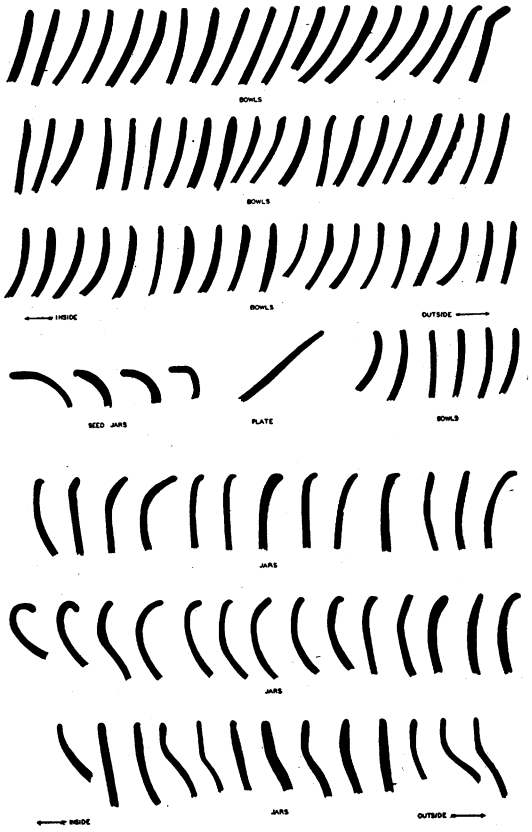


Fig. 55. Site RB 551. Typical rim profiles from Pueblo II black-on-white vessels, showing the great variety found.

had the same form of rotational symmetry. The element around which they were formed was in all cases a type of hooked triangle. Occasionally extra lines were added between triangles (figs. 42, *d, e;* 43, *d–h;* 44, *c;* 45, *c*); sometimes these lines joined two alternate triangles, forming an **S** interlocking with similar figures to each side (fig. 43, *d, f*). At other times the pair of triangles and its diagonal remained separate (fig. 43, *e, g*), leaving the concept of the **S** merely implied. The broken border line of figure 45, *c* evidences the careful planning underlying the more intricate designs. If the border lines had not been broken, the design would not have had an interlocking **S**. The break shown by an arrow in the illustration had been carelessly painted in, then scraped off later. The other breaks in the three-repeat band had been drawn correctly in the original painting.

Most of the hooked triangles of these designs were of essentially the same shape as their Pueblo I prototype, with its simple spur prolonged into an inward-facing scroll. Variations were introduced by means of angular or curvilinear scrolls, the use of a key figure at the inner extremity of the scroll, and in the shape and ornamentation of the triangle. Tusayan serration was usually applied to the hypotenuses of the triangles that were attached to the ends of the **S**, and the hypotenuse was usually, though not always, diagonal to the direction of the band. Figures 42, *a, e* and 44, *d* are the exceptions. Figure 44, *c* is unique. The triangles in figure 45, *a* are of peculiar interest in their similarity to Pueblo IV "bird figures" occurring on pottery of the Rio Grande drainage.[84] Figure 45, *b* shows a design unique in its diagonal arrangement of the pendent triangle. The triangles of this design also had a foot (as in fig. 45, *a*) and an elaborately convoluted spur.

An unusual band design is shown in figure 36, *d*, in which the even proportion of black to white, and the drawing of the scrolls and keys would allow it to be classified as Sosi style but for the presence of Tusayan serration surrounded by diaper-shaped, heavy-line framers. Other reminders of the persistence of Pueblo II decorative characteristics are shown in figure 36, *a* and *h*, in each of which a narrow band of meshing heavy triangles was painted above the more characteristically Pueblo III Tusayan-style bands below.

Diaper.—Most of the distinctive designs of Tusayan and Kayenta Black-on-white were based on two layouts. Offset quartered layouts, occasionally containing three instead of four offset triangles, were used on bowl interiors. Diaper layouts were used on the exteriors of large ollas, seed jars, and on the interior of one bowl.

Developmental Sequence: Large ollas present the most elaborate design of Pueblo III. Figures 46 to 48 show series of designs from such ollas, suggestive of the manner in which evolution of design may have developed from the Flagstaff interlocking **S** style of Pueblo II to the designs made at the end of Pueblo III in the Kayenta area.

Figure 46, *a* is a fine example of Flagstaff Black-on-white. The original was found in Kaycuddie Canyon, unassociated with any site, but its form and surface appearance clearly define its type. This design, as well as several of the following, has been dissected to show its elementary parts, parts which the complexity of the finished design tends to conceal. It will be observed that the design is of an interlocking **S** construction with fourfold rotational symmetry (fig. 46, *a1*). The two scrolls of the **S** are not actually connected in the stalk, but the interlocking serrations give coherence to the **S** figure. The last two dissections show the **S** figures unmeshed, the connections between rows of **S** figures remaining. The fourfold symmetry of this design makes it applicable to all-over decoration as applied in figure 27, *h*.

[84] Fewkes, 1919, pp. 233–236; Mera.

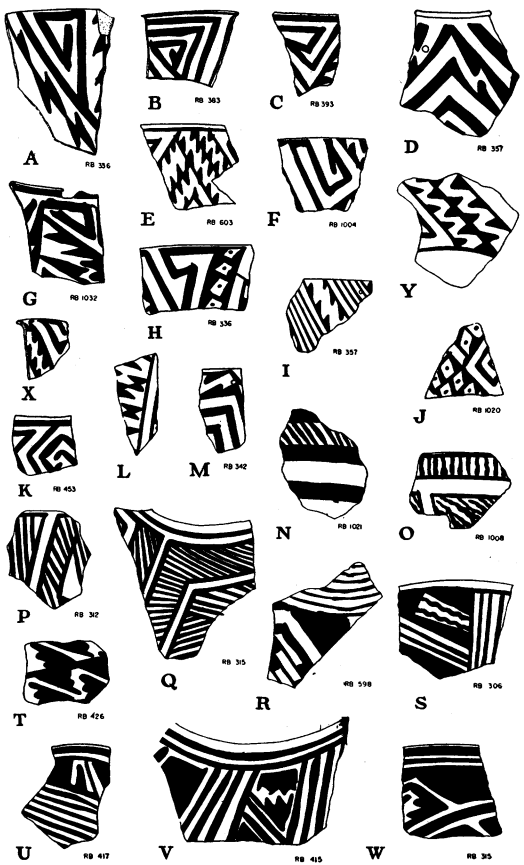


Fig. 56. Miscellaneous black-on-white sherds from various Pueblo II sites in the Tsegi canyons, showing unusual decorative features which are not entirely typical of any of the traditional design styles of the region.

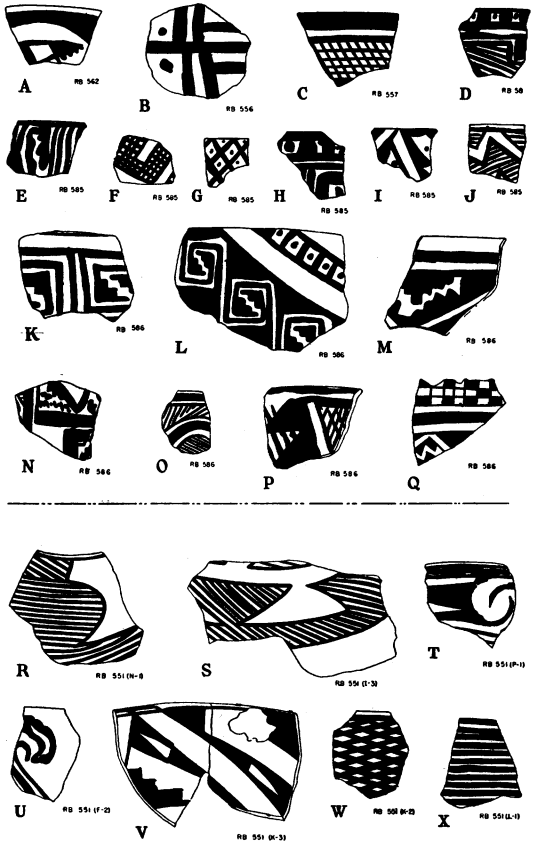


Fig. 57. A to Q, miscellaneous black-on-white sherds from various sites on the northern part of Black Mesa; R to X, Tusayan Black-on-red sherds from Site RB 551.

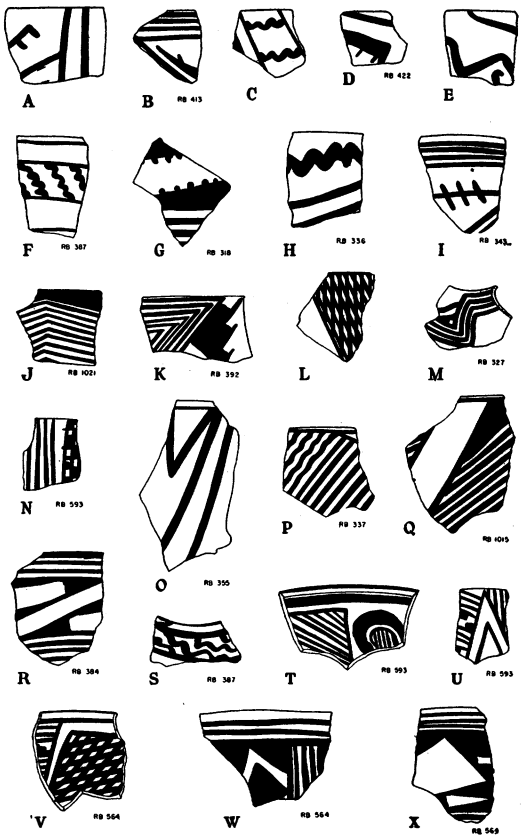


Fig. 58. A to S, miscellaneous Deadmans Black-on-red sherds from various sites in the Tsegi canyons; T to X, Tusayan Black-on-red sherds from sites in Marsh Pass.

Figure 46, *b* shows an olla design from a Pueblo III cemetery at Tachini Point, above Kayenta, on the rim of Black Mesa. Accompanying vessels from this cemetery suggest that it dates slightly earlier than Site RB 568. This specimen is in the Arizona State Museum and has been illustrated in an earlier publication.[85] On this olla the rows of interlocking **S** figures were separated (as is shown in the first dissection in figure 46, *b1*) and a zigzag with projections (46, *b2*), much like that shown in figure 46, *a2*, was introduced between the neighboring rows of **S** figures. This zigzag was drawn in a heavier line than the rest of the design, the stalks of the **S** figures were joined, a central and doubly serrated line was introduced, and the serrations were smaller than in most examples of Flagstaff Black-on-white. Both designs in figure 46, *a* and *b* were bordered by banding lines at the top: only *b* has a banding line at the bottom.

The design shown in figure 47, *a* was painted in a diaper pattern in typical Tusayan style. The basic similarity in layout to that of Flagstaff style is evident, though this vessel had four **S** figures instead of six as in figure 46, *a* and *b*.

The difference in layout between Flagstaff- and Tusayan-style designs lies primarily in the symmetry, which was fourfold rotational in Flagstaff, twofold rotational in Tusayan. Correlated with this symmetry difference was the presence of heavy framing lines in Tusayan style. These bordered the single zigzag band of interlocking **S** figures running around the pot and framed, as well, the isolated panels and triangular areas surrounding the orifice. These lines were usually 15–20 mm. wide, in marked contrast to the 4–5 mm. width of the other lines of the design (figs. 46, *b;* 47, *a, b;* 48, *b–e*). These framers were arranged like facing rows of simple spurred triangles in twofold rotational symmetry (fig. 47, *b*), and hence are in the stylistic line of descent from the spurred triangles of the Kayenta area Pueblo I designs. The white meander remaining between these two facing Tusayan framers consists of long panels in the areas bounded by the "backs" of the spurred triangles, connecting with squarish panels in the areas bounded by opposing spurs.

The stylistic position of the design shown in figure 46, *b* between the simple Tusayan style shown by 47, *a* and the Pueblo II Flagstaff style shown in figure 46, *a* seems indisputable in several respects:

1. Figure 46, *a* has six horizontal repeats, 46, *b* six repeats, 47, *a* four.
2. Number of vertical repeats on 46, *b* is between the number on 46, *a* and 47, *a*.
3. **S** stalks in 46, *a* have two elements, in 46, *b* three, and in 47, *a* four.
4. Size and type of serration in 46, *b* are intermediate between 46, *a* and 47, *a*.
5. Figure 46, *a* does not have Tusayan framers, 46, *b* has thin, irregularly drawn framers, 47, *a* has thick, standard Tusayan framers.

Range of Variability: The design shown in figure 47, *a* was stylistically the closest to Flagstaff Black-on-white of any in our Tusayan Black-on-white series, although we have no evidence that it was earlier than several of our other specimens which ranged further from Flagstaff style.[86] The variation in the series from the design shown in figure 47, *a* was due chiefly to the variety of fillers substituted for the stalk of the **S** in the series of long design panels, and for interlocking scrolls in the squarish panels. In spite of this apparent diversity, there remained a tendency to adhere to the original interlocking **S** pattern. This showed in the invariable connecting lines joining the panel fillers, and in the choice of fillers for the two types of panel. There was a tendency for the squarish panels to be filled with scrolls (figs. 36, *e;* 47, *b;* 48, *e*), although this was not invariable (exceptions are figs. 48, *c;* 41, *a*). There was a great variety in the fillers of the long panels; but it was

[85] Clarke, pl. 12.

[86] Guernsey (p. 65), shows an example of Flagstaff style of decoration, although the vessel was probably not technically Flagstaff Black-on-white.

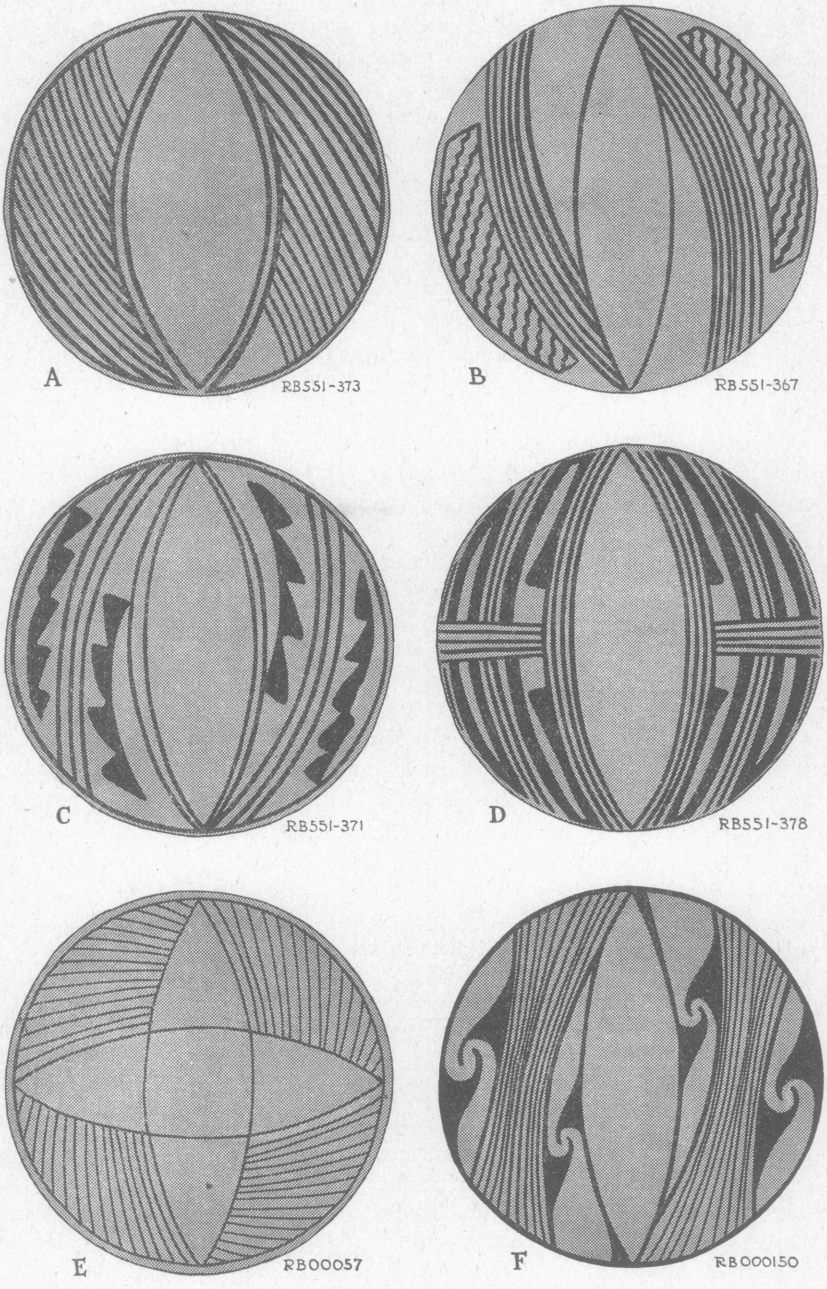


Fig. 59. Black-on-red bowls from Site RB 551 and various sites in the Tsegi canyons.

generally true that these panels were filled with running band designs (figs. 36, *e;* 47, *b;* 48, *d, e*) or with designs easily adaptable to a running band. Less commonly the long panels were filled in a manner that had little inherent appropriateness to the shape of the panel (fig. 48, *b, c*). The most ingenious feature of these panel fillers was the means of interconnection employed between the panels. All the panels were connected by single-stroke lines that were continuations of the outer lines of the panel fillers, from which the spurred triangles and other devices that filled the panels were pendent. The result was a series of continuous line meanders surrounding the pot. When this convention was followed most rigorously, the meander consisted of a running design the structural lines of which were continuous around the vessel. Figure 48, *e* is an example of such rigorous construction and was by all other criteria the finest specimen from a technical standpoint obtained from this area. The upper and lower bordering lines of the panel fillers were continuous, while all the area of the panels was filled with pendent enrichments.

In most specimens the layouts of this meander were not so logically constructed. As a general rule, poor design was correlated with other signs of poor craftsmanship. Figure 47, *a* exemplifies a commonly occurring departure from the simple meander: two lines are carried over between panels, the outer of which is simply carried around two sides of the square panel, the inner forming the rectangular interlocking scroll. In figure 47, *b* a different problem is presented. The quadruple scroll panels have two borders and a central structural line from which the middle part of the design is pendent. The problem of the disposition of these lines was neatly solved by carrying through all three lines to the adjacent long panels as the second dissection of this figure shows (fig. 47, *b2*). The same problem is presented in figure 48, *b* and *e*. In 48, *b* no attempt was made to carry the three lines through the long panels, but in 48, *e* they were worked into a clever interlock running band. Figure 48, *b* exhibits an intricate design pendent from four continuous banding lines. The relationship between this design and that on the band design shown in figure 44 shows how closely the design repertory was limited, and how ingeniously it was adapted to various layouts. The large olla in figure 41, *b* shows adaptation of the running line-enrichment system, characteristic of the diaper patterns, into a band design. Figure 49, *a* is unique in its layout of diamond-shaped panels set into a band. It will be noticed, however, that in each panel the four rectangular interlocking scrolls form a single line, broken only at the interlocking central keys.

All but one jar done in diaper style had four repetitions of the motif; figure 48, *b* had only three. Most of the designs showed compression in at least one panel owing to inaccurate spacing of the layout. Figures 47, *b* and 48, *a* and *b* are examples. In figure 47, *b* two square panels have one structural line omitted, are smaller, and were done in a different pattern from the two larger quadruple scroll panels.

Offset-Segmented.—Most of the Pueblo III black-on-white bowls and dippers were decorated in a form of either a diaper or a woven pattern wherein the entire inner design was divided into three or four segments.

Developmental Sequence: It seems plausible that the bar and scroll designs with four segments may have originated from Flagstaff interlock-**S** designs, although intermediate steps do not show such well-documented chronological and intercorrelated style developments as does the corresponding jar series (p. 113). Such a series could be formed, running figures 35, *f* to 35, *e* to 39, *c*. Changes somewhat parallel to those of the jar series mentioned above are easily seen:

1. Figure 35, *f* has six repeats, 35, *e* four, 39, *c* four (35, *e* and 39, *c* are quartered).
2. Size and type of serration is Flagstaff in 35, *e* and 35, *f*, Tusayan in 39, *c*.
3. Although figure 35, *e* and *f* shows no sign of Tusayan framers, the extra thickness of line on the **S** bars of 35, *e* emphasizes the offset quartered layout which has been further strengthened by Tusayan framers in figure 39, *c*.

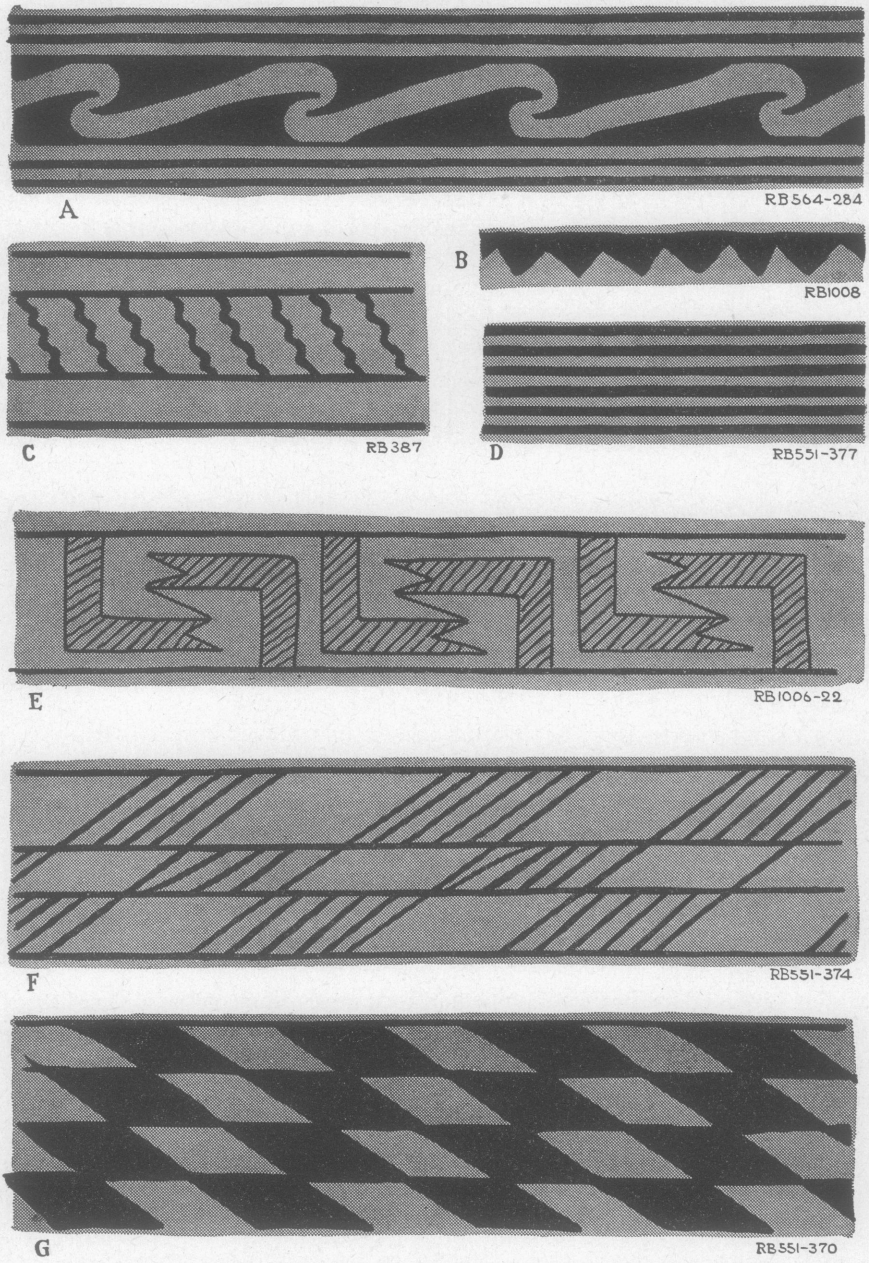


Fig. 60. Black-on-red border designs from Site RB 551 and various sites in the Tsegi canyons.

An additional degeneration from Flagstaff style not found in the jars is evidenced by the fact that, while Flagstaff designs both on jars and bowls were either clearly interlock-**S** pattern (see fig. 46, *a*) or were debasements clearly deriving from such patterns (as fig. 35, *f*), such derivation has become much obscured in figure 35, *e* and figure 39, *c* by disarrangement of the connections between stalks and scroll interlocks (fig. 35, *f*), followed by the substitution of single scrolls, for the more complicated interlocking scrolls of the interlock-**S** pattern. It may be noted here that a similar use of disconnected scrolls and bars occurred in offset quartered Hohokam bowl designs[87] as well as in diaper-pattern jars found in the same horizon.

Range of Variability: However the offset quartered layout may have been evolved, it was followed in designs using a wide variety of arrangements as fillers. There is a marked tendency in these designs toward the use of two patterns in alternate quadrants (fig. 39, *a, e, f;* fig. 70, *g*). That the offset quartered layout is not the only way of adapting interlock-**S** designs to bowl interiors is demonstrated by figure 27, *h,* with an all-over pattern, and by figure 38, *f,* which bears a diaper pattern like that shown on the jars.

The bowls illustrated in figure 39, *e, f* and plate 23, *c, d* show the use of Tusayan elements as bands in the offset quartered arrangement. The bowls in figures 37, *a, b* and 39, *a,* however, differ in that the heavy framing lines were omitted. These vessels, especially figure 39, *a,* suggest the style of Sosi Black-on-white. The use of triangular scrolls terminating in solid black elements in figures 37, *a* and 39, *a* is reminiscent of the Sosi-style bowls shown in figure 26, and suggests the possibility that the woven or braided pattern of these Pueblo III vessels may have been influenced by the orange-peel layouts of Pueblo II.

Miscellaneous bowl layouts.—The interiors of other Tusayan bowls were decorated with a conventional horizontal band, exactly in the manner of some ollas (fig. 38, *a, d, j, k*). The all-over scrolls of figure 37, *c,* the combination of cross and concentric circles shown in figure 35, *d,* and the very effective variant of the diaper style of figure 37, *i* were unique.

In another unique bowl (fig. 35, *c*) a typical Dogoszhi style meander was employed in combination with Tusayan serration. This vessel only serves to emphasize the fact that definitive separation of types on the basis of single elements can lead to erroneous inferences, and would make impossible the classification of such pieces as this. Another example of the existence of Dogoszhi Black-on-white in early Pueblo III times is the small pitcher shown in figure 37, *d,* recovered from burial 46 at Site RB 568.

Relations with Hohokam.—Any systematic presentation of a sequence of designs may, by its arrangement, lead to a false implication of chronological development, but the fact that the series of changes in design given here is well documented chronologically, at least in its general outlines, renders the sequence of much greater significance than it would be if the chronological hypothesis were based on a purely stylistic arrangement.

As a corollary to the discussion of the series described above, an enticing hypothesis presents itself, and is advanced with due trepidation; thorough investigation of it is beyond the scope of this paper. The Flagstaff-style interlock-**S** design is undoubtedly a product of the Pueblo pottery tradition, and Pueblo III diaper-pattern designs in the Tsegi area probably evolved from Flagstaff style. Beginning in the Sacaton phase of Red-on-buff Hohokam pottery, diaper patterns suddenly appeared, showing a sharp contrast to the preceding naturalistic, all-over patterns of

[87] Amsden, figs. 3; 5, *b;* 6, *b;* 7.

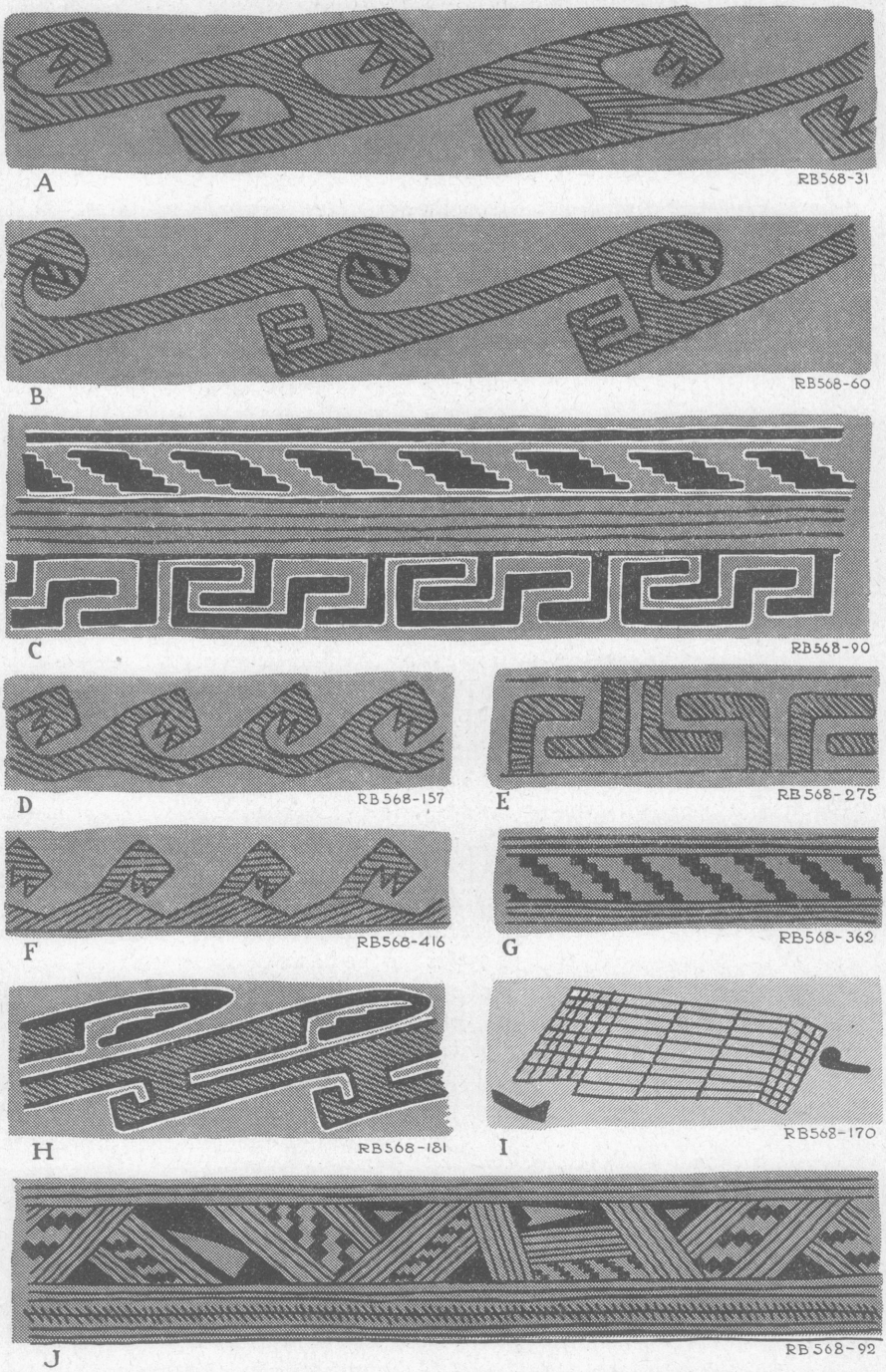


Fig. 61. Site RB 568. Pueblo III orange-ware border designs. I is Tsegi Black-on-orange. The others are Tusayan Black-on-red and Kiet Siel Polychrome.

earlier Hohokam phases.[88] These Hohokam diaper designs are markedly like Tusayan style patterns in arrangement, showing even more strongly several features which are suggestive of decadence from the original Flagstaff patterns, such as displacement of pendent scrolls from their related stalks and the indiscriminate use of unrelated scrolls in filling any vacant area in the design. In addition, round scrolls, filled in with paint to leave narrow white lines, consolidated and bordered **S** stalks, and other elements not found in Flagstaff style but found on the later Tusayan vessels occur on this Hohokam pottery. The probability of a direct influence of Tusayan style of design on the Hohokam, or vice versa, may be considered slight because of the distance and of the absence of trade fragments found in excavated sites. It seems very possible, however, that the Sacaton phase of Hohokam culture was later than 1100 A.D.[89] This was about the time that Flagstaff Black-on-white probably flourished, for sherds of it were found at Site RB 551 (p. 57).[90] In the Tsegi region, Tusayan Black-on-white, the pottery bearing designs most closely comparable to the Hohokan Sacaton style was made at about 1200 A.D. and later. The relationship, if any, between Hohokam and Pueblo III in the Tsegi is certainly tenuous, but that it may exist is at least suggested by the objective factors referred to. On the other hand, a common origin in pottery of the centrally located Flagstaff area seems a logical hypothesis.

Chronological criteria.—In addition to the design sequences above described, later changes in the design of this pottery may be indicated. Several of the burials at Site RB 568 had been exposed by wind action before excavation. All sherds recovered in the loose sand were saved, and it proved possible to reconstruct a number of vessels from them. Several of these vessels bore designs not present on vessels associated with burials, and there is some reason to believe them later (p. 86). Further evidence of the lateness of these designs is their presence on nearly all of the museum pieces from late Pueblo III cave ruins of this area.

The small jar shown in figure 40, *f* and a bowl bearing the design shown in figure 45, *b* were among these vessels. In these designs the black lines were conspicuously wider than the white intervals between them (about 2½ to 1). The line execution was extremely careful, and the pottery was dead white with a fine, chinalike texture.

Another jar with the texture described above had the characteristic interlock-**S** design on a surface which was previously ruled with thin horizontal encircling lines (thickness *ca.* 2 mm.) with spacing between the lines a little wider than the lines themselves (figs. 40, *g;* 45, *c;* pl. 24, *e*). The design was then superimposed over the narrow parallel ruling, and all horizontal members of the superimposed design were formed by filling in the white space between two of the narrow ruled lines. The net result was to make the width of lines about three times as great as that of the unpainted white intervals; this was approximately the same ratio as in the two vessels referred to in the preceding paragraph. This same procedure was followed in the long panels of figure 48, *b,* which comes from a vessel also found in a blown-out grave at Site RB 568. The small mug shown in figure 40, *k* was painted by the same technique and was made of the same white, fine-textured material. It was found in a cliff ruin in the Tsegi Canyon. The olla shown in figure 48, *b,* which came from a partly blown-out grave, also shows preliminary ruling before the designs in the long panels were drawn. This vessel does not have the chinalike, even texture of the aforementioned vessels. This so-called mosquito-bar or lacework design is the determinant of Kayenta Black-on-white, which is nearly universally

[88] Haury, p. 175 and pls CXLIII, CXLIV, CXLV; Amsden, fig. 3.

[89] Haury, pp. 177–178; figs. 105, 106. The date of 900 to 1100 assigned to the Sacaton phase in the Snaketown report is inferential only and may be revised to place that phase somewhat later.

[90] McGregor, 1938, p. 14.

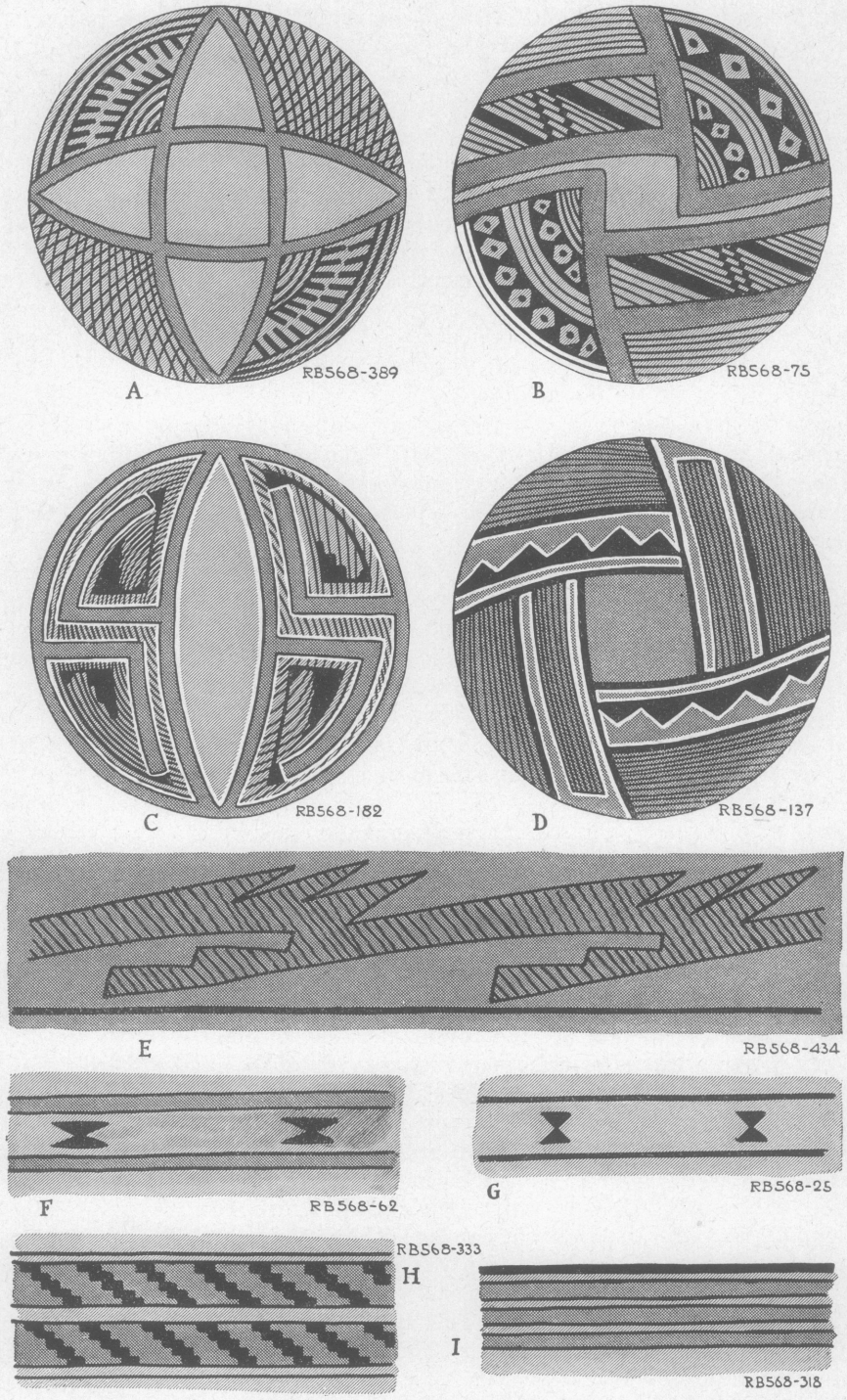


Fig. 62. Site RB 568. Tsegi Orange-ware bowls: A, B, F, H, I, Tusayan Polychrome; C, Kayenta Polychrome; D, Kiet Siel Polychrome; E, Tusayan Black-on-red; G, Tsegi Black-on-orange.

used on vessels taken from Pueblo III cliff ruins of this region. Most of such ruins in the Kayenta country, dated by dendrochronology, were occupied in the latter half of the thirteenth century.

An olla from a blown-out burial at Site RB 568, which remains unrestored, had the same style of design, and what may be called a "negative Tusayan framer." The characteristic framer was left in white, bordered by a black line of the regular framing width of about 20 mm. The ollas illustrated in figure 48, *e* and plate 26, *b* have the same feature, as did other specimens which have not been illustrated. This feature, as well as mosquito-bar work, is characteristic of the cliff-ruin ollas mentioned above, and thus is probably later than the Tusayan style so abundant at Site RB 568.

It has been possible to isolate certain other elements and decorative schemes of late appearance by comparison of the material from Site RB 568 with a series of designs drawn from black-on-white sherds from Betatakin, made available by John Wetherill, custodian of Navajo National Monument. Among the most striking of these was the use in the later pottery of a balancing of black and white areas of equal size and shape on the opposing sides of panels in designs having twofold rotational symmetry, instead of balancing two black areas in the same manner. The latter method was used in nearly all the earlier Pueblo III designs having this arrangement. One example of this late trait occurred on a bowl from Site RB 568 in a checker design (fig. 39, *f*), and in the mosquito-bar design on a ladle associated with other late pottery in a cliff granary in Tsegi Canyon (fig. 37, *g*). On the Betatakin pottery this balanced black-and-white design was applied to many of the more complex interlock patterns. Another feature characteristic of this late pottery is the use of mirror symmetry in panels, a nonexistent feature in black-on-white pottery from Site RB 568. This relatively late, finely executed pottery falls within the description of Kayenta Black-on-white as formulated previously,[91] and the data given here are intended as an amplification thereof. Colton and Hargrave also have named Betatakin Black-on-white, but it has not seemed a useful category and has been disregarded in this study.

Summary.—As has been pointed out in this section, the black-on-white pottery design of Pueblo III times in the Kayenta area is both rich and closely limited by a single group of conventions. Its basis in designs composed of interlocking **S** figures with serrated stalks seems clear, and the more general aspects of its variations from that source, both in arrangement and in the drawing of the decorative elements used, have been documented chronologically. The tremendous superficial change between the parent interlock-**S** designs and their varied progeny is attained almost entirely by the addition of enrichments in the form of scrolls and stepped triangles, always arranged in bifold rotational symmetry, and always pendent from the original **S**-interlock meander.

More accurate work on the Pueblo III black-on-white pottery of this area should be well repaid; in addition to the design differences noted above, three temper groups have been isolated by microscopic work on the pottery—sherd, quartz, and tuff—which may well correlate in an illuminating manner with the design. Such a wide variety and rapid change in the pottery industry bears out the evidence of architectural variety (the difference in kivas at Betatakin and Kiet Siel, for example), and may present a method of solving the history of the last, probably hectic, years of occupation in the Tsegi region.

[91] Colton and Hargrave, p. 217.

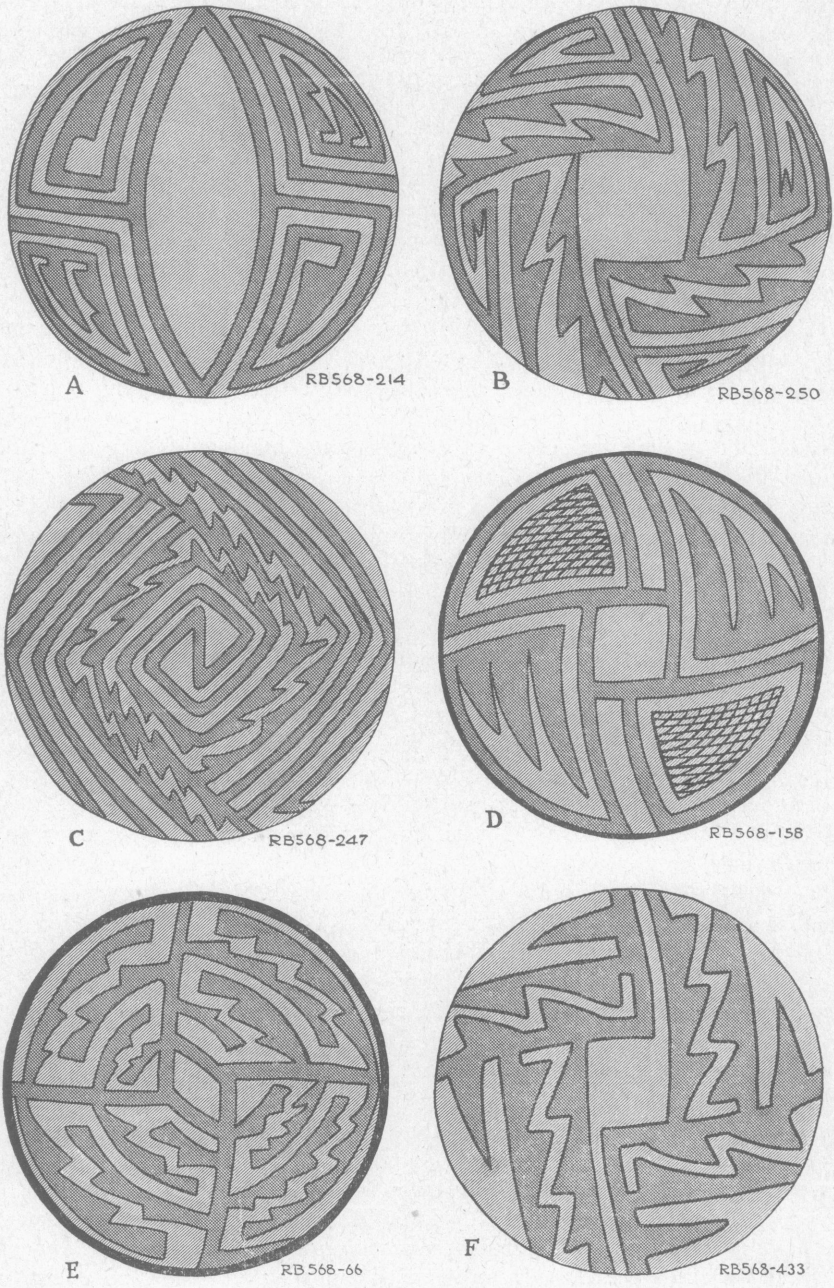


Fig. 63. Site RB 568. Tusayan Polychrome bowls.

Orange Ware

Early

The pottery of the Kayenta region made on a base of orange or buff clay may be classified into two major groupings. The first was a ware current in small percentages during Pueblo I times. Its relatively small frequency, coupled with the facts that at least part of it was tempered with dark igneous rock and that brilliantly reflecting specks appear on its surface, both unique features in pottery of this vicinity, suggest that it was imported. This ware has been named Deadmans Black-on-red[92] and was characteristic of Pueblo I in the area. The investigations of Kidder and Guernsey[93] provide some data on its general character, and the small amount recovered by the Expedition does not warrant any additional comment upon it. Sherds were found in insufficient numbers and in too small sizes to permit of significant design study.

It is not known at what time Deadmans Black-on-red disappeared from the region, but a suggestion is given by the stratigraphic position of the type in Site RB 551 (table 4). This pottery seems to have disappeared slightly before Kana-a Black-on-white disappeared, and was replaced by a new kind of orange ware which continued, decorated in various manners, through Pueblo III. This ware has been called Tsegi Orange ware[94] and has been subdivided into several types on the basis of the painted decoration applied to it. It is doubtful whether all these types are valid or useful as indicators of spatial or chronological distribution, but for ease of reference the terminology will be retained herein. In the discussion of decoration that follows, however, the features of all types will be considered together as parts of a closely integrated decorative tradition.

Pueblo II orange ware was normally decorated by a red slip which covered the bowls completely except for the outside bottom, and the exterior of jars except the base. This slip was often discolored, especially on the outside of vessels, to a sooty blackish color or, more rarely, to a russet brown. Upon this slip designs were drawn in black paint with a line somewhat thinner than that used on the contemporary Black Mesa or Sosi Black-on-white. Figures 59 and 60 show some of these designs, classified as Tusayan Black-on-red.

The discussion of design in the early periods is somewhat hampered by the paucity of examples available. That hatched areas appeared early is suggested by figure 60, *e* from Site RB 1006, which was occupied in late Pueblo I and early Pueblo II. The design shown in figure 60, *c* is also found on Tusayan Black-on-red from the same site as well as in others of that horizon. The name Medicine Black-on-red[95] has been used to designate another type differentiated from Tusayan Black-on-red, but the alleged differences were not apparent or significant with reference to the material in hand, and sherds of the two types were considered together in this study.

Tusayan Black-on-red from Site RB 551 was decorated with band designs of various sorts (fig. 60, *d, f, g*) which closely approximated the black-on-white design of the same period as used on Black Mesa and Sosi Black-on-white (figs. 28, 30, 31). In addition, there was evidence of the widespread use of "orange peel" layouts such as were found on the contemporary white ware from the site (fig. 59, *a–d*). Figure 59, *b* is doubtless from the same period, although it was found in the San Juan River canyon west of the Tsegi area. Figure 59, *e* is from the Tsegi Canyon. No decision is possible concerning the relative precedence in the appearance of this layout on the red-slipped and white-slipped pottery. Certainly the designs used on

[92] Colton and Hargrave, p. 71.
[93] Kidder and Guernsey, p. 135.
[94] Colton and Hargrave, p. 92.
[95] Colton and Hargrave, p. 72.

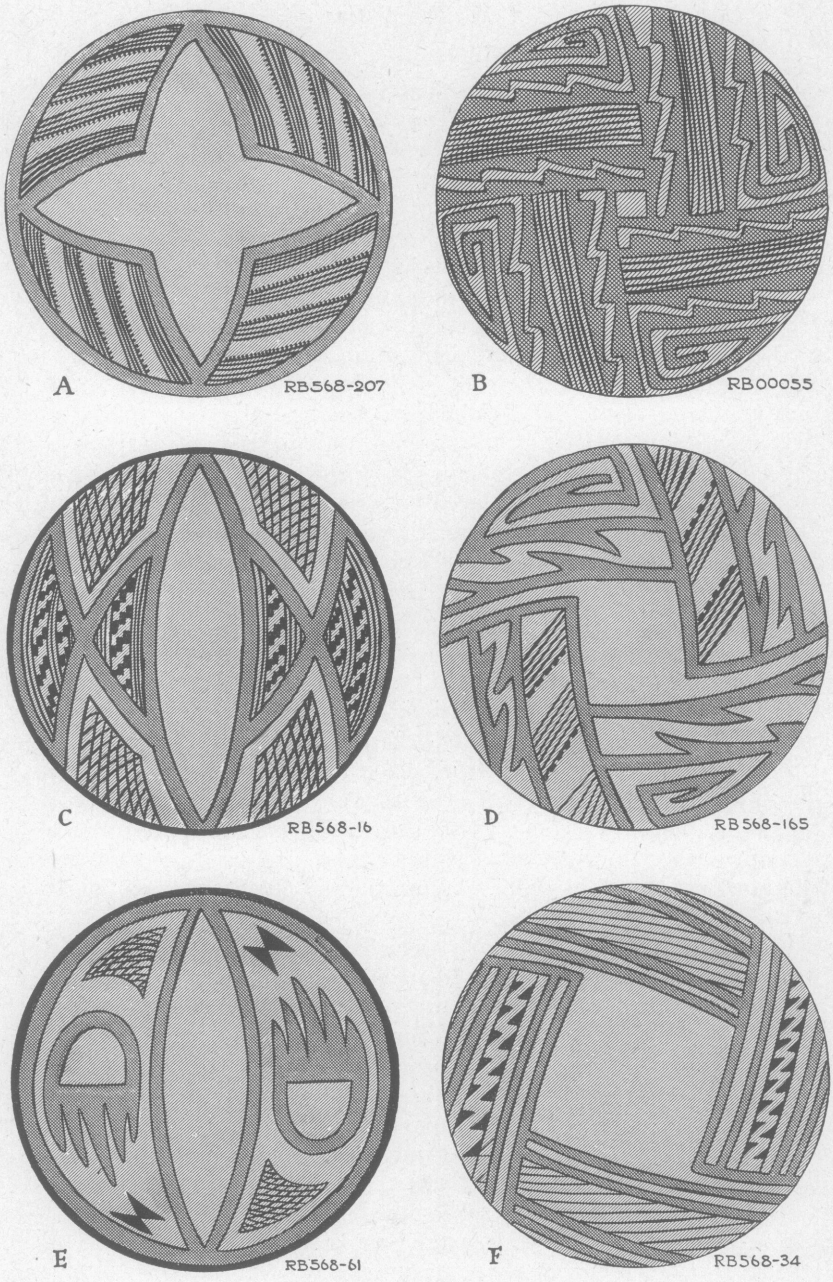


Fig. 64. Site RB 568. Tusayan Polychrome bowls.

the black-on-red bowls in connection with "orange peel" layouts were quite different in several respects from those of the black-on-white bowls (fig. 26), and there is thus the suggestion of a difference in their origin.

Since the red-slipped pottery had an orange base quite different in appearance from that of either the gray or white wares of its period, it would be expected that occasionally the slip was omitted, thus showing the distinctive orange surface. This did happen, as is shown by several unslipped fragments from Site RB 1008 (middle Pueblo II), while scanty material from other and earlier sites suggests that some plain orange ware may either have been made or have found its way into the area as early as Basketmaker III.

PUEBLO III

One important result of the classifications made in the study of this material is the clear demonstration that the polychrome pottery used by some investigators to define Pueblo III in the area appeared considerably earlier than the black-on-white pottery types which are also usually considered diagnostic of Pueblo III. Abundantly represented among Tsegi Canyon sites (period N, table 1) is the occurrence of polychrome pottery without either Tusayan or Kayenta Black-on-white. As has been mentioned elsewhere in this report (p. 16), the architecture of periods M and N is of the "unit type" considered diagnostic of Pueblo I and II rather than of the "big house" Pueblo III sort (see pp. 14–15 for a discussion of sites typical of this period). This would indicate that Tusayan Polychrome was in use in the region well before the end of Pueblo II, or else that the definition of Pueblo III must be changed to include sites of the "unit type." A considerable quantity of polychrome sherds was found at Site RB 564 (table 6), which strengthens this inference.

At present it can be said that no reliable criteria have been found for determining the the earliest appearance of the various types, aside from the appearance of polychrome described above, and the orange ware will therefore be discussed as a whole. Nearly all the material available for a design study came from Site RB 568, in any case, and therefore is representative of middle Pueblo III. Surface sherds of this ware are of little value for design study because of its tendency to weather heavily and the difficulty of reconstructing polychrome designs from small fragments.

Detailed description.—Many of the orange vessels were totally undecorated and, from the often noticeable soot blackening, must have been used as cooking vessels. It may be seen in table 1 that the increase of orange ware during Pueblo III was coincident with a corresponding decrease in the proportion of gray utility ware.

Several vessels of unslipped orange had a narrow black line running around the lip. These plain vessels were normally in the form of medium-sized bowls, jars, and ladles. Sometimes several broad black lines were used just below the rim on the inside of bowls, or on the outside of jars (fig. 68, *b*). A few examples were found of more elaborate design in black-on-orange vessels (figs. 61, *i;* 62, *g;* 66, *b;* 67, *d;* 69, *f*). A single bowl (fig. 65, *d*) exhibits an offset quartered design in red on the orange base, without the use of black.

The red-slipped, black-painted pottery made first during Pueblo II extended into Pueblo III, using a variety of patterns. On jars it was most often decorated by a Dogoszhi meander (figs. 67, *h;* 68, *a;* 61, *a, b, d, f*), although a large number of band designs were also used, of which figures 61, *j* and 67, *c* are unusually attractive examples. Some of these jars had a white line added as an outline to the figures. This feature has been used as the basis for a typological segregation and the name Kiet Siel Polychrome applied to it.[96] As far as we are aware, the use of white outlining

[96] Colton and Hargrave, p. 100.

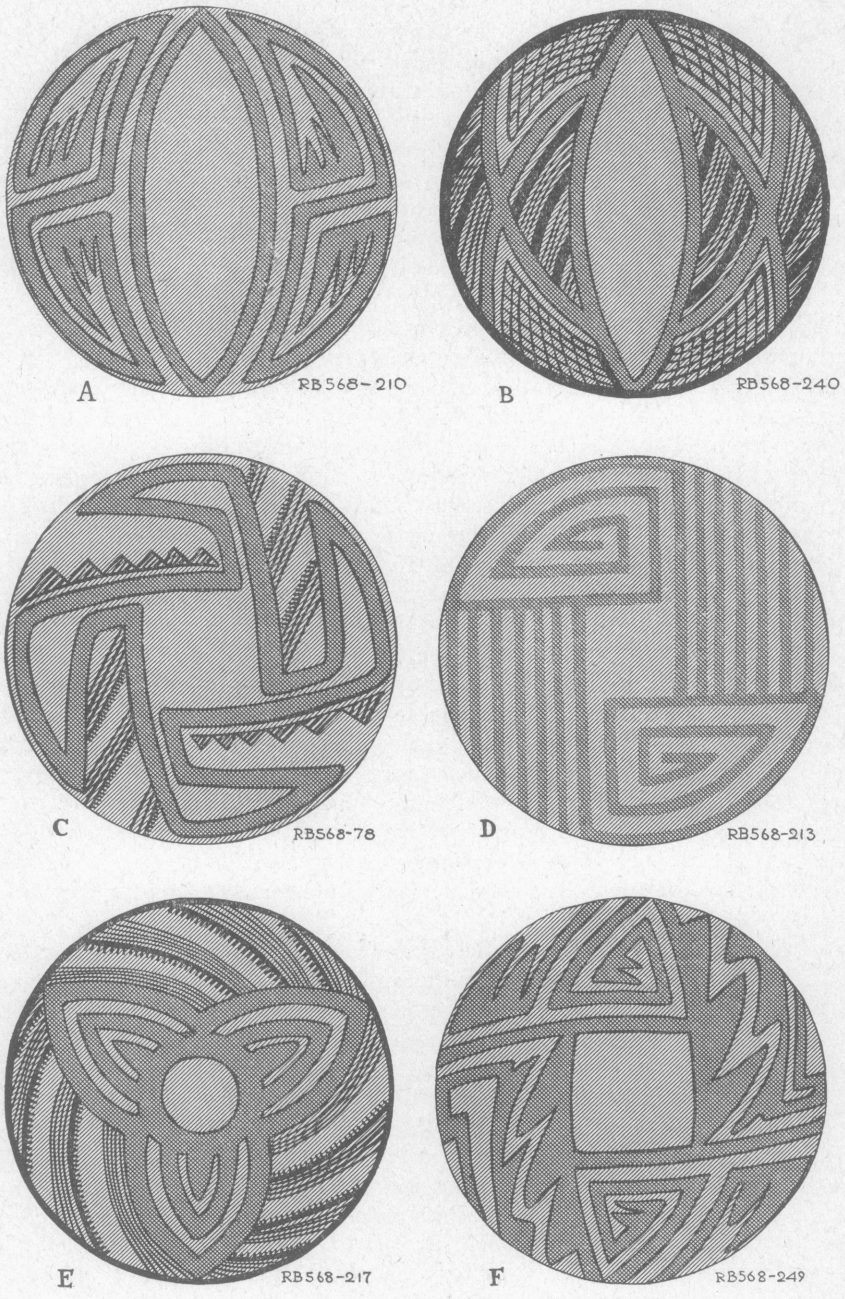


Fig. 65. Site RB 568. Tusayan Polychrome bowls. D is Tsegi Red-on-orange.

was confined to middle and late Pueblo III, but the impermanence of the paint makes its absence in earlier collections of doubtful significance. An example of a Dogoszhi meander thus treated is shown in figure 61, *h*. Other designs are shown in figures 67, *b, f;* 68, *d, e, h, i.* These are among the handsomest pieces in the collection.

The majority of bowls had either "orange peel" or "crossed orange peel" layouts with a variety of fillers and different color combinations. Examples of this style in black-on-red are shown in figures 66, *c, d–f;* 69, *a, g.*

The most frequently used and distinctive decorative scheme on the orange ware made during Pueblo III times was based on the employment of heavy lines and figures painted in red with a width of about 1 cm., bordered with a black line, and occasionally also a white line, each about 3 mm. wide. This scheme was occasionally used on jars (fig. 67, *a, g, i*) in simple arrangements, but occurs most frequently and elaborately on bowls and dippers. Such vessels, in addition to the decorated zone on the interior common in Tsegi area bowls, had a red-on-orange exterior design. This was usually limited to encircling stripes, but occasionally there are more complicated patterns (figs. 53, 54). The dippers had stripes and often other exterior decoration (fig. 69, *c*). It has been stated that wide red bands (fig. 53, *d, h*) indicated a considerably earlier date of manufacture than the other sorts of striping, and the name Citadel Polychrome was applied to it.[97] This does not hold for Site RB 568 at least, since bowls bearing wide stripes or slips were found in burials with types of pottery claimed to be later. In the early Pueblo III material from Site RB 564, both types of exterior striping occur.

Pottery using the three-color or four-color decorative scheme may advantageously be further subdivided, for purposes of classification, into:

1. Vessels in which the red design is used merely for the main layout.
2. Vessels where the red design, by means of a meander or branch, covers the whole design area.
3. Designs which represent compromises between the two systems.

Two jars (fig. 67, *a, i*) illustrate group 1. The red encircling stripes formed merely the frame for the design. (Figure 67, *g* was actually so simple that it conforms to none of these classifications). Other representatives of group 1 are illustrated in figures 62, *a;* 64, *a, c;* 65, *b, e;* 66, *a;* 69, *d, h.* The layouts represented include "orange peels" with crosses in the two side lunes (figs. 64, *c;* 65, *b*) and without crosses (fig. 69, *d*); crossed "orange peels" (figs. 62, *a;* 69, *h*); a variant from the crossed "orange peels" (fig. 64, *a*); and a central circle with three projecting half lunes (figs. 65, *e;* 66, *a*).

To group 2 belong figures 63, *a–c, e, f;* 65, *a, f.* There is considerable variety in these designs. Figures 63, *a* and 65, *a* are identifiable with the "orange peel" Sosi-style black-on-white bowls shown in figure 26, *c–e,* the differences being so slight that the change in materials and colors may be considered to account for them. It is provocative to note that these polychrome bowls were common after Sosi Black-on-white had apparently disappeared. Figure 63, *c* was based on a very ingenious **S** center arrangement with the two branched concentric scrolls of the **S** interlocking and filling the field. This was an arrangement unique in the series, although superficially it looks much like the common offset quartered layout, such as figure 65, *f.* In this example, the designs of the quarters alternated. It is reminiscent of, but not identical with, the black-on-white bowls having the same layout (for example, fig. 35, *e*). Figure 63, *b* and *f* were also offset quartered designs, but the red meander was broken between two quarters on opposing sides. The remaining bowl (fig. 63, *e*),

[97] Colton and Hargrave, pp. 75, 96.

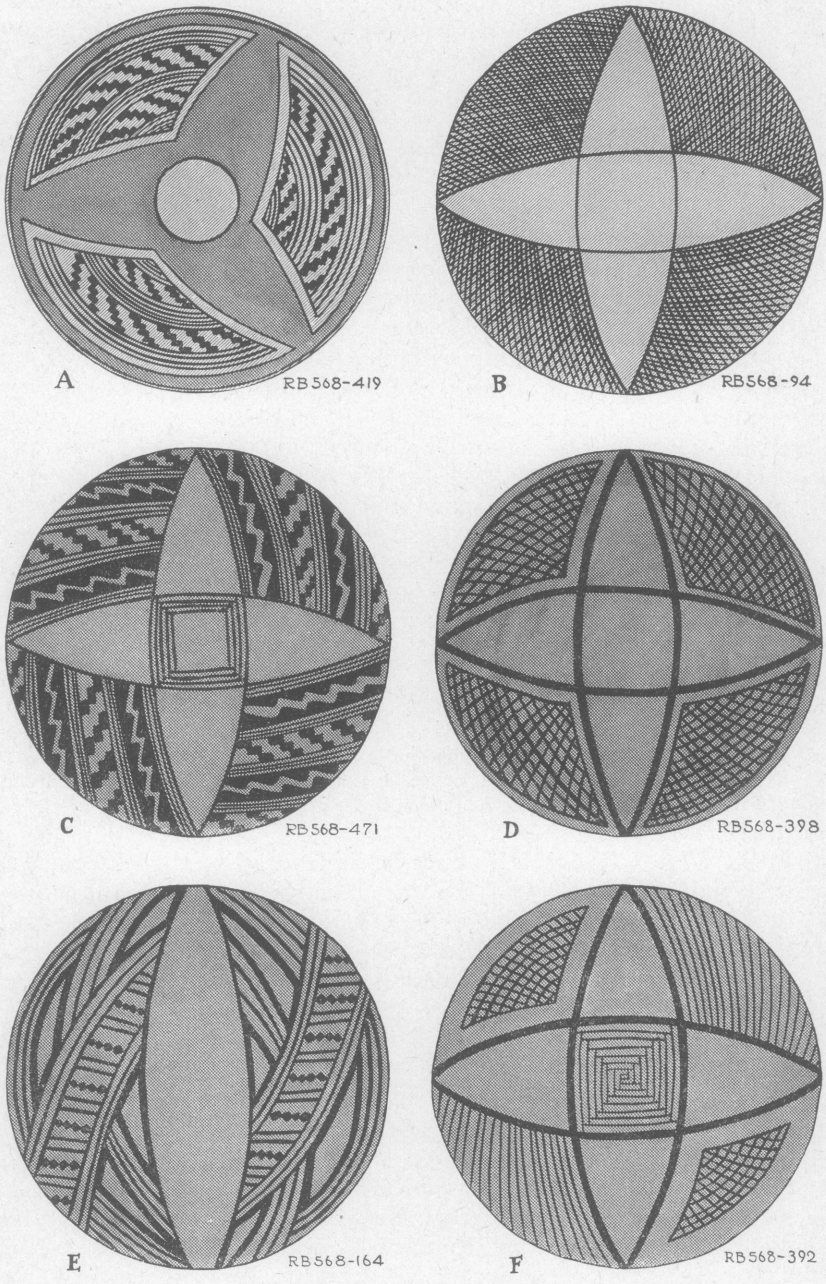


Fig. 66. Site RB 568. Pueblo III orange-ware bowls: A, Tusayan Polychrome; B, Tsegi Black-on-orange; C to F, Tusayan Black-on-red.

which was rather crudely drawn, may be classified as a panel design with alternating, interlocking serrated branches from the dividing lines of the panels. It is also closely similar to the offset quadrant style of figure 65, *f*.

Group 3, the compromise classification, holds all the rest of the three-color and four-color polychrome design. Figures 62, *b*; 64, *b, d, f*; 69, *b, c,* and 65, *c* are closely allied to the offset quartered designs of group 2, but utilize additional black-on-orange fillers rather than black-bordered red lines to complete the field. Figure 65, *c* is closely related to the rest of these offset quartered designs, but the red line was drawn as a continuous meander in the form of a swastika, rather than as a central figure or figures, with arms projecting toward the border. It has a whirling character not unlike figure 63, *c*. Figure 62, *c* illustrates a bowl similar to the group 2 simple "orange peel" bowls except that the ends of the **S** figures are done in black rather than red. The bowl shown in figure 64, *e* is also formed on a simple "orange peel" with disconnected fillers, the presence of black-bordered red fillers as well as black fillers placing it in group 3.

The black fillers used in the orange-ware designs were of relatively simple character. Simple and cross hatching in fillers were common, sometimes connected to the framing lines, sometimes continuous with a nesting border line. Figure 66, *f* illustrates the range. Such work was done in lines of the same thickness as the lines outlining the red areas. Staggered rectangles (figs. 64, *c*; 66, *a, c*; 67, *a, c*; 69, *b*) were common, as were lines with long, well-spaced ticking (figs. 64, *a*; 65, *c, e*; 67, *i*). The staggered rectangles at first glance appear to have been executed in the same technique as the serrations on Tusayan Black-on-white, but this was not the case. Whereas the Tusayan serration was formed by making joined strokes, at right angles to each other and without lifting the brush from the surface, the staggered rectangles of the Tusayan Polychrome were formed by individual parallel strokes, in contact along a portion of their edges, but executed by lifting the brush at the end of each. An exception is figure 68, *f*, in which, however, the lines were really zigzags rather than serrations or staggers. Thick black lines (fig. 65, *b*) were rarely used. Black "hourglasses" as shown in figure 64, *e* were common as isolated fillers. Quite a variety of other black-line fillers were used but were much less common than those mentioned.

The bowl shown in figure 62, *c* (group 3) is the only one in any of the three in which white outlining was employed.

The preceding threefold classification sheds no light at present upon either the dating or regional significances of this pottery. As stated (p. 127), it has thus far been impossible to formulate dating criteria within Pueblo III for this ware. Although the material is plentiful, it is so varied as to afford little opportunity for classificatory work. Moreover, it is almost all from a single site. Consequently the above groupings are quite arbitrary.

Relationship between white- and orange-ware design.—A puzzling problem that suggests itself in a study of orange-ware pottery lies in the surprisingly few points of similarity of design between it and the black-on-white pottery found in the same sites. The two wares were made in a single village, and by the same potters, as is proved by the finding of tools and materials for making both types, together with unfinished pottery of one type, in the same grave at Site RB 568. Uses of the two types were not different enough to account for their widely divergent design. An example of this remarkably complete correlation of design with color, as well as nearly positive proof that the same potter could make both types of design, is shown in the unique orange-ware bowl illustrated in figure 70, *g*. Alternate quadrants of the bowl were coated with white slip which was painted in black with the typical

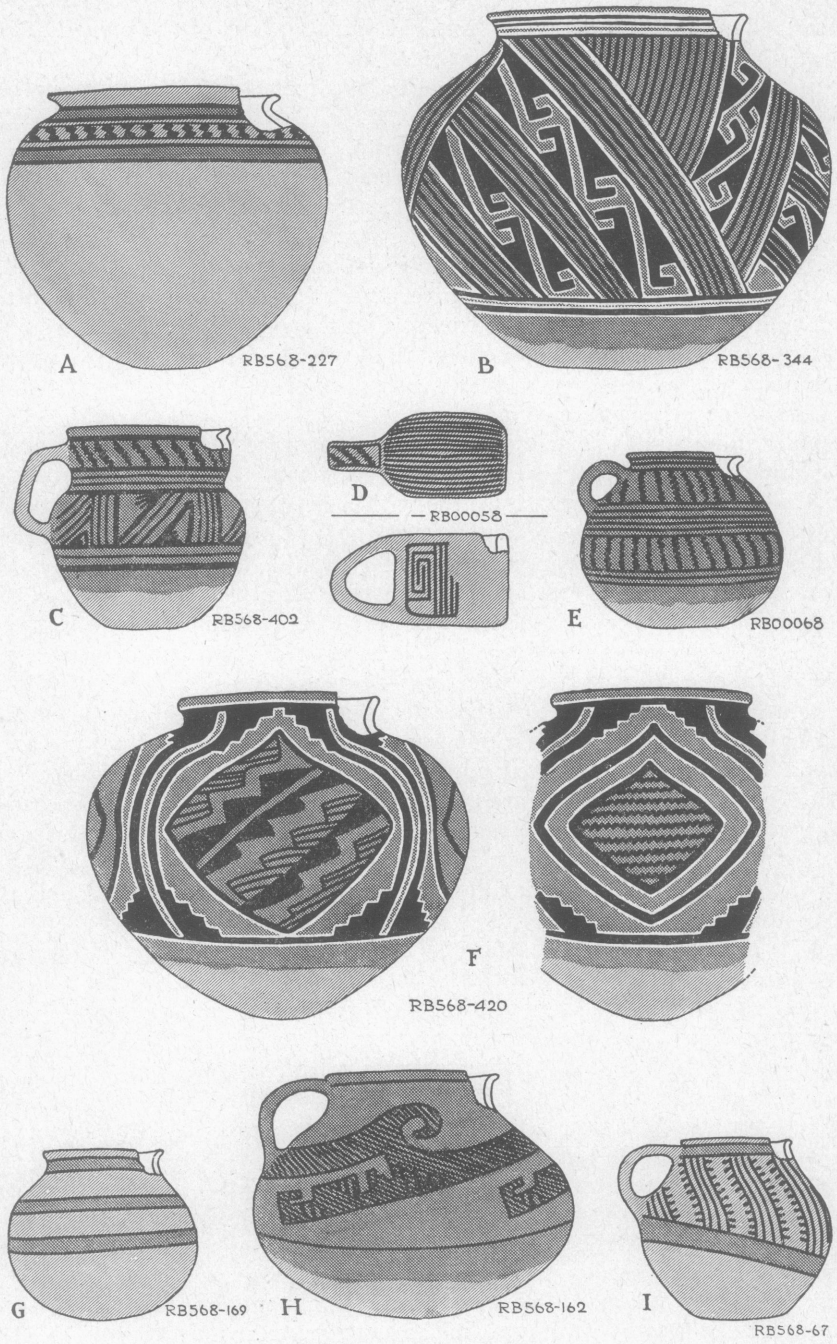


Fig. 67. Pueblo III (Tsegi) orange-ware jars and pitchers, various styles from Site RB 568 and Tsegi Canyon sites. A, G, I, Tusayan Polychrome; B, F, Kiet Siel Polychrome; C, E, H, Tusayan Black-on-red; D, Tsegi Black-on-orange.

Tusayan serrated **S** design. The other two quadrants were in typical three-color polychrome. Only on the outside of the bowl was the discrete character of the two types of design disregarded; encircling stripes, typical of Pueblo III orange-ware pottery, were drawn in white paint instead of red.

There is no escape from the fact that the separate masses of design used on the orange and white wares existed simultaneously in the same region. Whether they originated in the same region is unknown. Many suggestive comparisons may be made between the orange-ware design and that of the Pueblo II black-on-white pottery of the Tsegi area. The red designs were drawn in patterns which may well have sprung from the Pueblo II Sosi style, and there are few important differences (but one must admit at the same time there are few startling similarities) between the black fillers of Pueblo III orange ware and those of Pueblo II black-on-white. Certainly it may be said that Pueblo III orange-ware design followed more in the tradition of Pueblo II white-ware design than did Pueblo III black-on-white design. This similarity held in both layout (continued use of "orange peel" layout, for example) and in fillers.

The theory seems tenable at present that Pueblo III polychrome design was a cultural descendent from Pueblo II black-on-white, and that Pueblo III black-on-red slip design changed but little from the design of Pueblo II vessels of the same color combination. The systems of design used in the two Pueblo II types above mentioned intermingled, but were not influenced to a major degree by outside sources.

The surprising lack of an intermingling of design between the white and orange wares in Pueblo II then explains itself perhaps as follows: Pueblo III orange-ware design was a natural outgrowth of the free and diversified designs of Pueblo II in this area; the differences between the designs of the two periods can be explained by a change in the colors used and by gradual evolution without overwhelming outside influence. Pueblo III white-ware design, however, in major part is derived directly, as has already been said (p. 109), from the local copying of vessels from the Flagstaff area. The design evolved from this importation was characterized by its strict convention, as well as its use of elements foreign to local Pueblo II tradition, retaining an elaboration of the early local spurred-triangle designs as a basis for design layouts. It is these factors that make it easy to trace and distinguish it from design of local inspiration. The two types of design on orange and white wares merged but little during the period (possibly about one hundred years) in which they were being made side by side.

Although it is believed that later work will prove the theory advanced above essentially sound, it is only fair to state that it was formulated without much knowledge of the comparable pottery made to the north of the Tsegi region. Surface survey collections from west of the Four Corners area suggest an earlier incidence of polychrome pottery there. The considerable collection of pottery excavated by the Peabody Museum of Harvard at Alkali Ridge, Utah, was not available for this study, but its publication should shed additional light on the origins of the polychrome pottery of the Tsegi.

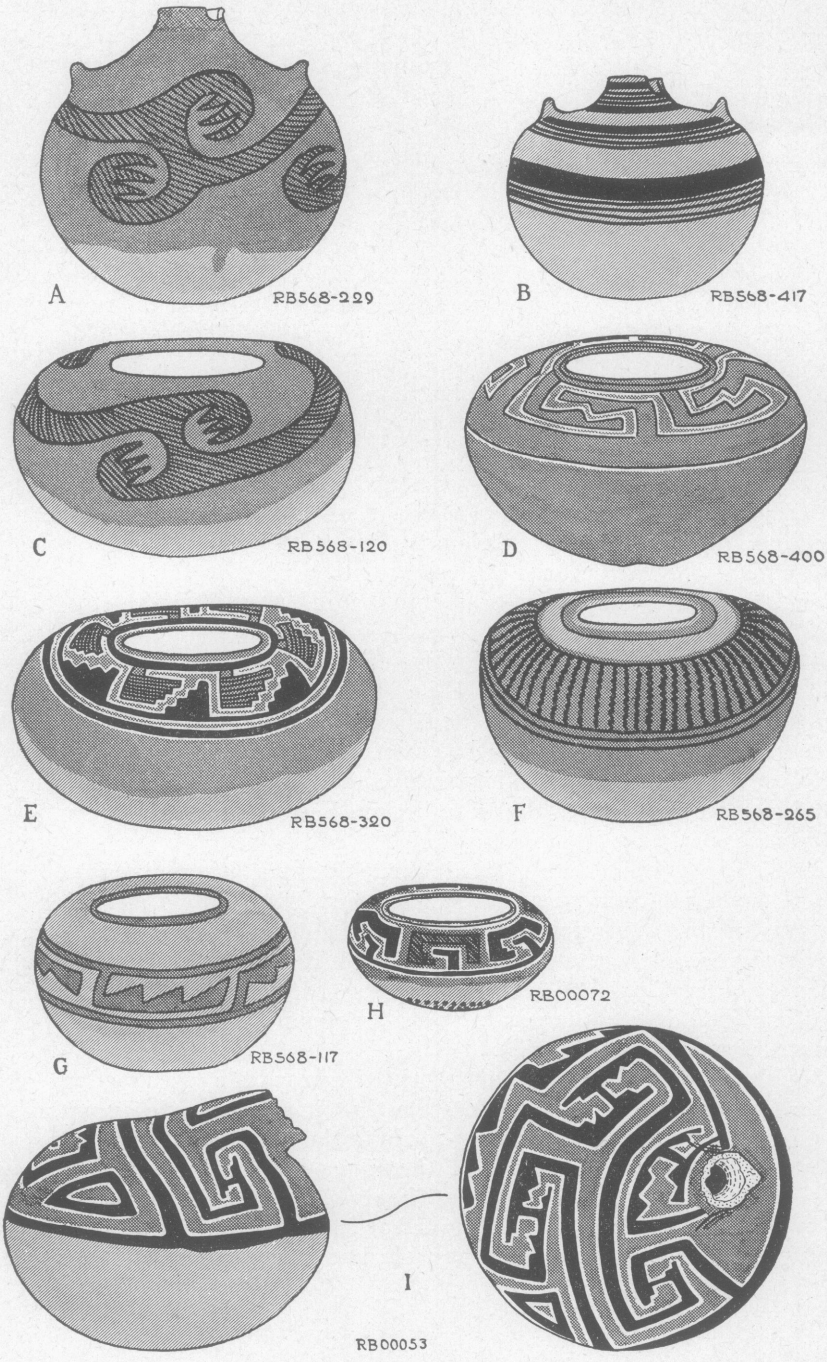


Fig. 68. Orange-ware canteens and seed jars, various styles, from Site RB 568 and Tsegi Canyon sites. A, C, Tusayan Black-on-red; B, Tsegi Black-on-orange; D, E, H, I, Kiet Siel Polychrome; F, G, Tusayan Polychrome.

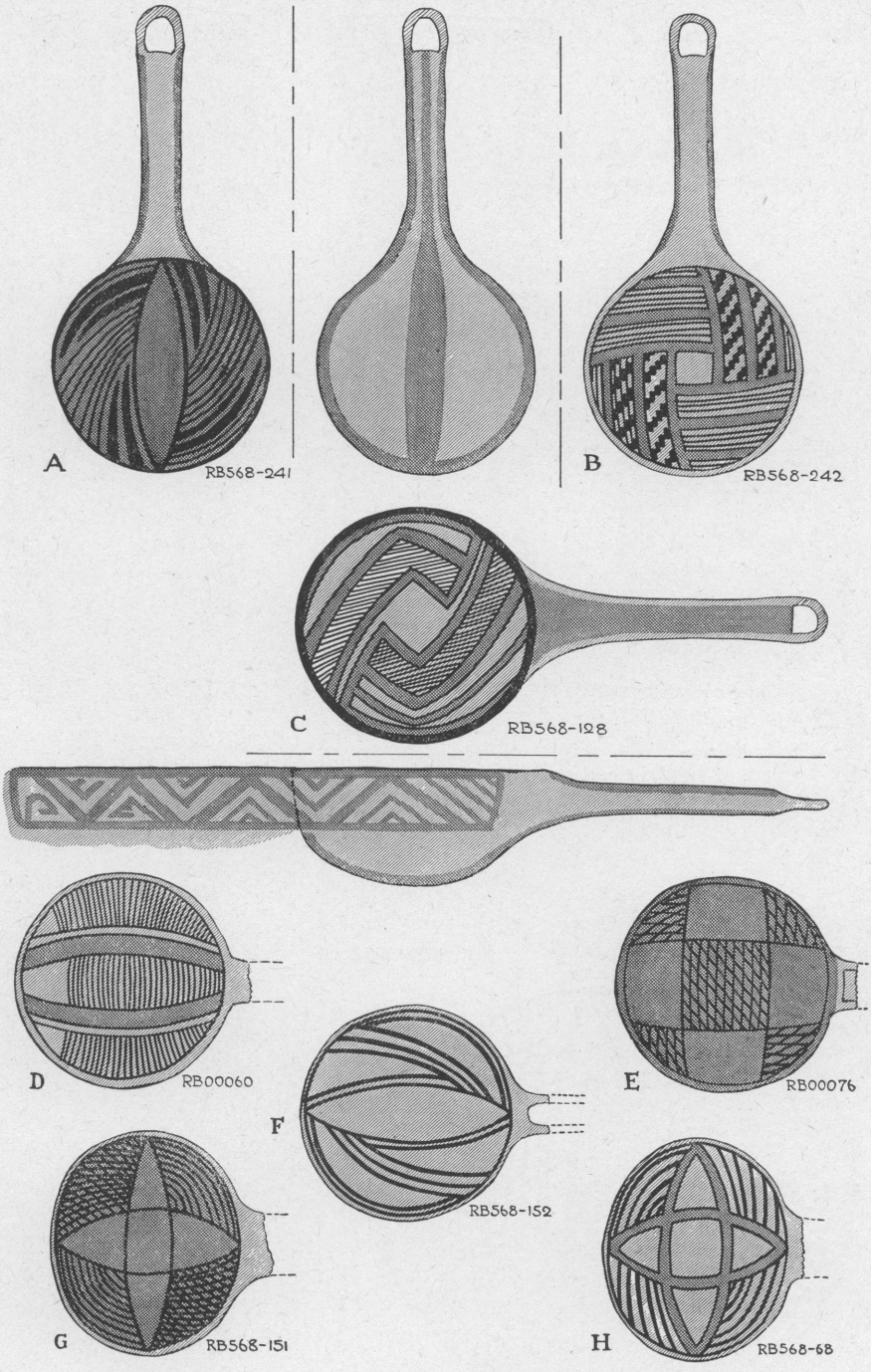


Fig. 69. Orange-ware dippers from Site RB 568 and Tsegi Canyon sites. A and B are painted on the outside in the same manner, as indicated by the drawing between them. The exterior decoration in red on C is shown extended.

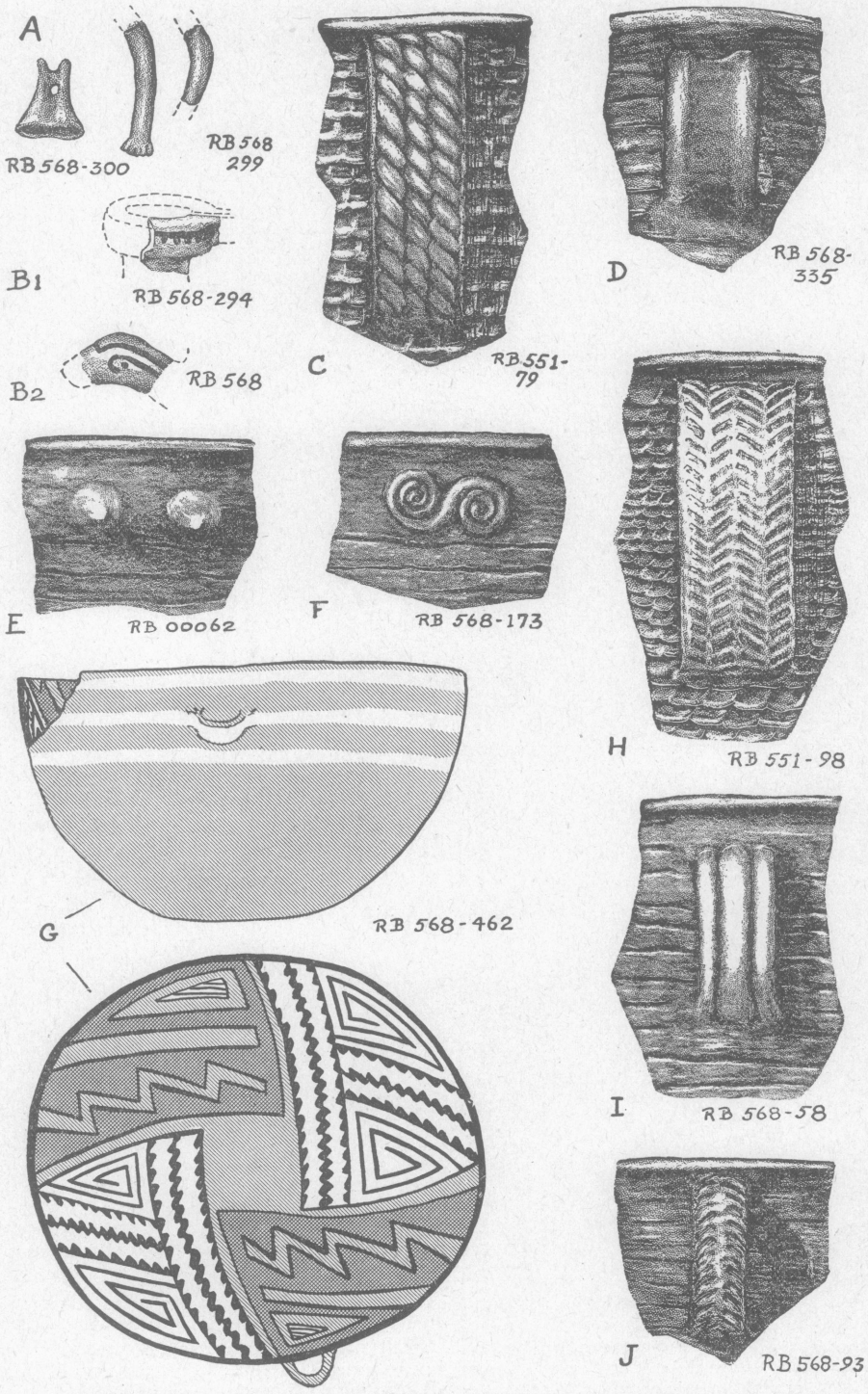


Fig. 70. Unique decorations and handles: handles from gray-ware jars from Sites RB 551 and RB 568, and a combination Tusayan Black-on-white and Tusayan Polychrome bowl from RB 568.

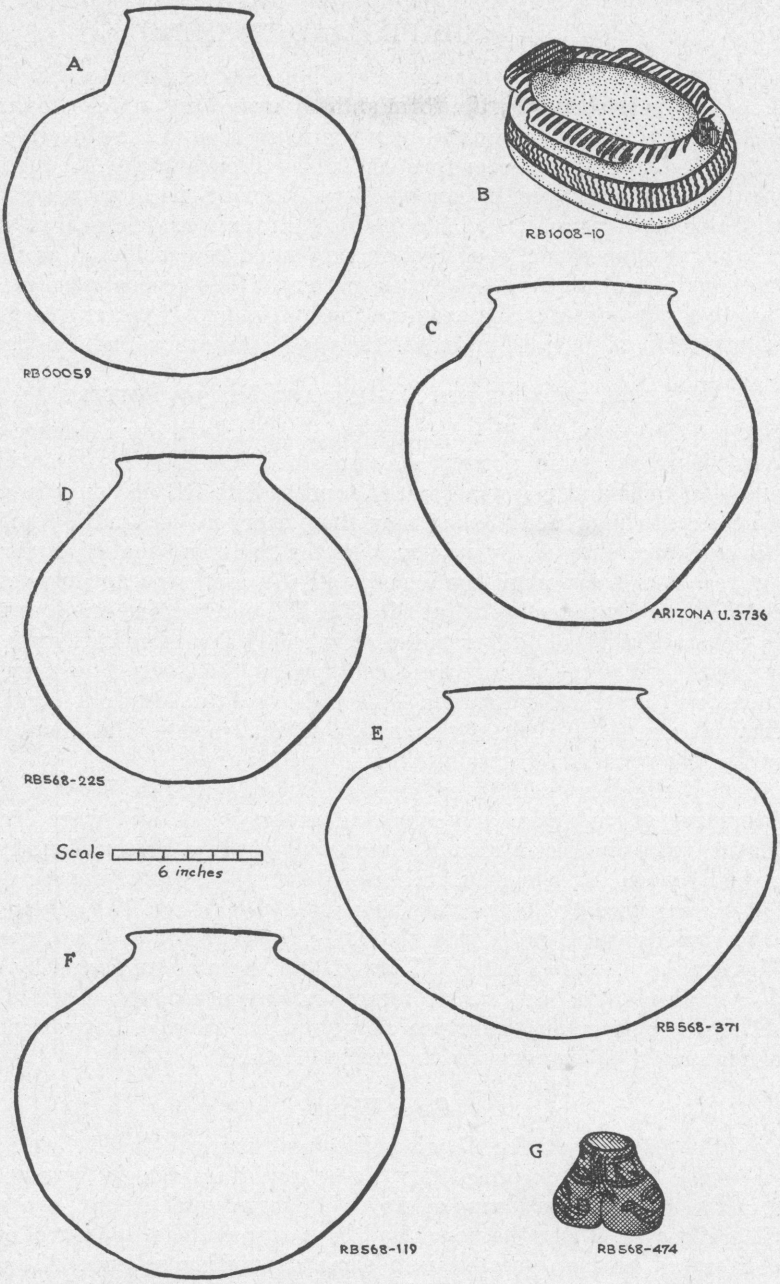


Fig. 71. Large Pueblo III white-ware olla shapes and two unusual specimens. A is a Flagstaff Black-on-white-style olla from the Tsegi. D, E, and F are Tusayan Black-on-white from Site RB 568. C is Flagstaff Black-on-white from Tachini Point, near Kayenta, now at the Arizona State Museum, Tucson, Arizona (Mus. no. 3736). B is a Black-on-white "bird" vessel, reconstructed from the two shaded fragments on the basis of analogy to other similar vessels. G is a Tusayan Black-on-red double-bodied miniature jar. The designs are illustrated elsewhere as follows: A, in fig. 46, A; C, in fig. 46, B; D, in fig. 47, B and plate 31, *a;* E, in fig. 47, A; F, in fig. 48, D.

POTTERY SHAPES AND FORMING

This section concerns itself with a consideration of the manual manipulation of clay and its results as shown by the form and texture of the surface of the pottery of the Kayenta area. An attempt will be made to go beyond the objective descriptions of these features and to infer from external evidence what were the processes that were probably employed in construction. Descriptions of processes are presented with due trepidation but with a feeling that their ethnological interest may justify the suggestions made, even though they must be considered as theoretical reconstructions of techniques used by the potters. These reconstructions are supported, however, by considerable examination and study of pottery forming, and by the examination of several hundred vessels and many thousands of sherds from the area.[98]

Specialization in the Making and Use of Pottery

Before entering into the detailed description of the wares, our evidence as to the amount of specialization in pottery making and use may be summarized here. Pottery-making tools and materials were found at Site RB 568 only in graves of women who seem to have been then, as now, the pottery makers in the Pueblos. Several of these graves showed, by mixtures of the tools and materials for making various wares, that one woman could make all the contemporaneous wares. Five graves out of the fifty investigated at Site RB 568 bore pottery-making materials and tools. Several graves, of adult females, were richly furnished with awls, metates, and other household utensils but bore no pottery-making tools. This suggests only a small degree of craft specialization. Although we do not have at hand age and sex determinations of the skeletal material, a safe surmise is that about one-third to one-half of the women at Site RB 568 made pottery.

The fact that the sherd collections from architecture at Site RB 568 and whole vessels from graves yielded nearly identical pottery type and ware frequencies proves that there was no specialization in mortuary pottery. Pottery found in graves was often badly worn, often broken, and showed signs of use after breaking. It seems likely that pottery used by the individual was buried with her. The only specialized uses of the various wares noted was that of gray ware for cooking, partly supplanted by orange ware in Pueblo III times, and the uses suggested by differing forms. For example, the largest, strongest vessels were made of white ware in Pueblo II and III times and were probably used for storage. Dippers and bowls were predominantly of orange ware in Pueblo III times.

Gray Ware

Almost all the pottery of the Tsegi region was manufactured by the coiling technique[99] smoothed by scraping. Only a few miniature vessels were apparently modeled in the fingers from lumps of clay. No examples of the use of the paddle-and-anvil are known. After the vessel had been formed, the structural coils were either obliterated or manipulated into some decorative scheme. Although the variations in this technique are well known, a reclassification of the gray ware, based on surface finish, was devised and applied to the material studied by the Expedition. Most of the groupings fit with reasonable accuracy into Colton and

[98] A report on the chemical and physical nature of the constituents of the pottery here discussed is in preparation. Research on such factors as the temperature of firing has also been carried out. It had been hoped to include the results of these studies in the present paper, but as it proved impossible adequately to complete the technical studies without unduly delaying publication, it was decided to publish the technical report later. For a comprehensive discussion of modern Pueblo pottery making, see Guthe.

[99] Guthe.

Hargrave's typology, but a summary of the reclassification is given below and is followed by a more detailed discussion:

I. Coils unmanipulated or merely smoothed and emphasized by grooving (Kana-a Gray, Coconino Gray).
II. Coils with sharp finger indentations, and overlapping in clapboard style.
  a) Clear-cut edges (Tusayan Corrugated).
  b) Softened edges (not exactly described by Colton and Hargrave; included within Kiet Siel Gray).
III. Coils flattened and without noticeable finger indentations.
  a) Coils overlapping in clapboard style.
    1. Clear-cut edges (subdivision of Moenkopi Corrugated).
    2. Softened edges (subdivision of Kiet Siel Gray).
  b) Coils not overlapping, but having a trough between them.
    1. Clear-cut edges (subdivision of Moenkopi Corrugated).
    2. Softened edges (subdivision of Kiet Siel Gray).
IV. Coils completely obliterated.
  a) Surface showing small sharp-edged grooves or abrasions, as if made by a hard scraper (Lino Gray or body sherds of Kana-a Gray).
  b) Surface rough, but without such clearly marked abrasions, as if wiped with a soft wet substance (typical Kiet Siel Gray).

These groups will be considered chronologically. They are illustrated in plate 28, *b*.

Lino Gray, the diagnostic Basketmaker III–Pueblo I gray ware, may be distinguished from the similar but later Kiet Siel Gray by the quality of its surface. Lino Gray shows abrasion scratches made by pulling hard granules incorporated in the paste along the surface, presumably during the process of smoothing. The edges of these scratches are sharp, often with a burr. Evidently the smoothing was done when the pottery was soft to leather-hard, and it is quite possible that some thinning may have been done at the same time. Interiors of narrow-mouthed Lino Gray jars show the partly unobliterated contacts of the fillets used in construction, indicating that they were built by the coiling method from clay fillets, as were all vessels indigenous to this area.

Kana-a Gray, the neck-banded gray pottery common in Pueblo I times (fig. 49, *a*; pl. 27, *h*), shows on its body the same abrasion marks characteristic of Lino Gray. Body sherds, in fact, are indistinguishable between the two types.[100] The neck bands were produced by fillets, laid up annularly and not spirally. Each ring or hoop was joined at one point in its periphery. The joints usually did not come directly above one another. The rings were laid either tangent, one above another, or occasionally overlapping in clapboard fashion. The contacts were occasionally emphasized by tooled grooves. Toward the end of Pueblo I, as indicated by the pottery from Site RB 1006, the clapboard neck-banded pottery occasionally was made with slight finger indentation of the clapboards, a technique that was almost universally followed in Pueblo II, when exquisite skill was achieved.

Tusayan Corrugated vessels, which were almost always jars, although an occasional bowl occurred, were characteristic of Pueblo II and were usually made with extraordinary skill. The finest in the collection was recovered at Site RB 551 (fig. 50, *h*; pl. 28, *a*). Its walls had a uniform thickness of only 8 mm.—measured in the troughs between the clapboards. The height of this jar was 37 cm., its greatest diameter 32 cm., and its symmetry was almost perfect. The forming of so delicate a vessel in such a size without deformation and entirely by manual methods was a considerable achievement.

[100] This has recently been pointed out, Colton, 1940, p. 338.

Corrugated vessels were constructed by building up fillets of clay in a spiral from the bottom nearly to the top; the uppermost, or rim fillets, were then attached as rings rather than as a continuation of the spiral. Although an exhaustive study was not made, every complete or restorable vessel in the collection was examined and was found to have been coiled in a counterclockwise direction when viewed from above. Apparently the vessel was turned in a clockwise direction by the potter and the fillets pressed into position by the thumb and forefinger of the left hand. The fillets were a flattened ellipse in cross section and sloped sharply downward toward the outside of the vessel; usually each fillet overlapped the two immediately lower ones, so that a horizontal cross section intersects three fillets. It was doubtless to this fact that the vessels owed their perfect bonding and rigidity.

It is likely that the walls were originally made thicker, then thinned on the inside by abrasion or scraping, and finally wiped with a damp mass of cloth or fiber to produce a relatively smooth surface.

At about the beginning of Pueblo III, a modification occurred in the gray ware of the region in the direction of less precision in surface finish. The clapboard style continued, but the coils were flattened and no longer showed the meticulous finger indentations of Tusayan Corrugated. Two broad divisions of Pueblo III gray ware have already been made, and the type names Moenkopi Corrugated and Kiet Siel Gray applied to them.[101]

The descriptions formulated by Colton and Hargrave for these types fit the material under consideration, but a further subdivision was made for laboratory purposes in Moenkopi Corrugated. The two groups resulting were called respectively Moenkopi Rough Coil and Moenkopi Flat Coil, though it cannot be said that the distinction is significant typologically. In each group the coils were flattened, but the Rough Coil examples preserved the clapboard effect, the lower edge of each coil protruding slightly outward beyond the upper edge of the coil immediately below it. In the Rough Coil vessels, also, shallow and irregular finger indentations remained visible, numerous small pits and bumps made the surface rough, and frequent minute cracks ran transversely across the coils, as if they had been squeezed together hurriedly and carelessly when the clay was moderately dry.

On Flat Coil vessels, the coils remained sharply defined, but the overlapping clapboard effect was avoided. The surface was a good deal smoother and more even. Almost no evidence of finger indentations remained, and the minute cracks, pits, and small irregularities were smoothed out. Plate 28, *b* illustrates these distinctions. It appears that some of the Smooth Coil vessels may have been smoothed and flattened by means of some hard implement, such as a stick or stone, after the coils had all been laid in place.

Still another treatment was applied to some Pueblo III gray-ware vessels, whereby the surface, while still wet, was rubbed or wiped with a soft cloth or bundle of grass, obliterating the sharp edges of the coils and fingerprints. Sometimes this resulted in a relatively even surface; sometimes the surface was gently ridged where the outline of the coils was modified but not obliterated. Both these styles had variants, but probably all of them can best be grouped as Kiet Siel Gray pending further investigation. The type differed from Lino Gray and Kana-a Gray in being coarser and more crumbling and in having less sharply defined abrasions on the surface.[102]

Shapes of gray-ware vessels differed considerably between Pueblo I and Pueblo

[101] Colton and Hargrave, pp. 197, 198.

[102] Examples of Coconino Gray and Medicine Gray occurred, but they do not require comment in addition to that contained in Colton and Hargrave, pp. 199, 201.

III. Except for a few bowl sherds of Tusayan Corrugated, occurring in some Pueblo II sites, and Pueblo III Moenkopi Corrugated platters, jars and pitchers were the only plain gray-ware forms. The characteristic shape of both Lino Gray and Kana-a Gray was a small vessel with a spherical body and a wide neck, tapering slightly inward but flaring just below the rim, and perhaps two-thirds the height of the body (fig. 49, *a*). Such vessels were rarely over 20 cm. high.[103]

Tusayan Corrugated jars and ollas were usually a good deal larger (up to 35 cm. in height), though numerous miniature examples were found. Bodies were usually nearly spherical, with very wide short necks drawn very slightly upward, and flaring slightly at the rim (fig. 50, *f, g, h*; pls. 28, *a*, 29, *c*). Part of a plain gray plate was found at Site RB 551, similar in shape to the plates typical of Pueblo III at Site RB 568, but without perforations (fig. 50, *e*).

Pueblo III gray-ware ollas (pl. 14, *a;* fig. 52) were slightly larger than those of Pueblo II; heights were up to 40 cm. They were as a rule even more nearly spherical than earlier forms, and usually had a flaring rim set at a sharp angle to the spherical body curve without an intervening neck. The orifices were large, but relatively smaller than those of Pueblo II. A few examples were very similar to those from Pueblo II (pls. 27, *a–g;* 29, *a, b;* fig. 52, *f–h*).

Several plates were found at Site RB 568, made in the manner of Moenkopi Corrugated. These plates were smoothed on the interior, and perforated around the periphery by holes punched into the clay when still wet. The holes were 3 to 4 mm. in diameter and from 2 to 3 cm. apart. Figure 52, *d* and plate 30, *a, b* illustrate such plates. Some of these were orange ware, but were exactly the same in shape and structure as the gray-ware examples.

Most of the gray-ware ollas, as well as all the perforated plates, show an imprint on their bottoms made by having been placed on a concave sherd during construction (pl. 30). At the same time, the clapboard placement of the spiral fillets extended to the center of the bottom. The method of forming was apparently to build the bottom of the vessel by spiral coiling, probably on the outside of a large sherd. When a diameter of about 25 cm. had been attained, the olla base or plate was probably lifted and placed in the concave side of the sherd with the inside of the new vessel up. Then building was completed. Jars lacking an exterior mark nevertheless usually showed a perceptible change in the spacing of indentations at the point where the form or mold terminated. Several groups of sherds adaptable as forms were found in burials with other pottery-making tools at Site RB 568. Often the edges were smooth from use, or had been deliberately smoothed for the purpose. This method of reversing the bottom of a vessel after first forming is at present practiced among the Yuma Indians.[104]

White Ware

The characteristic white pottery of Pueblo I was Kana-a Black-on-white, which shows no surface scratches similar to those on Lino Gray. The majority of the pieces were slipped fairly heavily with a clear white clay and show marks of smoothing, presumably with a pebble, over the slip. The characteristic faint grooving and high polish produced by this technique are clearly apparent. Experiment indicated that this finish can be produced best when the slip is damp but not strongly wet, and that the process of slipping and polishing is facilitated by allowing the piece of pottery to dry partly or completely before the slip is applied. The thickness of

[103] An exception is RB 1002–2, a beautifully made Kana-a Gray-ware jar 29 cm. in height. It also has a shoulder, thus departing from the usual near-spherical form.

[104] Rogers, pp. 8–9.

the slip produced by a single coat depends of course upon the consistency of the liquid applied, but a more important factor is the absorptive power of the clay under the slip. This in turn depends on the degree of moisture in the clay when the slip is applied. The pressure of smoothing deforms the vessel unless it is fairly dry. On the jars, at least, the slip seems to have been applied by painting it on rather than by dipping the jar in the slip. The edges between slipped and unslipped areas clearly show brush strokes. This method of applying the slip is the modern Pueblo practice.[105]

A considerable proportion of Kana-a Black-on-white sherds do not show evidence of stone polishing as described above. A slip is apparent, but it has a lumpy surface caused by protrusion of temper grains through the slip. It is impossible to state at present whether or not this difference in technique is of temporal significance. Few jars of this type were found, but in general they apparently were similar in size and shape to the contemporary gray ware, with globular bodies and tall stovepipe necks. The rims were straight.

Bowls were usually shallow and usually between 17 and 22 cm. in diameter (table 8). They were sometimes spherical, but often less than a hemisphere (fig. 49, *b, d*); the commonest shape was parabolic with sharply curved bottoms and outward-sloping sides (fig. 49, *c*). Figure 49, *g* is a Black Mesa Black-on-white bowl but illustrates a typical Kana-a shape. Part of a shallow scoop ladle was found at Site RB 392, but is not illustrated. It was decorated with two bands like that shown in figure 20, *c*.

The black-on-white pottery of early Pueblo II (fig. 51) was fairly heavily slipped, but was markedly different from Pueblo I pottery in having thicker walls, averaging about 7 mm. (table 8 shows relative wall thicknesses) and a beautifully rounded contour without the slight bulges and depressions which occur commonly in Pueblo I black-on-white pottery. Pueblo III black-on-white pottery also had this remarkably even surface. A clue to it may well lie in the finding of the spherically concave sandstone tool described on page 55, which could easily produce such an even curvature if used in smoothing the pottery. Pueblo II black-on-white pottery occasionally shows fine striations under the slip, as though such smoothing and thinning on the dry or nearly dry vessel had been done before the slipping and polishing process by which the vessel was finished. Clear evidence of another method of thinning and finishing a vessel is shown by a Pueblo II jar in the collection of John Wetherill at Kayenta. Extensive spalling or chipping off of an extraordinarily thick chalky white slip has occurred. Under this slip the outer surface of the body shows unmistakable evidence of having been pared down with a flint chip.

The earliest of the large white-ware ollas for which the region is famous were found in the Pueblo II horizon at Site RB 551. Restorations of several are shown in figure 51 with drawings of some of the smaller white-ware jars and canteens of the same period. A tall, "stovepipe" neck was characteristic (fig. 51, *a*); this was modified in a variety of forms, all constricted, short, and inward-sloping. Often, especially on the short sloping necks, the rim flared considerably. (See figure 55 for an illustration of the wide variety of rim forms.)

The bodies of these ollas were large, often as much as 40 cm. high, exclusive of the neck. They were usually pear-shaped with small, flattened bases, and the greatest diameter was ordinarily somewhat above the midline (fig. 51, *g, h*). Many were nearly spherical, however (fig. 51, *i*). The uppermost portion of the body had a tendency to become almost flat and to form a sharp angle with the neck.

One fragment of a canteen was found at RB 551. It was apparently spherical

[105] Guthe, pp. 57–58; Stevenson, p. 375.

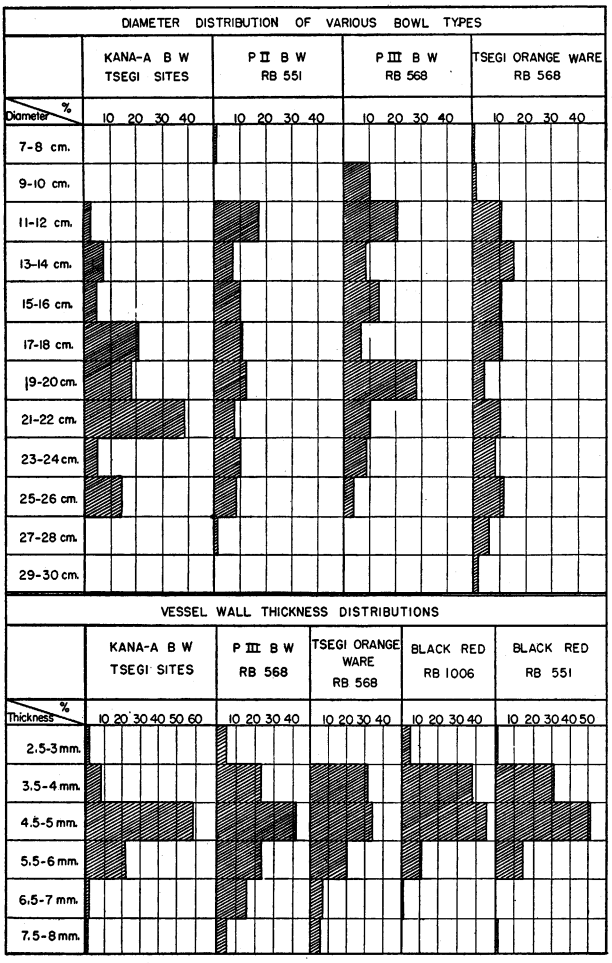


TABLE 8. The upper chart indicates the distribution of several categories of black-on-white bowls according to their diameters, expressed in terms of the percentage of each size group to the entire collection of the type included in each column. Most of the measurements were made from sherds by means of the diametrometer. The lower chart indicates a similar distribution of sherds of various types from several sites arranged according to thickness, each group being expressed according to its percentage of the entire collection represented in each column.

with a narrow vertical neck and two lugs with vertical perforations (fig. 51, *b*). It was decorated in a crude and unusual combination of Sosi and Dogoszhi styles (not illustrated).

Pueblo II black-on-white bowls were well slipped and polished, but were undistinguished in shape. They tended to be spherical in curvature, but were usually less than a hemisphere, with outward sloping sides and direct rims (fig. 55). Rarely, a flaring rim or slightly incurved rim occurred (fig. 50, *c, d*).

Pueblo III black-on-white ollas, of which a series is illustrated in figures 41 and 71 and plates 25 and 26, show certain similarities to the large Pueblo II ollas. They were slipped and highly polished. Figure 71, *a* is a Flagstaff Black-on-white vessel.

Figure 71, *c* is hardly distinguishable from those of Pueblo II shown in figure 51. More characteristic forms, however, are those shown in plate 26, in which the general pear shape was retained but the neck was shortened almost to the vanishing point. These were similar in size to Pueblo II ollas, about 40 cm. in height. Other typical shapes are illustrated by figure 71, *d, f* and plate 25, *a, b*. Although no two of these are exactly alike, they do have certain features in common. All tend to be spherical or somewhat squatty and to have short necks and widely flaring rims, with very slight flattening of the base.

A parallel can be pointed out between the changes in the shape of ollas in both gray ware and black-on-white ware between Pueblo II and Pueblo III. In each ware the earlier vessels were taller with longer necks, whereas the later vessels tended to become more spherical, with shorter necks and more widely flaring rims.

The remarkable flat-shouldered jar shown in figure 40, *g* and plate 24, *e* probably appeared late in Pueblo III; all examples noted of this shape were decorated in Kayenta Black-on-white style. They are among the most exquisitely formed pottery vessels found in the entire Southwest. The example illustrated is 17 cm. high and its walls do not exceed 3 mm. in thickness. Nevertheless its symmetry is almost perfect.

Pueblo III white-ware bowls were made in a wide variety of shapes and few general statements are possible. Figure 38 illustrates the range. Diameters varied from about 9 to 26 cm., with the largest number being about 19 or 20 cm. Most of them were relatively deep, in a few instances being actually deeper than wide (fig. 38, *h*). They were sometimes hemispherical, sometimes with outward-sloping rims, frequently with slightly flattened bottoms and angular walls (fig. 38, *d, g*). Rims were usually direct and flat; only rarely were they flared (fig. 38, *d*).

A number of black-on-white canteens were found at Site RB 568 which are illustrated in figure 36, *a–d*; *c* was wholly unpainted, and it is notable that none of the others was typically Tusayan in style. All designs appear to be transitional between Pueblo II and Pueblo III. Figure 36, *b* was a football-shaped vessel with lug handles. The attachment of the lugs is interesting; they were made from a projecting loop of the coil and thus were a structural part of the vessel.

White-ware dippers in Pueblo III were relatively less numerous than orange-ware dippers. Two examples were carefully painted (fig. 37, *g* and *i*). Four others were plain white and small (fig. 40, *a–d*). One other example (RB 568–129, not

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EXPLANATION OF TABLE 9

TABLE 9. This table presents in graphic form the relation between vessel shapes and sizes at Sites RB 551 and RB 568. The horizontal lines form a scale of vessel sizes, expressed in terms of capacity in cubic centimeters and arranged in geometric relation to each other. The vertical lines divide the chart into columns, each of which includes vessels of a particular shape, as indicated at the top of each column. The shapes have been generalized into a relatively small number, but each vessel examined approximates one of the generalized shapes and falls easily into its category. Each "×" on the chart represents one vessel of the shape and size indicated.

The vessels included from Site RB 568 are all complete or nearly complete specimens. The specimens from Site RB 551, however, are mostly reconstructed from large sherds, the size of which was sufficiently great to permit fairly exact measurement of curvature by the diametrometer and thus to provide reliable data for the reconstruction of the vessel shape and calculation of its capacity.

In determining capacity, close precision was not attempted, but reasonably accurate results were attained by measuring exactly the greatest horizontal diameter and the total height of each vessel and then calculating the approximate capacity by the formula: $\frac{2}{3} \pi r^2 h$, where $r = \frac{1}{2}$ the diameter and h equals the total height, exclusive (for jars) of the neck. This formula is correct for bodies of perfectly spherical shape, and although the vessels measured are none of them exactly spherical, they are nearly enough so to make the error in calculation relatively small. In any event, the method used provides a practical and rapid means of determining vessel sizes to a degree of accuracy satisfactory for all ordinary purposes of study and comparison.

In table 8 is shown the percentage distribution of bowl diameters for different sites and periods.

TABLE 9

Shapes / Capacity in cc	RB 568 – Tsegi Orange Ware										RB568	RB 568 – Black-on-White												RB 551 – Black-on-White				
	Bowls					Ladles	Jars				Corrug. Jars	Bowls						Ladles	Jars					Bowls			Ladles	Large ollas
	∪	∪	∪	∪	∪		Pitchers	Globular ollas	Seed Jars	Canteens		∪	∪	∪	∪	∪	∪		Pitchers	○	⌓	Seed Jars	Canteens	∪	∪	∪		
300						xx xx x					x							x x x	x x					x x x x	x x x x		x x x x	
400						x	x				x							x	x					x x	x x		x x	
500	x			x		x					x	x x						x x						x	x x			
600	x						x x x	x				x		x					x x					x x				
700		x					x x x												x x					x	x			
800	x					x																		x	x		x	
900							x x				x													x x x	x			
1000	x	x x x				x	x		x			x							x						x				
	x	x				x x	x					x x x	x										x x	x	x x	x		
	x x					x	x																	x	x		x	
1500	x x						x		x																			
	x			x x							x		x		x								x		x x x x			
2000		x x	x							x		x				x				x								
2500	x																							x	x x x			
	x									x															x x x			
3000	x x											x		x		x			x			x x x						
3500	x	x		x				x														x x x			x x			
	x	x						x x x	x		x									x		x x	x	x	x x			
4000	x x		x		x				x x	x											x							
4500	x	x							x			x x													x x	x x		
5000											x																	
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20,000																			x								x	
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30,000																			x x x								x	
40,000																			x								x x x	
Totals	20	10	2	4	4	12	13	7	6	3	7	11	2	2	2	1	1	6	9	6	2	9	4	21	39	3	10	8

illustrated) had five small holes punched through the upper side of the cylindrical handle, as if it were designed for use as a rattle. No pebble was contained inside the handle, however.

Pueblo III black-on-white ware shapes are also illustrated in plates 23, 24, 25, and 26, and figure 36. These are as a whole notable for thinness of wall and for careful, symmetrical forming—especially the four seed jars shown in plate 23, *a* and *b* and figure 36, *i* and *j*, which are remarkably thin and fine.

Orange Ware

Not enough Tsegi Orange ware is available from the earlier horizons to warrant comment, but a large quantity was recovered from Site RB 568 and can be taken as representative of middle Pueblo III. These vessels were mostly bowls, with a smaller number of ladles, seed jars, small pitchers, and small jars. Many of the bowls showed signs of use in cooking; they may have supplanted gray ware for the purpose.

In structural technique the orange-ware vessels were inferior to the black-on-white. The clay of which they were made was friable. Surfaces were evenly smoothed, but often finely granular and not highly polished, except where a heavy red slip was applied. Probably all were made by the usual coiling method, although coils were almost always obliterated. A few plates were exceptional in this respect (pl. 30). Little can be added to the descriptions of physical characteristics of this ware given by Colton and Hargrave.[106]

The shapes of jars, ollas, and pitchers of Tsegi Orange ware were varied, but in general they harmonized fairly closely with the shapes of contemporary gray and white vessels. The basic form was nearly spherical, usually with a slightly flattened base and a wide, short neck with flaring rim. (See figure 67 for examples.) In many pitchers, however, the rim was almost direct (fig. 67, *i*). An unusual vessel, closely resembling the pear-shaped black-on-white ollas of Pueblo II and III is illustrated in figure 67, *f*. It is smaller, however, being only 19.6 cm. high. A unique mug (fig. 67, *d*) was found near Site RB 568 but not in any definite association. It is painted in black on orange and is 5.8 cm. high.

Seed jars were fairly common in orange ware and tended to be globular rather than squat (fig. 68, *c–h*). In this respect they differed somewhat from Pueblo III black-on-white seed jars, which were more compressed vertically (fig. 36, *e–j*). Some of the orange seed jars had slightly concave bases, but less markedly so than the Tusayan Black-on-white seed jars. One small seed jar in Kiet Siel Polychrome, found on the mesa top west of Marsh Pass, had a perforated bottom for use as a colander (fig. 68, *h*). A black-on-white colander is shown in figure 36, *g*.

Orange-ware bowls conformed to no strict standards of shape, as reference to figures 53 and 54 will indicate. Almost always the rims sloped outward and only rarely was a hemispherical shape approached (fig. 53, *d*). A slightly flattened base was the rule, and occasionally the base was very slightly concave. Widely everted rims were common (figs. 53, *a, i*; 54, *h, j*). The trough spout in figure 53, *a* is unique. Bowl rims also underwent an apparent change from Pueblo II to Pueblo III. In the earlier period (from which a number of rims were recovered, though few whole vessels) rims were usually made with a faint bulge or thickening about 3 cm. below the extremity of the rim; above that point they tapered exteriorly. Nearly all bowls from Site RB 568, on the other hand, were made with an almost constant wall thickness, and the rim was either square, rounded, or flaring, but rarely tapered. The examples in figure 54, *e* and *j* are unusual. Orange-ware bowls

[106] Colton and Hargrave, pp. 72–76, 92–101.

covered a wide size range from 7 to 30 cm. in diameter, the majority being about evenly distributed between 12 and 25 cm.

Orange-ware dippers were numerous and well made at Site RB 568. Those of larger size, as well as similar white-ware dippers, were often heavily abraded into a bevel along the outer edge of the rim. The position of this bevel was always toward the user's left if the dipper was held in the right hand. Probably it was caused by using the dipper to scrape water or grain out of large storage jars. Evidently the users were right-handed people.

A few orange-ware canteens were found in Pueblo III association. Two examples (fig. 68, *a, b*) each had two lugs on opposite sides of the constricted neck, which were perforated horizontally for suspension. A beautifully made Kiet Siel Polychrome canteen with a diagonal neck (unfortunately not complete) came from a point near Long House in Marsh Pass. It had no lugs (fig. 68, *i*).

Handles

A consideration of handles and unusual shapes has been omitted from the preceding discussion, but some general observations can be made. During Pueblo I vertical loop handles were used on both gray- and white-ware pitchers. They were circular in cross section and extended from just below the rim to just above the shoulder of the body; the loops were large enough for the insertion of at least three fingers (fig. 49, *a, e, f*). No handles were used on bowls during Pueblo I, and no true dippers have been found, although scoop-shaped ladles were in use (No. RB 392–2, not illustrated).

In Pueblo II the large storage jars and ollas were without handles, but elaborate vertical strap handles were attached to the smaller Tusayan Corrugated jars, sometimes braided from clay fillets or stamped with designs suggestive of weaving (fig. 70, *c, h*). Pitchers in white and orange ware were few in number and usually were small; they had a single vertical loop handle. White-ware bowls usually were without handles, but sometimes had one small loop, usually horizontal (fig. 50, *o*), but in one instance vertical. The white bowl shown in figure 50, *m* is unique in having a bow handle extending in a vertical semicircle from rim to rim. The small loop handles marked the beginning of a style that became more general on bowls in Pueblo III, when both orange- and white-ware bowls usually had single loop handles. They were almost always horizontal and of a rounded oblong in cross section. One Tusayan Polychrome bowl (fig. 62, *a*) had a vertical handle.

These small inefficient loops, even on the small bowls, hardly provided sufficient leverage for support of a filled container, and must either have been designed as hangers for the vessels when empty or else were purely ornamental.

The smaller gray-ware jars at Site RB 568 frequently had a single handle, usually vertical, less frequently horizontal. As a rule the handles were composed of two or three parallel fillets of clay (fig. 70, *i*), but sometimes were a single flat or slightly concave strap (fig. 70, *d*). Rare examples were intricately decorated (fig. 70, *j*). Occasionally appliqué nipples or scrolls were attached (fig. 70, *e, f*).

Dipper handles show a marked contrast between Pueblo II and Pueblo III. The material from Site RB 551 contained many dipper handles; nearly all were made in some form of strap, the cross section of which was an elongated rectangle. Sometimes the long axis of the cross section was vertical, as in figure 50, *i, k*, and then it was doubled back and attached to form a long loop, both branches of which could be grasped in the hand. Frequently the long axis of the cross section was horizontal, as in figure 50, *q, s, v*. In these specimens it was not doubled back, but occasionally was turned up at the tip (fig. 50, *q*) and often was formed into a shallow trough

(figs. 27, *g, i*; 50, *q, v*). Figure 50, *l, n,* and *p* shows variations made in circular cross section. Most of the Pueblo II dipper handles were attached by inserting the proximal end into a hole punched through the wall of the dipper body, and then welding the inner surface of the body to the handle.

At Site RB 568 the dipper handles were usually tubular in cross section in both white and orange wares, and the method of attachment was new. A pointed nub of clay was left at the point on the vessel where the handle was to be attached. The handle was formed around a wooden stick, then pressed into place around the nub and sealed externally with a thin fillet. A thin strap loop was usually molded to the outer extremity of the handle (figs. 37, *g, i*; 53, *c, g*; 69, *a–c*). An unusual handle is shown in figure 37, *f*. Perhaps a long wooden handle was tied to this. Figures 53, *j* and 69, *f* illustrate handles of the Pueblo II type. The handle of figure 53, *c* is solid, and formed of an inner rod and outer ornamental casing. It may represent a baby on a cradle board.

Unusual Forms

Several peculiar or unique specimens should be referred to. At Site RB 1008 were found fragments of the vessel reconstructed in figure 71, *b*. The reconstruction is based on a similar example in the collection of John Wetherill at Kayenta.

A few miniature double-bodied jars were found. A black-on-red example is illustrated in figure 71, *g* from the Pueblo III Site RB 568. It is 7.7 cm. high. A similar one of black-on-white ware came from the Pueblo II Site RB 564.

Figure 52, *c* shows a small gray-ware jug from Site RB 568 bearing a decoration of swirled ridges in high relief. The spiral ridges were formed by pinching the horizontal fillets as they were laid, and were not added later in an appliqué technique. This fact is evidenced by vestiges of the structural coils running across the spiral ridges.

Several modeled clay fragments were found at Site RB 568. The orange-ware arm fragments shown in figure 70, *a* were the only evidence of human figurines discovered. The other object in figure 70, *a* is a pendant, while the two fragments in figure 70, *b* were probably parts of black-on-white effigy bowls of the general type of figure 71, *b*.

From time to time there has been speculation as to whether examples of different types of pottery found in the same area and period might have been made by a single potter. The possibility of village specialization has been raised and good evidence thereof apparently exists in certain places. In Site RB 568 evidence strongly indicated that various types of vessels were not only made in the same village but perhaps by the same woman. This was true of the orange and white wares, despite the sharp demarcation between the design traditions. No difference in either household or mortuary use was apparent. Moreover, in burial 2 at this site, not only did the materials for making black-on-white ware accompany the burial, but unfired orange pottery together with the tools and materials for its manufacture were also found.

CONCLUSION

This report describes the major part of the archaeological work performed by the Rainbow Bridge–Monument Valley Expedition up to the present time. Most of the data presented are from the Tsegi drainage in northeastern Arizona or its immediate vicinity and cover the period from Pueblo I to the close of Pueblo III, the termination of the period of Pueblo occupation in the area. Data from other parts of the area and from the Basketmaker period are not included in the report.

The following conclusions summarize the significance of the work undertaken. First, a method of relative chronology has been developed which permitted the approximate chronological placement of sites from this region by means of surface collections of sherd materials. Some clarification of the pottery types has been made and the relative significance of various previous classifications has been indicated. The most important change, perhaps, is the indication that the distinctions in Pueblo III orange-ware types appear to have little or no temporal significance. The necessarily arbitrary nature of the lines drawn between periods in a culture sequence has been demonstrated by the presence of various time spans impossible to classify under existing period definitions. These spans consist of time differentials between certain changes in architectural and pottery types previously regarded as being more or less contemporaneous. For example, a temporal difference has been established between the first appearance of what have been regarded as the diagnostic orange-ware types for Pueblo III and the diagnostic black-on-white ware types for the same period. Differences in architectural associations of the first appearances of these Pueblo III orange-ware and white-ware series indicate that a redefinition of the boundary between Pueblo II and Pueblo III for the area is needed. Less marked, but probably still significant, lack of conformity between pottery and architectural sequences is suggested for the Pueblo I and Pueblo II periods. The priority of Black Mesa Black-on-white relative to other Pueblo II black-on-whites seems verified.

Important contributions have resulted from the meticulous analysis of pottery manufacture and design in the area. Finer discriminations within the utility gray wares have been made, indicating technological differences with temporal significance within some of the accepted classifications. The chief result of the design study has been the documentation of a developmental relationship among types of pottery from the Kayenta area. The evolution of Black Mesa Black-on-white from the antecedent Kana-a Black-on-white seems clearly established. The later Pueblo II black-on-whites, Sosi and Dogoszhi, on the other hand, seem to have come from a different, although related, tradition and possibly were the result of influences from outside the area; at least no clear transition from earlier local types is apparent. A sequence of development in black-on-white design from Pueblo I to Pueblo III is traced, showing influences of layout and the use of some design elements carrying over from Pueblo I to Pueblo III. There is a relation between Dogoszhi Black-on-white design and that on certain examples of the black-on-red slipped orange ware, and in Pueblo III it appears that the orange ware series follows in the design tradition of earlier black-on-white far more closely than does Pueblo III black-on-white. The design of the latter was extensively influenced by Flagstaff Black-on-white, a Pueblo II style of the San Francisco Mountain region, which was relatively rare in Pueblo II pottery of the Kayenta region.

Excavational evidence shows fairly certainly that the Kayenta orange-ware and white-ware series were concurrent pottery traditions, at least during Pueblo III. Not only were they made in the same villages, but they seem often to have been made

by the same potters. The extraordinary consistency of the two design traditions and the almost complete lack of any overlapping between orange- and white-ware design in Pueblo III consequently present a cultural phenomenon of unusual interest. In this connection, however, it should be borne in mind that clear-cut parallel traditions also exist between the various gray-ware types and both the black-on-white and black-on-orange wares. Our own cultural tradition might suggest that the two decorated styles belong in the same category, but it is apparent that to the aboriginal inhabitants of the Tsegi region the orange and white wares occupied quite distinct categories.

It is evident that much remains to be done in the Tsegi region and that the work of the Expedition thus far has been primarily of value in defining problems. It is clear that the Basketmaker problems have not been conclusively solved and the transition from Basketmaker to Pueblo I remains obscure. More work on Pueblo I with special emphasis on the transition to Pueblo II is needed. Pueblo II also presents many variations which need to be understood more thoroughly, while redefinition of the demarcation between Pueblo II and Pueblo III is required. The relation of early, middle, and late Pueblo III, especially the problem of the relationship between the open sites and the cave sites, still needs clarification.

More excavation is needed for several purposes. One is the more careful working out of the relations between pottery types and architectural styles. Larger quantities of material are needed for the study of artifacts of stone and bone. The study by Jones in Appendix II indicates clearly that a good deal more can be done to reconstruct life in the region through greater attention to the organic materials present in sites. Finally, there is urgent need to discover sites with wood datable by dendrochronology to provide a more precise calendar than the present relative dating.

Many of the problems raised in the course of this paper also await work in surrounding areas. The provenience of the early red wares, the relation of polychromes to the surrounding regions, and the derivation of such black-on-white types as Sosi and Dogoszhi depend on such knowledge. The Expedition still has some pertinent material to publish, but, in the main, new work is needed to solve the problems which have been raised.

APPENDIX I

RECENT GEOLOGY OF THE TSEGI CANYON[107]

BY

JOHN T. HACK

INTRODUCTION

THE TSEGI CANYON, a deep and narrow gorge walled by the buff-red rocks of the Jurassic, is well known for its beauty and grandeur. Although it is now a wilderness inhabited only by a few Navajo families, it was once the home of many Pueblo farmers. The ruins of their villages are scattered over the canyon floor, on rock benches of the canyon walls, and in almost inaccessible caves and arches hundreds of feet above the canyon bottom. The deterioration and abandonment of this obviously once fertile area is related clearly to its recent geology.

While engaged in a study of the physical environment of the Hopi people and their prehistoric ancestors, under the auspices of the Peabody Museum of Harvard University, the writer visited the Tsegi Canyon as a guest of the Rainbow Bridge–Monument Valley Expedition. The present brief account of the Tsegi Canyon may be considered in relation to a more detailed report on the homeland of the Hopi published by the Peabody Museum.[108]

The writer spent one week in the Tsegi Canyon in 1938 in company with Dr. George W. Brainerd, Dr. Ralph L. Beals, and Dr. Charles del Norte Winning, who made available all the archaeological data obtained by the Rainbow Bridge–Monument Valley Expedition up to that time. At a later time the writer revisited the locality with Dr. Kirk Bryan, whose encouragement to scientific endeavor and whose suggestions concerning the geologic history of the period of Pueblo occupation are gratefully acknowledged.

GENERAL SETTING

The Tsegi Canyon is the main and also the outlet canyon of a system of canyons that begins on Skeleton Mesa, a deeply dissected plateau underlain by the sandstones of the Glen Canyon group (Navajo, Kayenta, and Wingate formations). Its main stream flows southeastward between cliffs from five hundred to one thousand feet high, and is joined by numerous steep-walled, narrow tributary canyons. At Marsh Pass the stream reaches the Comb Ridge monocline, an area where the rocks dip sharply southeastward. Here the stream turns abruptly to the northeast, following the upturned outcrop of the softer Morrison beds, and thence onto the low, barren plains south of the Monument Valley. The monocline at Marsh Pass is flanked on the northwest by the resistant Navajo sandstone which holds up Skeleton Mesa, and on the southeast by the younger, resistant Mesaverde sandstone which holds up the broad plateau of Black Mesa. These two regions are very different in aspect. The Skeleton Mesa area is characterized by deep and narrow canyons, having narrow alluvial floors, whereas the Black Mesa area is less deeply dissected and contains many shallow valleys, at the present time more fertile.

The lower Tsegi Canyon exposes four Mesozoic rock formations. Its floor is underlain by the Chinle shale (400 to 700 feet) of Triassic age. This is overlain

[107] Published with the permission of the Peabody Museum of Harvard University.
[108] Hack, 1942.

by the red Wingate sandstone (30 to 450 feet) of Jurassic age, which in many places forms wide rock benches less than halfway up the canyon walls. The Jurassic Kayenta formation of shale and limestone (3 to 200 feet) and the massive red Navajo sandstone (400 to 1000 feet) form the higher canyon walls.[109]

The floor of the Tsegi Canyon contains waterlaid alluvium of a reddish color which in the lower reaches is about ninety feet thick. This alluvium is now dissected by a well-integrated system of arroyos, which have been cut since 1884.

Water Supply and Sites for Dwellings

The massive Wingate and Navajo sandstones are porous formations and good aquifers. As the region drained by the Tsegi Canyon is in the semiarid or subhumid zone of piñon, juniper, and Douglas fir, and therefore probably has a mean annual precipitation of about twelve to fourteen inches, the canyon has a better water supply than many regions near by. Its main stream flows throughout the year and there are many springs in the narrow tributary canyons.

The massive sandstone of the canyon walls contains many caves, and high arches etched in bas relief on the precipitous cliffs. According to Gregory,[110] these great cavities are formed by ground water seeping along a relatively impervious layer in the massive sandstone which has dissolved the weak cement and caused the undermining of the rock above. The caves are clearly associated with regions of concentrated underground seepage of water, and many of them contain springs. Thus the caves, whether they occur in the Wingate sandstone near the bottom of the canyon, or in the Navajo sandstone high on the canyon walls, were excellent building sites for the ancient Pueblos, and now contain many ruins.

Springs are found in many places at the contact of the Navajo sandstone with the Kayenta formation on the wide rock bench of the canyon wall, and springs occur at the base of the Wingate sandstone on the canyon floor. Probably the largest supply of water, however, is found in the alluvium in the bottom of the canyon. At present this alluvium is dissected and its contained water is tapped by deep arroyos, which thus have a perennial flow. Before 1884, when the recent dissection began,[111] there was a small perennial stream flowing on top of the alluvial floor and several lakes existed in the lower part of the canyon (Marsh Pass sheet of the U.S. Geological Survey, surveyed in 1883). Water could probably have been obtained in many places on the canyon floor by digging shallow wells. Thus the bottom of the canyon made an excellent site for dwellings, and numerous ruins are found on the narrow alluvial flat. They are, however, all of Pueblo II and III age, older ruins being confined to rock benches or talus slopes of the canyon sides (Watson Smith, personal communication, 1940).

Tsegi Canyon as a Habitation for an Agricultural People

At the present time the Tsegi Canyon is truly a wilderness. In spite of its relatively good water supply, which should serve to water many herds of livestock, only three or four Navajo families live in the canyon. They live principally by raising sheep, as there are at most only three or four cornfields and a small peach orchard, irrigated from a spring. These fields furnish a quite inadequate food supply for even this small population.

Before the recent epicycle of erosion began in 1884 the region supported a much larger population of Navajos, and cornfields were more abundant, for crops could be watered by diversion of the small perennial stream and by use of floodwaters coming from numerous small tributary canyons.

[109] See Gregory, 1917. [110] *Ibid.*, p. 133. [111] *Ibid.*, p. 130.

At that time the ground water table was high, and vegetation in the narrow alluvial bottom lands was relatively dense and presumably consisted of alkali sacaton and shadscale, making excellent forage. Some of the higher reaches of the canyon, which as yet are not completely dissected by arroyos, still contain lush grassy vegetation.

The dissection by a completely integrated system of arroyos in the lower part of the canyon lowered the water table, destroyed the succulent grasses and weeds, and now allows only an impoverished vegetation to survive, consisting of such plants as greasewood, shadscale, snakeweed, and sparse grass. The bottoms of the present deep and narrow arroyos contain both perennial and flood waters but are too narrow to allow room for farming.

Before 1300 A.D., that is, from Basketmaker to Pueblo III time, the Tsegi Canyon supported a large agricultural population which must have farmed on the canyon floor. Geological study of the alluvium of the Tsegi Canyon permits a reconstruction of the conditions under which farming could have been practiced at various times during the Puebloan occupation, and sheds considerable light on the archaeological history of the region.

Geology of the Recent Alluvium

GENERAL

The present stream of the Tsegi Canyon flows on bedrock or close to bedrock in a deep arroyo whose walls are from twenty-five to eighty feet high, and composed of reddish gravel, sand, silt, and clay. The dissection of the alluvium by the present arroyo has converted the flood plain of 1885 into a terrace which lies from twenty to fifty feet above the present stream grade. This lowest terrace begins at the steep arroyo banks. A higher terrace lies from ten to twenty feet above the lower terrace. In most places it is found several hundred yards back from the arroyo, and is separated from the lower terrace by a low embankment. Where the present arroyo intersects this embankment, it can be seen that the terraces are composed of two bodies of alluvium separated from each other by an unconformity, and that each body of alluvium extends to bedrock. The younger body of alluvium, which forms the lower terrace, is correlative with the Naha formation or No. 3 fill of the Jeddito Valley.[112] The older body of alluvium, a higher terrace, is here called the Tsegi formation (No. 2 fill). These two formations and the terraces which they form have been followed from a point on Laguna Creek three miles northeast of Marsh Pass (pl. 31, *b*) to a point six miles up the Tsegi Canyon near the ruin of Betatakin. At outcrop after outcrop it is evident that after deposition of the Tsegi formation a system of deep arroyos formed similar to those of the present, and that after this erosion, deposition again took place, filling up the ancient arroyos, not completely, but to a point from ten to twenty feet below the tops of their former banks, as is shown diagrammatically in figure 72.

Earlier stages in the history of the canyon are recorded in the great falling dunes which extend from the forested top of Skeleton Mesa down the southwest canyon wall to the canyon floor (pl. 31, *a*). These dunes are ancient, since they are now stabilized by vegetation and are being eroded by water and wind. Where the bases of these dunes are exposed in the walls of arroyos it is clear that they are overlain by the older alluvium, the Tsegi formation, and thus record a period of severe wind action which preceded deposition of the Tsegi formation. It is believed that these falling dunes formed when the climate was much drier than at present and during the postglacial optimum of climate which occurred between 5000 and

[112] Hack, 1939, 1942.

2000 B.C., a theory discussed in a report of the Peabody Museum.[113] They are thus much older than the Basketmaker or Puebloan occupation.

In the Jeddito Valley the Naha and Tsegi formations and a system of dunes correlative with the falling dunes of the Tsegi Canyon are underlain by an older water-laid formation, containing remains of Proboscidian, called the Jeddito formation. So far as known, there is no representative of this formation in the Tsegi Canyon. (But a proboscidian tooth of mammoth type was found on the floor of Wild Cat Canyon, a Tsegi tributary.—G. W. B.)

Above the alluvial canyon floor a prominent rock terrace is seen in many places on the canyon sides. This terrace is cut on the Wingate sandstone and the Chinle shale, and is believed to be a pediment, an erosion surface formed during a halt

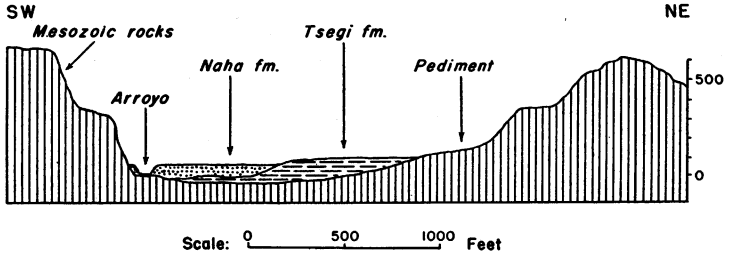


Fig. 72. Schematic cross section of Tsegi Canyon, showing positional relationship of the successive alluvial valley fills, about one-half mile above Marsh Pass.

in the process of carving the canyon. The ancient falling dunes cover parts of this rock terrace or pediment, and it is clear that the terrace is older than the dunes or than any of the alluvium, and must be of Pleistocene age. It is the site of many ruins.

ARCHAEOLOGICAL DATING OF GEOLOGIC EVENTS

The geologic events which affected the human occupation of the Tsegi Canyon are only the most recent of those recorded by the geological features of the canyon. It is possible that men lived in the Tsegi Canyon in very early times, perhaps before the dry period which caused the formation of the falling dunes. There is, however, no tangible evidence of occupation of the canyon or of the neighboring region before the entrance of the Puebloans about the beginning of our era. The deposition of the Tsegi formation, however, is the first geological event which could have occurred during Pueblo or Basketmaker occupation of the region.

Tsegi formation.—The Tsegi formation underlies the highest terrace of the alluvial canyon floor. It extends from one wall of the canyon to the other and is absent only in the center, where it is replaced by the younger Naha formation. Numerous houses of Pueblo II and III age are found on the Tsegi formation, so that it must be older than Pueblo II (900 A.D.). It is younger than the falling dunes, and therefore probably younger than 2000 B.C. No artifacts have as yet been found in this formation, although it was presumably being deposited during Basketmaker time.

Tsegi-Naha epicycle of erosion.—Following early Pueblo III time (1150–1200 A.D.) erosion of the Tsegi formation occurred and large and deep arroyos formed. That this erosion must have occurred after early Pueblo III time is shown by two sites on the canyon floor. These small collections of houses, one of Pueblo II age and one of Pueblo III age, were built on the Tsegi formation, and were partially destroyed by the post-Tsegi arroyo. The Pueblo II site shown in figure 73 near the

[113] Hack, 1942.

intersection of Tsegi and Guernsey canyons was occupied during the hundred years between 1000 and 1100 A.D. After it was abandoned, it was eroded by deep arroyos, and blocks of building stone slumped down the arroyo bank to be later buried by the Naha formation.

The arroyos formed in the Tsegi-Naha interval of erosion, after or during late Pueblo III time, were clearly as deep as the modern arroyos, for they extended in many places to bedrock and were considerably wider.

Naha formation.—The deep arroyos of the Tsegi-Naha interval of erosion were later filled with alluvium up to a level ten to twenty feet below the top of the Tsegi formation. This younger channel fill, called the Naha formation, contains many pueblo artifacts. Fourteen feet above the bottom of Betatakin arroyo, a short tribu-

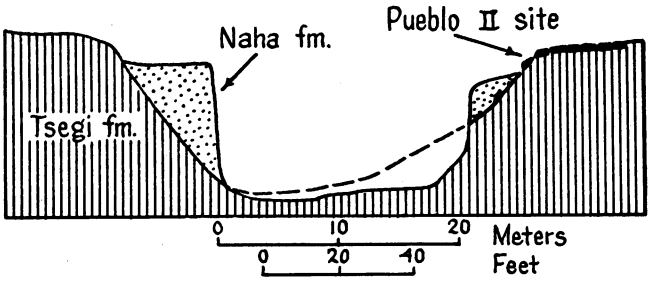


Fig. 73. Measured cross section of the main arroyo of Tsegi Canyon, showing the relationship of a Pueblo II site to the Tsegi and Naha formations.

tary of the Tsegi Canyon, a sherd of Kiet Siel Gray (1225–1300 A.D.) was found in the Naha formation. Near Cobra Head a sherd of Tsegi Orange (1100–1300 A.D.) was found forty-five feet above the present stream grade. Below Marsh Pass the following assemblage was found in the Naha formation:

Type	Number of sherds
Undecorated White ware	2
Flagstaff Black-on-white	2
Sosi Black-on-white	1
Dogoszhi Black-on-white	1
Tsegi Orange ware	1
Dogoszhi Polychrome	1
Tsegi Black-on-orange	1
Tusayan Polychrome	4
Moenkopi Corrugated	25
Plain Gray ware	15

The youngest of these sherds are of late Pueblo III age (1200–1300 A.D.).

Thus the Naha formation must be at least as young as or younger than late Pueblo III. The deposition of the older Tsegi formation was complete by 900 A.D. Arroyos dissected this formation after early Pueblo III time (1150–1200 A.D.), and these arroyos were partly filled by the Naha formation sometime as late as or later than 1300 A.D. Evidence in the Tsegi Canyon proves only that the Naha formation was deposited after 1250 A.D. and that deposition was complete before 1880. However, it is believed that the Naha formation of the Tsegi Canyon is correlative with the Naha formation of the Jeddito Valley, which was deposited between 1300 or 1400 A.D. and 1700 A.D. The Tsegi-Naha epicycle of erosion thus occurrred in the

late thirteenth or early fourteenth century. The fact that there are no Pueblo ruins in the Tsegi Canyon of later type than Pueblo III (1100–1300) indicates that the canyon was abandoned by the Pueblos near the year 1300. Thus the general evidence of occupation supports the inference made from potsherds enclosed in the youngest alluvium, that the Naha formation began to form between 1000 and 1400 A.D.

HISTORY OF DEPOSITION AND EROSION

The early geologic history of the Tsegi Canyon can be worked out by correlation with the Jeddito Valley, but it is only the last few thousand years of its history which need concern us here. This history is shown diagrammatically in figure 74. Probably at some time before 2000 B.C., alluvium, if any had ever existed, had been washed out of the canyon, which had largely a bedrock floor. Great falling dunes extended down the cliffs of the southwest canyon wall. At this time the climate must have been very dry, if dunes could form on Skeleton Mesa where at present there is a thick growth of piñon, juniper, and Douglas fir.

Following this dry period, alluvium was deposited in the canyon by aggrading streams. By 900 A.D. the alluvium was eighty feet thick in the lower part of the canyon, and the stream flowed over it in a shallow channel which periodically flooded its banks.

After early Pueblo III time, and probably around 1300 A.D., erosion occurred, forming a deep arroyo system. This was followed by a period of alluviation, but the arroyos were filled only up to a height from ten to twenty feet below the former stream grade. The main stream never again flooded the whole valley floor but flowed in a channel or inner valley, which was wide enough, however, to permit several lakes to exist and to permit farming on its bottom. In 1884, the stream again began to cut down, forming the wide system of arroyos which are seen today.

EFFECT OF THE RECENT GEOLOGIC HISTORY ON THE AGRICULTURE OF THE INHABITANTS

In Basketmaker and early Pueblo time, while the Tsegi formation was being deposited, conditions in the Tsegi Canyon must have been ideal for farming. The stream was aggrading and fields could have been located along the main stream and in tributary canyons. The fact that no ruins earlier than Pueblo II are found on the Tsegi formation is significant. This means either that earlier villages were buried by the aggrading streams or that the canyon floor was not suitable for habitation before Pueblo II time. It is suggested that in Basketmaker and Pueblo I time the stream was actively aggrading, and shifted from one side of the canyon to the other. Such conditions would have been ideal for farming. In Pueblo II time the gradient became stabilized and the stream flowed in a more permanent channel so that houses could be located on the canyon floor. Conditions were still suitable for farming, however, for the water table was high, and water of the main stream and tributary streams, whether perennial or flood, could easily be diverted and spread over the fields on the wide alluvial floor.

At the end of Pueblo III time, or later, when the post-Tsegi, pre-Naha epicycle of erosion occurred, all the farmlands must have been destroyed and the region made as barren as it is today. Occupation by a large agricultural population was impossible. Furthermore, the canyon never again saw the favorable farming conditions of Basketmaker and early Pueblo time, for the main stream never again spread over the whole valley floor. However, in Naha time the water table was high, vegetation was lush, and small areas overspread by floods were available in the inner valley of the Naha terrace, so that a relatively small population of Navajos

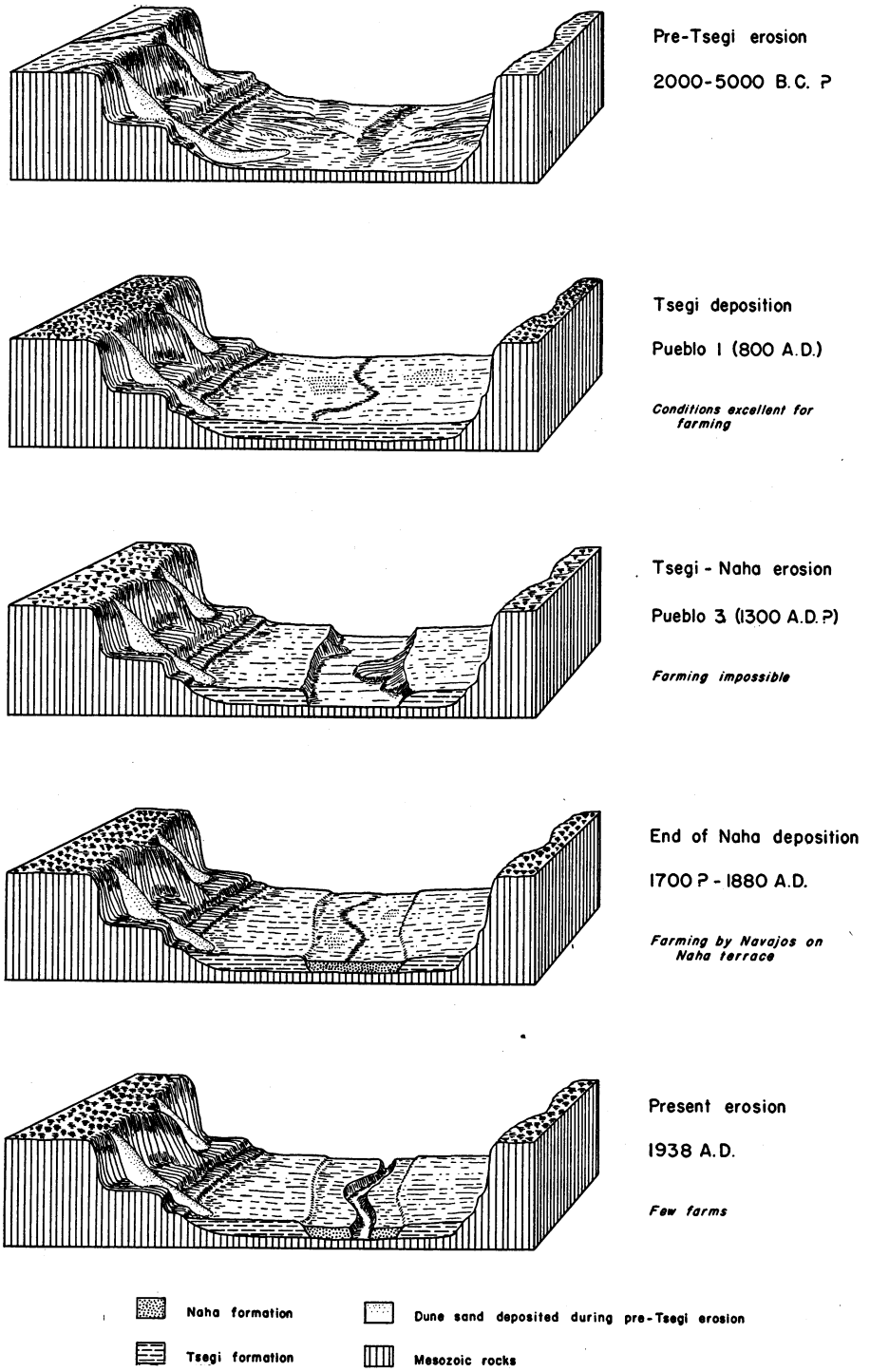


Fig. 74. Hypothetical series of block diagrams of Tsegi Canyon, illustrating the chronological sequence of the stages of erosion and deposition from preoccupational times to the present.

made a good living in the canyon, prior to the recent disastrous epicycle of erosion which began in 1884.

Thus the abandonment of the Tsegi Canyon by the Pueblos is accounted for by the changing conditions of deposition and erosion of its stream. In the thirteenth century, or shortly thereafter, the region became barren and the inhabitants abandoned it, perhaps in favor of regions like the Hopi Country, less affected by this environmental change.

Appendix II

PLANT MATERIALS

BY

Volney H. Jones

About thirty lots of plant remains from the excavations of the Rainbow Bridge–Monument Valley Expedition were submitted to the Ethnobotanical Laboratory, Museum of Anthropology, University of Michigan. These lots of material, consisting of a large number of individual specimens, remain on deposit at the Laboratory, where they are available for study and comparison.

These plant remains are, in general, well preserved and are quite diverse in the objects represented and in the plant sources of materials. The majority of the specimens were identifiable, and interpretations of most could be made. They offer interesting information on certain aspects of plant utilization by the former inhabitants of the sites involved. For convenience of discussion, they may be divided into several groups.

Cultivated Food Plants

MAIZE

Remains of maize or corn are abundant in the material, being chiefly in the form of cobs, but a few kernels are present, as are ear stalks and husks. There are no complete ears and no kernels are attached to cobs, so it is not possible to associate cob types with kernel types. Forty-five corncobs were noted as follows:

356–1 One corncob, 14-row, 15 cm. long, 2.5 cm. in maximum diameter, elliptical in cross section. Kernels apparently removed in the immature or "roasting ear" stage.

414–1 One corncob, 10-row, 8.5 cm. long, 1.7 cm. maximum diameter, elliptical, kernels removed immature.

616–1 Four corncobs, one incomplete. Two 8-row, two 10-row. From 7 to 15 cm. in length, from 1.5 to 2 cm. in maximum diameter. All more or less elliptical and all seem to have had the kernels removed in immature stage.

682–1 Twenty-nine corncobs, some of which are incomplete, and a few small fragments of cobs. These exhibit great diversity in several characteristics. Three have 14 rows, fourteen have 12 rows, and twelve have 10 rows. The length varies from 5.5 cm. to 11.5 cm. and the maximum diameter from 1.5 to 3 cm. Most of the cobs are elliptical. The kernels of most were removed in the immature stage. A few of the cobs have red chaff. Some show abnormalities such as extreme fasciation, prominent chaff, and spiral rows.

699–1 Seven corncobs, three of which have 12 rows, two of which have 10 rows, and the remaining two have 8 rows. Three are incomplete in length and the remainder are from 6 to 7 cm. in length. Vary in diameter from 1.3 to 2.2 cm. Most are elliptical. Kernels of all removed in immature stage. Three have prominent chaff.

851–10 Four corncobs which show unusual uniformity. One is incomplete and the other three are from 10 to 12 cm. in length. All are 2 cm. in maximum diameter. Three have 12 rows and the other has 10. All are elliptical and all have had the kernels removed in the roasting ear stage. It appears that these are all from a single horticultural variety.

Summarization of this list emphasizes the variability of the cobs in size and number of rows. Four have 14 rows, twenty have 12 rows, seventeen have 10 rows, and four have 8 rows. The greatest dimensions are 15 cm. in length and 3 cm. in diameter. The smallest dimensions are 4.5 cm. in length and 1 cm. in diameter. The average length is about 9 cm. and the average diameter about 1.9 cm. It is difficult to interpret this variability, but it suggests that several types and varieties of corn were cultivated.

Duplicates of most of these cobs could probably be found in present day Southwestern Indian agriculture. Cobs of elliptical cross section, so common in the arch-

aeological material, are still characteristic. The modern corn is primarily 10-row and 12-row, with 14-row and 8-row types scarce, just as in the archaeological corn. The modern corn averages considerably larger than this archaeological corn, but what explanation might be offered for this we are not ready to say. It is interesting to note the abnormalities and the red cobs. Abnormalities such as these crop up in almost any field of corn at present and apparently did so in the past. Some of the modern Pueblo corns have red cobs, as do certain varieties of commercial corns.

It is surprising that so many of the cobs seem to have had the kernels removed in the immature or "roasting ear" stage. The modern Southwestern Indians roast a part of their corn in the "green" stage, but the great bulk is allowed to mature and the kernels are ground for bread.

Only a few corn kernels occur in the material. These are all of normal size and are comparable in other characteristics to modern Pueblo corn.

357–1 Three kernels of dark purple flour corn.
568–349 Five kernels of dark purple flour corn, very similar to the foregoing and apparently of the same horticultural variety.
851–misc. A single kernel of tan-colored corn which has been partly eaten, apparently by a rodent. Intermediate in type between flour and flint corn.

The two lots of dark purple corn are similar in every way to those from certain ears in our collections obtained from the Hopi in 1935. This particular variety, which is called *koko ma* by the Hopi, is discussed by Whiting.[114] The Hopi grow this variety primarily for a dye rather than as a food, but this practice may well be recent. This purple corn, considered "black" by the Hopi, is symbolic of the zenith in their ceremonial scheme of directions. This ceremonial association and the fact that Hopi informants told Forde[115] that this was one of the varieties cultivated in the "old days" suggests its antiquity. This achaeological find attests its antiquity in the area, at least.

The kernel of tan corn is similar to some of the intermediate types of corn cultivated at present by some of the Rio Grande Pueblos.

The following ear-stalks and husks were noted.

699–1 Corn ear-stalk of average size.
699–1 Several fragments of corn husks.
851–1 Corn ear-stalk of average size.
851–misc. A wad of cornhusk apparently chewed.

There is nothing particularly significant about specimens of ear stalks and husks except that they indicate the presence of corn. It is not possible to determine the type of corn from them.

BEAN

Only a single bean (851–misc.) was found. This is a tan kidney bean (*Phaseolus vulgaris*) of average size (12 mm. in length) and more or less truncated at the ends. It is similar to some of the present-day Pueblo beans.

PUMPKINS

The presence of pumpkins is indicated by a fruit stem (peduncle), and fragments of rinds (699–1), and by one broken seed (851–misc.). All these seem to be of the species *Curcurbita moschata* and appear to be of the Striped Cushaw type. This species and type is commonly found archaeologically in the Southwest and predominates in present-day Pueblo agriculture. See Whiting[116] for its occurrence and use among the Hopi.

[114] Whiting. [115] Forde, p. 392. [116] Whiting, p. 93.

Uncultivated Foods

There are several specimens of edible materials which it seems safe to assume probably represent food. These are primarily seeds, but other items are present.

568–123 Several lumps of very small seeds, constituting about a half pint in quantity. These were gathered and stored, probably for food purposes. The seeds are less than a millimeter in length and are more or less translucent. The degree of efficiency in gathering and preparing seeds of this size for food must have been very low. We have so far been unable to identify these seeds, but consider that they may be grass seeds.

568–230 About a pint of seeds from bowl No. 231, burial No. 38. These are primarily from Goosefoot (*Chenopodium* spp.) but there are several other kinds of seeds present in lesser quantity. Among these are *Suaeda* spp., *Amaranthus* spp., *Malva* spp., and *Polygonum* spp. It is probable that it was intended to gather seeds of Goosefoot for food, for they were and are used for food by Southwestern Indians. The other seeds probably were gathered inadvertently in beating the seeds into baskets with seed-beaters.

568–349 One entire pit and many fragments of pits of Hackberry (*Celtis* sp.). These are probably of *Celtis reticulata,* a species whose fruits ("berries") were used as food by Indians.

568–354 A small quantity of seeds of Amaranth (*Amaranthus* sp.). The seeds of various species of Amaranthus are often found in archaeological sites in the Southwest and are still used as food by the Indians of the region.

851–misc. A portion of a small cactus plant (*Echinocereus* sp.). The fruits and pulpy stems of cacti of this genus were commonly eaten. The stems were either boiled or baked.

Two particularly interesting specimens were two lumps (568–352 B–40) appearing externally like resin or gum. On cutting into these it was found that both were more or less crystalline and that it was definitely not resinous. The material of each was found to be soluble in water and very sweet to the taste, suggesting that they were sugar or honey. Since sources of concentrated sugar were scarce in aboriginal times, the specimens assumed unusual interest and were submitted to Dr. Elias Yanovsky, Chemist, Carbohydrate Research Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture. His findings follow:

Spec. A: Crystalline and opaque, weighing about 2.5 grams.
Optical rotation: +4.6° V (in 2 dm. tube).
Contains 8.7 per cent reducing sugars (calculated as dextrose).
Contains 34.7 per cent nonreducing sugars.
Seliwanoff's test for levulose positive, indicating sucrose invert sugar.
Crystalline material examined microscopically showed it to resemble closely the trisaccharide melezitose in optical properties.

Spec. B: Clear and gummy, weighing about 1 gram.
Optical rotation: +3.7° V.
Contains 38.8 per cent reducing sugars.
Contains 19.6 per cent nonreducing sugars.
Seliwanoff's test for levulose negative, indicating absence of sucrose or invert sugar.
Not examined microscopically.

It is evident that the specimens are different in appearance and in properties and doubtless are different in origin. Dr. Yanovsky considers that indications are that specimen A is partially crystallized honey-dew. It resembles honey-dew in color and in taste. Specimen B is more puzzling, and Dr. Yanovsky is less certain as to its origin, but he suspects that it is a melezitose gum of vegetable origin. We are unable to suggest any particular plant from which it might have come.

If the specimen A is truly honey-dew, as it seems to be, it is exceedingly interesting and valuable as an indication of ancient use of honey-dew, probably in much the same manner as in recent times. The honey-dew is secreted on plants by small insects known as aphids. Witherspoon has described in some detail the gathering of honey-dew by certain Indians of Nevada, probably Paiute.[117]

[117] Witherspoon, p. 380.

Fibers

TEXTILES

There are only four textile specimens in the material submitted to us. Two of these are sandal fragments, one a fragment of cotton cloth, and the other appears to be an impression.

COTTON

The only evidences of cotton are a small fragment of woven cloth (851–5) and a piece of cotton cord (851–2). These indicate the presence of and knowledge of cotton but do not necessarily prove its cultivation in the immediate area, since cotton was a prominent trade article.

851–4 Portion of a sandal woven of strips about 3 to 5 mm. wide. The weave is twilling (alternately over-two, under-two) and the margin is braided. It shows considerable wear. The material is split yucca leaves, apparently from the broad-leaved yucca (*Yucca baccata*).

851–5 A small, irregular fragment of cotton cloth roughly 2 cm. by 3 cm. in size. No margin or selvage is evident. The regularity of weave suggests that it was loom-woven, and the threads probably are spun with a spindle. The threads are uniform in width and about 0.5 mm. wide. The weave is plain plaiting and the weaving is fairly close, with about 12 to 14 threads per cm. The threads are tightly spun counterclockwise. The cotton is likely Hopi cotton (*Grossypium hopi*), which seems to have been the only species of aboriginal cotton in the Southwest.

851–6 Heel portion of sandal woven of strips about 5 to 7 mm. in width. The weave is twilling (alternately over-two, under-two) and the margin finished by twisting the elements about each other and running them back through. It shows much wear. The material appears to have been used in its full width. It is of yucca leaves probably from *Yucca angustissima*.

CORDAGE AND THONGS

A rather large number of pieces of cordage and yucca thongs occur. These were studied in some detail. Identifications of the fibers in the cordage were all made by Miss Gretchen Beardsley, a student in ethnobotany at the University of Michigan.

851–2 Twenty-four fragments of cordage. These vary from about 1.5 mm. in diameter to about 5 mm., but are mostly from 2 to 3 mm. Most are carefully made of uniform diameter and twisted tightly, but a few are carelessly and loosely made. Several are knotted and one is spliced.

All but one are of two strands, the exception being of four strands. Twenty are twisted in a counterclockwise direction, and the remaining four are clockwise. In every instance the individual strands are twisted in the direction opposite to that in which they are twisted together. This leaves little doubt that all were manufactured by rolling the fibers on the thigh under the palm of the hand in one direction until the strands are formed, and then reversing the motion to roll the strands together to form the cord. This was an almost universal method of cordage manufacture.

All but two of the pieces of cord are made of fibers of yucca (*Yucca* spp.). One is of herbaceous bast fibers which suggest Indian hemp (*Apocynum* sp.) and the other is made of cotton, probably Hopi cotton (*Gossypium hopi*). This great predominance of yucca is typical in archaeological cordage from the Pueblo region.

The piece of cotton cord is unusual and exceedingly interesting. It is the specimen mentioned as having four strands. Each of these strands is composed of two elements. An analysis indicates that the four strands were each made individually by rolling on the thigh, and then the four were twisted together in a separate operation by the same method. Four-strand cords are rare, and considerable skill must be required to make them; however, this specimen is very neatly and smoothly made. Cotton is seldom used in cordage, instead being spun into yarn with the spindle. Hand-twisting of cotton into cord has been noted among the Yuma.

618–1 and 851–8 These two specimens are so similar that they can be discussed together. They are yucca cords about 5 mm. in diameter, each twisted of two strands in a counterclockwise direction. Each is wrapped with fine feathers, the quills having been split and wrapped spirally around the cords. These must be parts of feather robes or feather blankets such as are sometimes found in sites in the region.

851–misc. A quantity of strips and throngs of yucca leaves. Some of the leaves apparently have been split, while others show the complete leaf width. Most of these are knotted, several kinds of knots being used. These were doubtless used in binding; some show wear from use.

618–1 A split yucca leaf, probably intended as a thong, but not knotted.
699–1 A knotted yucca thong, similar to those discussed in 851–misc.
851–7 Strips of yucca leaves consisting of three strands neatly braided together.

MISCELLANEOUS

851–1 Four curds or quids, three of yucca and one of corn husk. Such quids are frequently reported from western sites and various explanations of them have been offered. Possibly a plausible one is that the fibers were chewed to break them down for textile purposes.
851–misc. A yucca fiber quid similar to those discussed above.
851–3 A lashing composed of two twisted elements tied together at each end. This is about 25 cm. long. The material seems to be grass but is not yet definitely identified.

Foreshafted Arrow

A portion of a reed foreshafted arrow seems worthy of particular attention.

356–2 Portion of reed arrow shaft with part of wooden foreshaft in place. The reed shaft is about 25 cm. in length and the broken wood foreshaft about 3 cm. The foreshaft is bound in with sinew.

The shaft is reed grass (*Phragmites communis*) and the foreshaft is of hard wood showing the distinctive structure of the very hard woods of the shrubby desert plants of the family Chenopodiaceae. It compares well with wood of the greasewood (*Sarcobatus vermiculatus*) and with Saltbush (*Atriplex* spp.), seeming most like the former.

This type of arrow seems to have been widespread and common, for it is often reported both archaeologically and ethnologically in the Southwest. In 1931, an Isleta Indian gave me a crude demonstration of the manufacture of reed arrows and information concerning them. Reed grass was used for the shaft, and wood of *Atriplex canescens* for the foreshaft, which was bound in with sinew. He claimed that this wood caused infection in wounds made by it and that arrows with it were called "poison arrows." Arrows with the wood foreshaft sharpened were light and swift and were used for war purposes. For hunting arrows, a stone arrow point was added. An advantage of the reed shaft arrows in war was said to be that the shaft broke when the arrow struck, and the arrows could not be shot back by the enemy.

Miscellaneous

FLORA

There are a number of miscellaneous items of plant origin.[118] The purpose, function, and significance, if any, of most of these is not evident.

851–9 A split stick about 23 mm. long, burned at one end and with yucca fiber bound around the other. The stick seems to be willow (*Salix* sp.). Smeared on a part of the stick is a white, starchy material. The starch grains of this are very small and definitely are not from corn. We are not yet certain from what plant the starch came.
851–misc. Segments of stem of some grass, unidentified.
851–misc. Segments of stem with insect gall. This seems to be of goldenrod (*Solidago* sp.).
682 A small quantity of stems and leaves of some small bunch grass, matted together. Unidentified.
618–1 Several pieces of charcoal, all seeming to be pine (*Pinus* sp.).
618–1 A stick about 9 cm. long, burned at one end. Apparently cottonwood (*Populus* sp.).

[118] Included with the plant materials submitted were some specimens of animal origin, which are here recorded briefly.

616–2. A specimen of dung. This was dissolved and the intact contents extracted. Hair and small bones were found to be present. These were examined by Dr. Emmet T. Hooper, Assistant Curator of Mammals, Museum of Zoölogy, University of Michigan. He found both the hair and bones to be of a wood rat or pack rat (*Neotoma* sp.). Apparently the meal had been of this animal only. The dung is characteristically canine in appearance and consistency, but of what particular animal we are unable to say.

699–1. Several large pieces of leg bones. Dr. Hooper considers that these are probably from a bear.

851–misc. Claw with the adjacent joint and considerable hair. This seems to be from a jackrabbit (*Lepus* sp.).

APPENDIX III

STATISTICAL METHODS USED IN THE DETERMINATION OF THE POTTERY CHRONOLOGY

THE GENERAL METHOD used in the arrangement of the pottery collections of the sites surveyed by the Expedition in a relative chronological sequence has been outlined in the text (pp. 13–19). The fuller description of methods given here may be of interest to others working with similar material.

SORTING ERRORS

No matter how clearly defined or objective the sorting criteria between types are made, some subjective judgments are made in sorting masses of heavily worn and finely fragmented pottery. In order to neutralize the effects of such judgments, the sorting was done after first combining the previously labeled sherd collections from all the sites. This process was designed with the purpose of eliminating all tendencies of the sorter to distort the distinguishing lines between types and of placing doubtful sherds in the groups most strongly represented in the individual collections. The large proportion of transitional sites demonstrated by this survey suggests the possibility that in this, as in other areas, there may be an unconscious tendency on the part of investigators to push transitional sites into the period represented by the major proportion of the pottery sample through unconscious bias in pottery sorting.

SAMPLING ERRORS

In the working out of table 1, in which the results of the sherd-frequency work are embodied, the following steps were taken. The bar graphs, described on page 13 of the text, were compiled to show frequencies of pottery types and the size of the sherd sample from each site. The chronological order of the major types in the Kayenta area has been known for some time.[119] The slips bearing the bar graphs, when placed in accordance with this order, although generally falling into a linear sequence, were seen to show widely varying and thus confusing percentages of wares and types. It was suspected that much of this confusion in frequencies of pottery groups might prove to have been caused by errors of sampling inherent in the technique of surface sherd collecting. By hypothecating such errors, testing for them and, if present, neutralizing them by whatever means were available, the sites presented a much more logical developmental picture. A discussion of these errors follows:

DOUBLE OR LONG OCCUPATION

Double or long occupation is particularly common in collections from caves. Many of these sites showed only Pueblo I and III types, thus giving unmistakable proof of double occupation. It was usually possible to separate such collections and to use their two components separately in plotting table 1. The surface collections from all other sites of sufficient size were used without subdivision in this table. Possibly, collections from the surface of sites which had a long occupation have exaggerated the transition periods, so pronounced in the table. However, most of the sites were small, suggesting a short occupation. Comparison of the type frequencies found in transition periods with samples from stratified deposits (see tables 3–6 and upper half of table 1) verified the presence of long transition periods during which, for example, Pueblo I and Pueblo II black-on-whites were made by the same people simultaneously. A further confirmation of such transition periods lay in the finding

[119] See "Geographic and Historical Sketch of the Area," pp. 1–3.

of occasional pieces of pottery showing characteristics of two periods. An example was the bowl shown in figure 38, *g*.[120]

DEGREE OF FRAGMENTATION

The degree to which pottery has been broken on the surface of a site introduces differential factors in the number of sherds of various wares, depending upon the size and hardness of the original vessels. Fortunately, Site RB 568 yielded large collections of both sherds and whole vessels from the same time period. The frequencies of the sherds and of the whole vessels, when plotted separately, yielded graphs so similar as to incline us to disregard degree of fragmentation as a disturbing factor in our collections. The possibility that a large number of pieces of a single pot in a small collection may distort the type frequencies was cut down by the obvious expedient of counting all sherds evidently belonging to one pot as a single fragment.

PERSONAL FACTOR

Personal factors may influence the making of the surface sherd collection. In spite of effort made to collect every sherd in the surface area covered, it was found that collections made from the same site but by different men or at different times varied widely. This variation, happily for this study, was found to consist almost completely of differences in the relative frequencies of the wares. For example, although the frequencies of gray and white wares often varied considerably in two collections from the surface of the same site, the relative proportions of Kana-a Black-on-white to Black Mesa Black-on-white, and of Tusayan Gray to Lino Gray, were constant. This fact was probably due to the difference in visibility between the two wares, a difference which does not affect the collection of types within the wares. There is also a tendency, even among the most careful collectors, to collect the larger and more attractive specimens.

In order to correct for this factor of variability, types were studied in relation to their percentage frequency to the ware, rather than to the whole sample. In the Kayenta area, ware frequencies were found to have little value as time indicators, the frequencies of wares changing more slowly than that of their component types, so their exclusion in the formation of the chronology is not important. In table 1, for example, the ware percentages were calculated from group averages, after the group average type percentages, with the ware as a base, had been used as the basis of the chronological placing of the sites.

INSUFFICIENT SIZE OF SAMPLE

Insufficient size of sample is a problem encountered in all statistical work. The collections from the Kayenta area varied from six to several thousand sherds. None of less than thirty sherds were considered because of the large frequency of errors inherent to samples smaller than this number. Table 10 was used to check whether collections showing wide divergencies from the mass of the material in the frequencies of certain types within a ware were actually abnormal beyond reasonable doubt. The table was plotted on log-log graph paper from the following formula:

$$PE_{fp} = 0.6745\sqrt{\frac{fp(100-fp)}{N}}$$

when PE_{fp} = probable error in terms of percentage frequency
fp = percentage frequency
N = number of sherds in base (sample considered)

[120] In the University of Arizona Museum there is a specimen consisting of two Black-on-white seed jars joined by a strap and handle, one of which is in typical Kana-a style, and the other is just as typical Black Mesa. This specimen was found by Emil Haury in Kiet Siel Canyon.

Table 10 should be read by projecting the point of intersection of N and fp to the left-hand border where PE_{fp} may be read. For example, if the number of sherds in the sample is 55, and the percentage of the type considered is 70, the probable error will be a frequency of 3.5 per cent (55 ± 3.5 per cent). Since PE is calculated to include 50 per cent of the possibilities, there is a fifty-fifty chance that the true percentage of the type considered (the percentage which a sample of infinitely large large size would give) lies between 51.5 and 58.5. The figure 2.5 PE

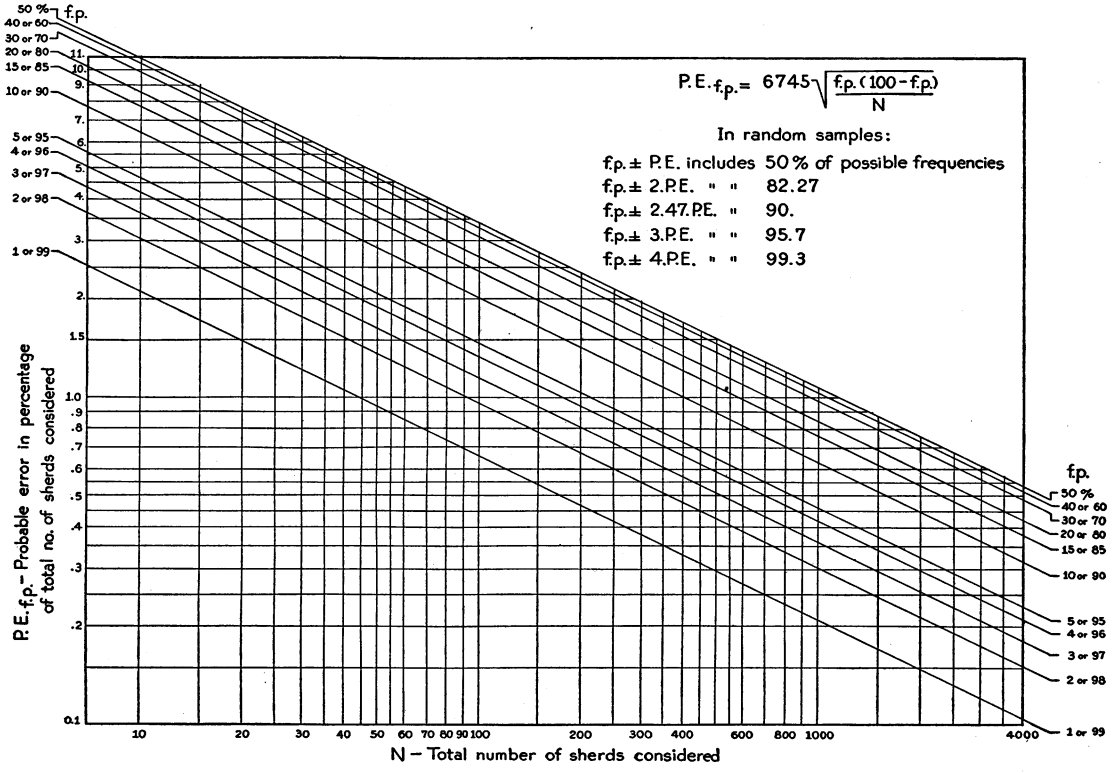


TABLE 10. Probable-error graph.

(about 9 chances out of 10) is a useful one beyond which, if the percentage frequency of a sample is aberrant, it is well to investigate. This formula loses accuracy when fp is near 0 or 100.[121]

FORMATION OF CHRONOLOGICAL SEQUENCE

After the elimination of the above sorting and sampling errors, the significant differences due to chronological and regional distribution should remain, freed of the irrelevancies produced by the working methods. The separation of the regional from chronological differences posed a problem. In the first place, chronological differences should have far outweighed regional ones in this survey, since the sites used to construct this chronology all lie within a circle about twenty miles in diameter.

In an effort to use objectively the largest possible number of valid criteria in the chronological arrangement of the sites, the following type of graph (table 11) was utilized, whereby the relative proportions of four chronologically significant types could be used simultaneously in placing the site.

[121] Distribution curves of samples in which the fp is close to 0 or 100 per cent are heavily skewed; thus equal plus and minus values of PE_{fp} will obviously not include equal numbers of samples.

The sites included in the scatter diagram (table 11) show mixtures of Pueblo I and II gray wares and white wares unmixed with any Pueblo III sherds. The horizontal axis shows the frequency of Pueblo I (Kana-a) black-on-white compared to Pueblo II (Dogoszhi, Black Mesa, Sosi, Flagstaff) black-on-whites, with total

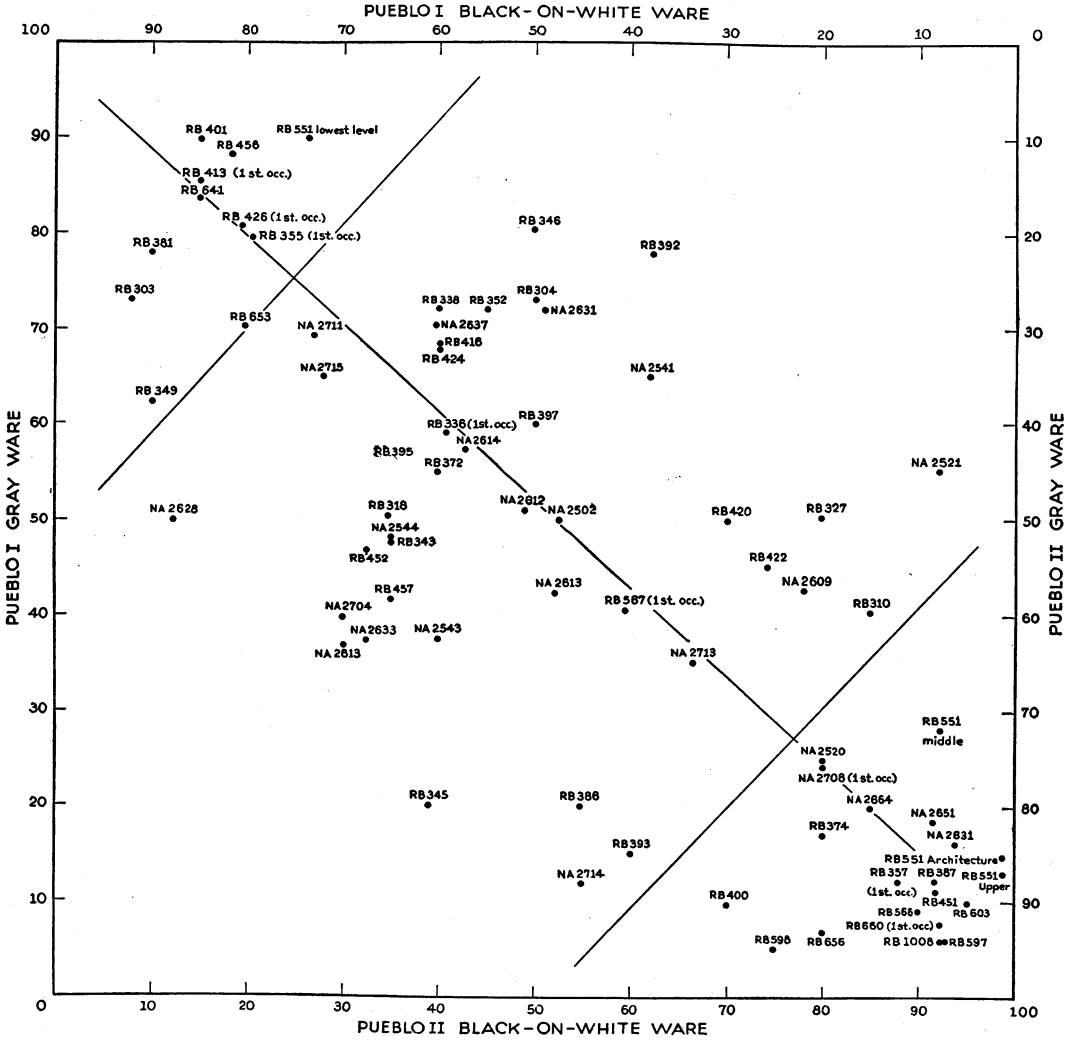


TABLE 11. Proportions of four pottery types on a series of sites.

decorated white ware as a base. The vertical axis has total gray ware as a base, giving frequencies of Pueblo I gray ware (Lino and Kana-a) compared to Pueblo II gray wares (Tusayan and Moenkopi). The marked tendency for sites to cluster in a line, from the upper left-hand corner to the lower right, has been accentuated by a line drawn as an estimation of a mean value (regression line) of the position of the collections. The sites which lie farthest from the line (for example, RB 345 and RB 392 on table 11) were tested by the probable-error graph. It was found that their aberrance from the mean was not beyond a reasonable possibility.[122] By draw-

[122] Chi square and the regression line were not calculated here. The calculation would be complicated owing to the necessity of weighting each sample according to the number of fragments it contained. Estimations of the regression line and calculation of probable error on aberrant sites seemed sufficient for our purpose.

ing verticals to the regression line at the 25- and 75-per cent points, the sites on this graph were divided into groups J, K, and M in table 1.

Nine other scatter diagrams, correlating the frequencies of different pottery types, were used in the formation of several other groups in table 1. In selecting which of the graphs to employ in the formation of the various groups, the graphs showing the most distinct clumping of sites about a line were used—since such clumping is indicative of rapid chronological change and hence of greater sensitivity in the types plotted. Once the grouping and the chronological order of the sites had been fixed, average percentages of types and wares were plotted on vertical lines drawn in chronological order and spaced proportionally to the number of sherds in the group sample. Connecting all corresponding points produced table 1.

Regional Differences

In pottery collections found in stratigraphic sequence, the variation of pottery frequencies can obviously be due only to one fundamental factor—that of chronology. Thus, a changing frequency of one type of pottery is sufficient to establish a time change through the strata. In a group of surface collections, however, a variation in the frequency of one type may be due to any one of many factors, in addition to that of chronology, such as the extent of the zone of manufacture of the type in question, and the pottery trade relationships existent in the area at the time the pottery was in use. Such factors extraneous to the chronology must be of necessity identified from the information contained in the group of collections, aided by knowledge of their provenience. We were fortunate in knowing the stratigraphic sequences of most of the main types in the Kayenta area, and our site chronology is founded upon this knowledge. With the chronological variable eliminated, a few regional differences were apparent.

In checking the scatter diagrams by the probable-error formula, a small group of atypical sites was isolated. These sites were of Pueblo II times from Tsegi-ot-sosi Canyon. These are atypical in (1) having no Moenkopi Corrugated and (2) having a high percentage of Sosi Black-on-white. Certain Pueblo III sites from the central and eastern parts of Black Mesa contained considerable black-on-white pottery which could not be fitted into the classification of Kayenta sites (for sherd frequencies of both Tsegi-ot-sosi and Black Mesa groups see table 1). These two groups show the only regional variations in collections described in this report.

Discussion

The foregoing procedure is not recommended as a universal method of dealing with pottery samples. It was used for the solution of a particular problem, namely the placing of nonstratigraphic collections in a chronological sequence, of which the major landmarks were already known. The method gave, we believe, an objective and quite exact solution to the problem, and yielded as a by-product a much closer idea of the history of pottery making in the area by showing the time relationships of the rise and fall of the various pottery types made in the Kayenta region. It may be worth while to theorize here that the almost complete lack of instances of two separate pottery types appearing or disappearing at the same time (see table 1) is doubtless characteristic of all cultures which proceeded through their span with but little violent interruption.[123]

[123] The system of pottery terminology in the Pueblo area is better adapted to close work in this type of problem than is any system where the pottery types or their equivalents are named by, and thus limited to, archaeological periods.

BIBLIOGRAPHY

AMSDEN, CHARLES AVERY

1936. *An Analysis of Hohokam Pottery Design.* Gila Pueblo, Medallion Papers, No. XXIII. Globe, Ariz.

BARTLETT, KATHARINE

1930. "Stone Artifacts: San Francisco Mountain Region," *Museum Notes,* Vol. III, No. 6, pp. 1–4. Northern Arizona Society of Science and Art, Flagstaff, Ariz.

1933. *Pueblo Milling Stones of the Flagstaff Region and Their Relation to Others in the Southwest: A Study in Progressive Efficiency.* Museum of Northern Arizona, Bull. No. 3. Northern Arizona Society of Science and Art, Flagstaff, Ariz.

1934. *The Material Culture of Pueblo II in the San Francisco Mountains, Arizona.* Museum of Northern Arizona, Bull. No. 7. Northern Arizona Society of Science and Art, Flagstaff, Ariz.

BUNZEL, RUTH

1929. *The Pueblo Potter.* Columbia University, Contributions to Anthropology, Vol. 8.

BERNHEIMER, CHARLES L.

1924. *Rainbow Bridge.* Doubleday, Page & Co., New York City.

CLARKE, ELEANOR P.

1935. *Designs on the Prehistoric Pottery of Arizona.* Bull. No. 4, Vol. VI. Social Science Bull. No. 9. University of Arizona, Tucson, Ariz.

COLTON, HAROLD S.

1933. *Pueblo II in the San Francisco Mountains,* Arizona. Museum of Northern Arizona, Bull. No. 4, pp. 3–14. Northern Arizona Society of Science and Art, Flagstaff, Ariz.

1936. "The Rise and Fall of the Prehistoric Population of Northern Arizona," *Science,* n.s., Vol. 84, No. 2181, pp. 337–343. Lancaster, Pa.

1940. "Notes on a Pottery Type called Lino Gray," *American Antiquity,* Vol. 5, No. 4 (April, 1940), p. 338.

1941. "Black Mesa Black-on-white," *ibid.,* Vol. 7, No. 2 (Oct., 1941), pp. 164–165.

———, and BAXTER, FRANK C.

1932. *Days in the Painted Desert and the San Francisco Mountains: A Guide.* Museum of Northern Arizona, Bull. No. 2. Northern Arizona Society of Science and Art, Flagstaff, Ariz.

———, and HARGRAVE, LYNDON L.

1937. *Handbook of Northern Arizona Pottery Wares.* Museum of Northern Arizona, Bull. No. 11. Northern Arizona Society of Science and Art, Flagstaff, Ariz.

COSGROVE, H. S. and C. B.

1932. *The Swarts Ruin, a Typical Mimbres Site in Southwestern New Mexico.* Peabody Museum of American Archaeology and Ethnology, Papers, Vol. 15, No. 1. Cambridge, Mass.

CUMMINGS, BYRON

1915. The Kivas of the San Juan Drainage," *American Anthropologist,* Vol. 17, No. 2, pp. 272–282.

FEWKES, JESSE WALTER

1911. *Preliminary Report on a Visit to the Navaho National Monument.* Bull. No. 50, Bureau of American Ethnology. Smithsonian Institution, Washington, D.C.

1919. "Designs on Prehistoric Hopi Pottery," *Twenty-third Annual Report,* Bureau of American Ethnology, pp. 207–284. Smithsonian Institution, Washington, D.C.

1923. *Designs on Prehistoric Pottery from the Mimbres Valley, New Mexico.* Miscellaneous Collections, Vol. LXXIV, No. 6, Publ. No. 2713. Smithsonian Institution, Washington, D.C.

1924. *Additional Designs on Prehistoric Mimbres Pottery.* Miscellaneous Collections, Vol. LXXVI, No. 8, Publ. No. 2748. Smithsonian Institution, Washington, D.C.

FORDE, C. DARYLL

1931. "Hopi Agriculture and Land Ownership," *Journal of the Royal Anthropological Institute,* Vol. 61, pp. 357–411.

GILLMOR, FRANCES, and WETHERILL, LOUISA WADE

1934. *Traders to the Navajos.* Houghton Mifflin Co., Boston, Mass.

GLADWIN, HAROLD S.

1927. *Excavations at Casa Grande, Arizona.* Southwest Museum, Papers, No. 2. Los Angeles, Calif.

———, and W.

1931. *Some Southwestern Pottery Types, Series II.* Gila Pueblo, Medallion Papers, No. X. Globe, Ariz.

GLADWIN, HAROLD S., and HAURY, EMIL W., SAYLES, E. B., and GLADWIN, NORA.
1937. *Excavations at Snaketown.* Gila Pueblo, Medallion Papers, Nos. XXV and XXVI. Globe, Ariz.

GREGORY, HERBERT ERNEST
1916. *The Navajo Country: A Geographic and Hydrographic Reconnaissance of Parts of Arizona, New Mexico, and Utah.* Water Supply Paper No. 380. U. S. Geological Survey, Washington, D.C.
1917. *Geology of the Navajo Country.* Professional Paper No. 93. U.S. Geological Survey, Washington, D.C.

GUERNSEY, SAMUEL J.
1931. *Explorations in Northeastern Arizona. Report on the Archaeological Field Work of 1920–1923.* Peabody Museum of American Archaeology and Ethnology, Papers, Vol. XII, No. 1. Cambridge, Mass.

———, and KIDDER, ALFRED VINCENT
1921. *Basketmaker Caves of Northeastern Arizona. Report on the Explorations, 1916–1917.* Peabody Museum of American Archaeology and Ethnology, Papers, Vol. VIII, No. 2. Cambridge, Mass.

GUTHE, CARL E.
1925. *Pueblo Pottery Making.* Papers of the Southwestern Expedition, No. 2. Phillips Academy, Andover, Mass. Yale University Press, New Haven, Conn.

HACK, JOHN T.
1939. "The Late Quaternary History of Several Valleys of Northern Arizona: A Preliminary Announcement," *Museum Notes,* Vol. 11, No. 11, pp. 67–73. Northern Arizona Society of Science and Art, Flagstaff, Ariz.
1942. *Changing Physical Environment of the Hopi Indians of Arizona.* Peabody Museum of American Archaeology and Ethnology, Papers, Vol. XXXV, No. 1. Cambridge, Mass.

HARGRAVE, LYNDON L.
1932. *Guide to Forty Pottery Types from the Hopi Country and the San Francisco Mountains, Arizona.* Museum of Northern Arizona, Bull. No. 1. Northern Arizona Society of Science and Art, Flagstaff, Ariz.
1933. *Pueblo II Houses of the San Francisco Mountains, Arizona.* Museum of Northern Arizona, Bull. No. 4, pp. 15–75. Northern Arizona Society of Science and Art, Flagstaff, Ariz.
1934*a*. "The Tsegi Country," *Museum Notes,* Vol. 6, No. 11, pp. 51–54. Northern Arizona Society of Science and Art, Flagstaff, Ariz.
1934*b*. "A Recently Discovered Basketmaker Burial Cave in the Tsegi," *ibid.,* Vol. 7, No. 4, p. 13. Northern Arizona Society of Science and Art, Flagstaff, Ariz.
1935*a*. *Report on Archaeological Reconnaissance in the Rainbow Plateau Area of Northern Arizona and Southern Utah, Based upon Field Work by the Rainbow Bridge–Monument Valley Expedition of 1933.* University of California Press, Berkeley, Calif.
1935*b*. "Archaeological Investigations in the Tsegi Canyons of Northeastern Arizona in 1934," *Museum Notes,* Vol. 7, No. 7, pp. 25–28. Northern Arizona Society of Science and Art, Flagstaff, Ariz.

HAURY, EMIL W.
1937. *The Pottery of Snaketown* (Chapter xvi in Gladwin, Haury, Sayles, and Gladwin, *op. cit.,* Vol. 1).

HAWLEY, FLORENCE M.
1934. *The Significance of the Dated Prehistory of Chetro Ketl, Chaco Canyon, New Mexico.* Monographs of the School of American Research, No. 2.

JUDD, NIEL MERTON
1930. *The Excavation and Repair of Betatakin.* Proceedings of the United States National Museum, Vol. 77, Art. 5, Publ. No. 2828. Smithsonian Institution, Washington, D. C.

KIDDER, ALFRED VINCENT
1924. *An Introduction to the Study of Southwestern Archaeology.* Papers of the Southwestern Expedition, No. 1. Phillips Academy, Andover, Mass. Yale University Press, New Haven, Conn.
1932. *The Artifacts of Pecos. Ibid.,* No. 6. Phillips Academy, Andover, Mass. Yale University Press, New Haven, Conn.
1936. *The Pottery of Pecos,* Vol. II. *Ibid.,* No. 7. Phillips Academy, Andover, Mass. Yale University Press, New Haven, Conn.

———, and AMSDEN, CHARLES AVERY
1931. *The Pottery of Pecos,* Vol. I. *Ibid.,* No. 5. Phillips Academy, Andover, Mass. Yale University Press, New Haven, Conn.

KIDDER, ALFRED VINCENT, and GUERNSEY, SAMUEL J.
1919. *Archaeological Explorations in Northeastern Arizona.* Bull. No. 65, Bureau of American Ethnology. Smithsonian Institution, Washington, D.C.
MARTIN, PAUL S.
1936. *Lowry Ruin in Southwestern Colorado.* Publications, Anthropological Series, Vol. XXIII, No. 1. Field Museum of Natural History, Chicago, Ill.
———, and WILLIS, ELIZABETH S.
1940. *Anasazi Painted Pottery in Field Museum of Natural History.* Anthropology, Memoirs, Vol. 5. Field Museum of Natural History, Chicago, Ill.
MERA, H. P.
1937. *The "Rain Bird," A Study in Pueblo Design.* Memoirs, Vol. II. Laboratory of Anthropology, Santa Fe, N. M.
MOOREHEAD, WARREN K.
1890. *Fort Ancient, the Great Prehistoric Earthwork of Warren County, Ohio.* Cincinnati, O.
MORRIS, EARL H.
1927. *The Beginnings of Pottery Making in the San Juan Area: Unfired Prototypes of the Wares of the Earliest Ceramic Period.* Anthropological Papers, Vol. XXVIII. American Museum of Natural History, New York City.
1939. *Archaeological Studies in the La Plata District, Southwestern Colorado and Northwestern New Mexico.* The Carnegie Institution, Washington, D.C.
MORSS, NOEL
1931. *Notes on the Archaeology of the Kaibito and Rainbow Plateaus in Arizona.* Peabody Museum of American Archaeology and Ethnology, Papers, Vol. XII, No. 2. Cambridge, Mass.
MCGREGOR, JOHN C.
1938. *How Some Important Northern Arizona Pottery Types Were Dated.* Museum of Northern Arizona, Bull. No. 13. Northern Arizona Society of Science and Art, Flagstaff, Arizona.
1941. *Southwestern Archaeology.* G. Wiley and Sons, Inc., New York City.
PINCKLEY, EDNA T.
1926. *Casa Grande, the Greatest Valley Pueblo of Arizona.* Arizona Archaeological and Historical Society.
PRUDDEN, T. MITCHELL
1903. The Prehistoric Ruins of the San Juan Watershed in Utah, Arizona, Colorado, and New Mexico," *American Anthropologist,* Vol. 5, No. 2, pp. 224–288.
1914. "The Circular Kivas of Small Ruins in the San Juan Watershed," *ibid.,* Vol. 16, No. 1, pp. 33–58.
RENAUD, E. B.
1935. "Classification and Description of Arrowheads," *Southwestern Lore,* Vol. I, No. 2, pp. 5–8. Gunnison, Colo.
ROBERTS, FRANK H. H., JR.
1931. *The Ruins at Kiatuthlanna, Eastern Arizona.* Bull. No. 100, Bureau of American Ethnology. Smithsonian Institution, Washington, D.C.
1935. "A Survey of Southwestern Archaeology," *American Anthropologist,* Vol. 37, No. 1, pp. 1–35.
ROGERS, MALCOLM J.
1936. *Yuman Pottery Making.* San Diego Museum, Papers, No. 2. San Diego, California.
ROYS, LAWRENCE
1936. "Masonry of Lowry Ruin and of the Southwest." (Section VI in Martin, *op. cit.,* 1936).
STEPHEN, ALEXANDER T.
1936. *Hopi Journal,* ed. by Elsie Clews Parsons. Columbia University, Contributions to Anthropology, Vol. 23.
STEVENSON, MATHILDA C.
1904. The Zuñi Indians, Their Mythology, Esoteric Fraternities and Ceremonies," *Twenty-third Annual Report,* Bureau of American Ethnology. Smithsonian Institution, Washington, D.C.
WEST, GEORGE A.
1927. "Explorations in Navajo Canyon, Arizona," *Yearbook,* Vol. 5, pp. 7–39. Public Museum of the City of Milwaukee. Milwaukee, Wis.
WHITING, ALFRED F.
1939. "Ethnobotany of the Hopi," Arizona Museum *Journal,* No. 15, pp. 68–69. Phoenix, Ariz.
WITHERSPOON, W. W.
1889. Collection of Honey Dew by the Nevada Indians," *American Anthropologist,* o.s., Vol. 2, No. 4, p. 380.

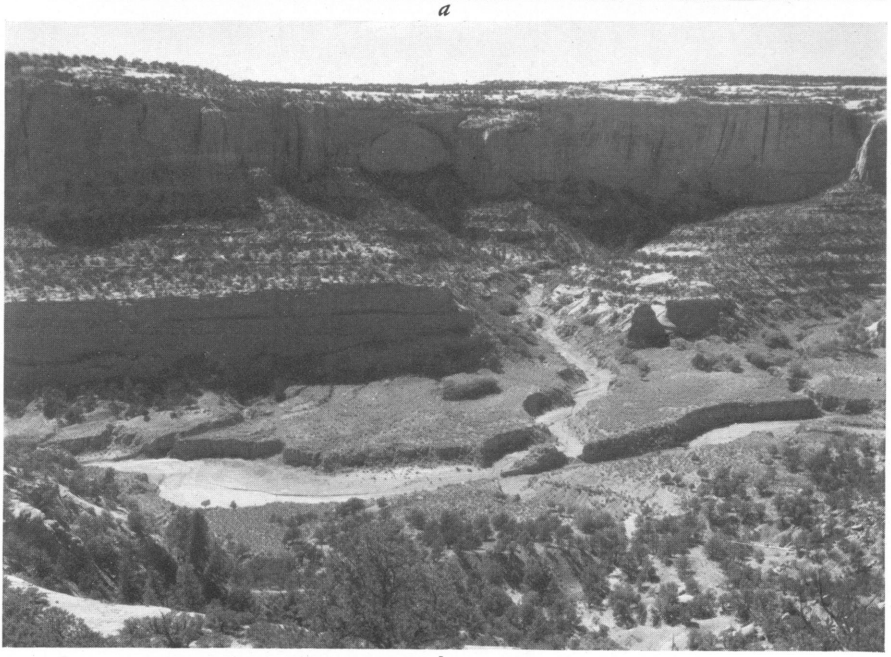
PLATES

PLATE 1

a. General view of a typical portion of Tsegi Canyon, showing arroyo, valley floor, Wingate and Navajo sandstone cliffs, and mesa top.

b. Transverse view of Tsegi Canyon, showing arroyo, valley floor, Wingate and Navajo sandstone cliffs, small tributary wash, and a characteristic dome-shaped cave.

a



b

PLATE 2

a. Site RB 1006. View of floor of pit structure 2, showing fireplace and "woodbox," with clay ridges on floor leading to two ventilator openings.

b. Site RB 1006. Pit structure 3, view of the lower floor. The center has been disturbed, but the original floor is present about the edges. The raised area in the background is believed to be the floor of an earlier structure.

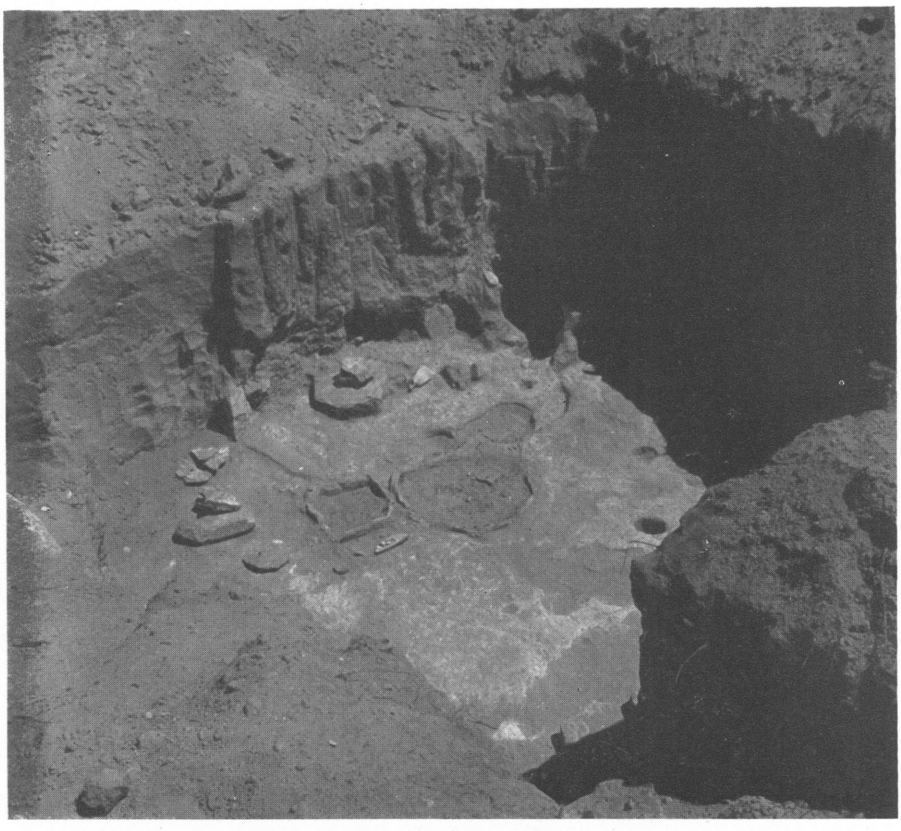


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PLATE 3

a. Site RB 1006. Surface structure 2, showing storage bins in the foreground. Room 4 is at the left, room 1 at the right.

b. Site RB 1006. Interior wall construction of room 2, surface structure 2.

a

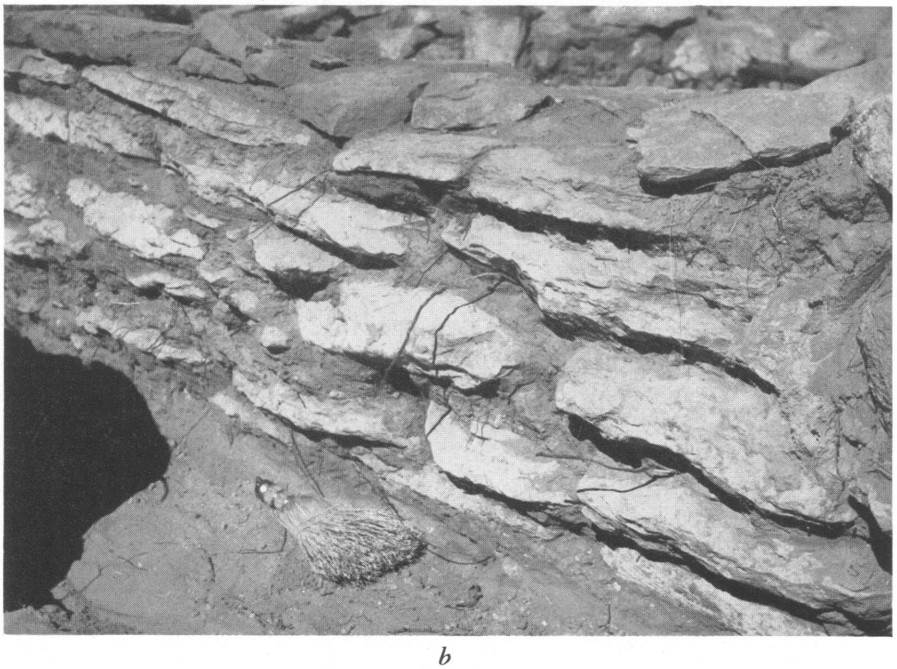

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PLATE 4

a. Site RB 1006. Room 3, surface structure 2, showing cyst at northeast corner, clay floor partly removed to show underlying slab floor, and, in the background, a possible bench formed by the second interior construction.

b. Site RB 1006. Paved storage room inside room 4, surface structure 2.

a

b

PLATE 5

a. Site RB 551. Aerial view of the site from the northeast. The site is indicated by "×." The circle above and slightly to the right of "×" is a Navajo sheep corral.

b. Site RB 551. View from top of hill northeast of site, showing excavation in the foreground.

a

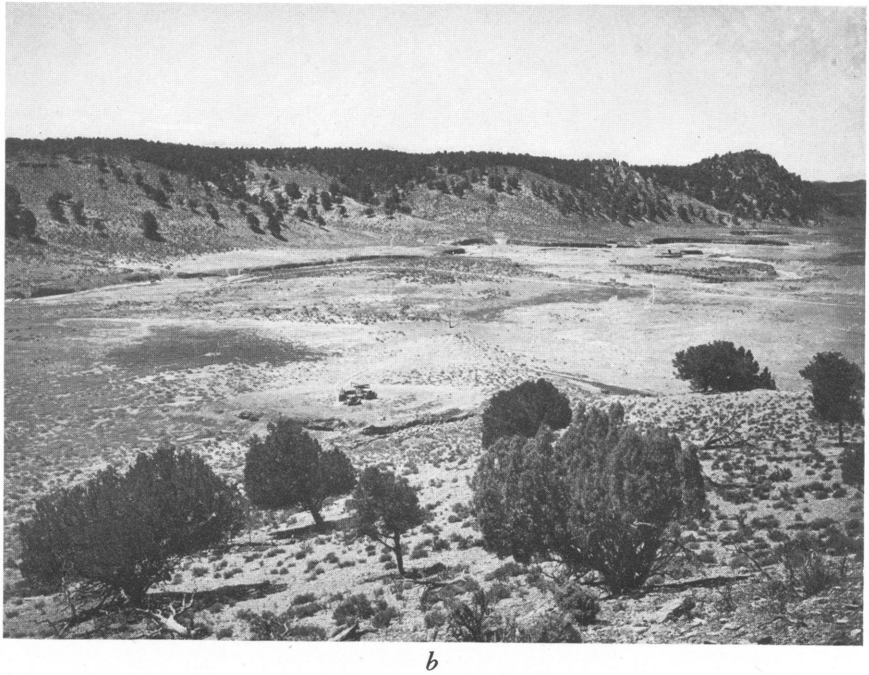

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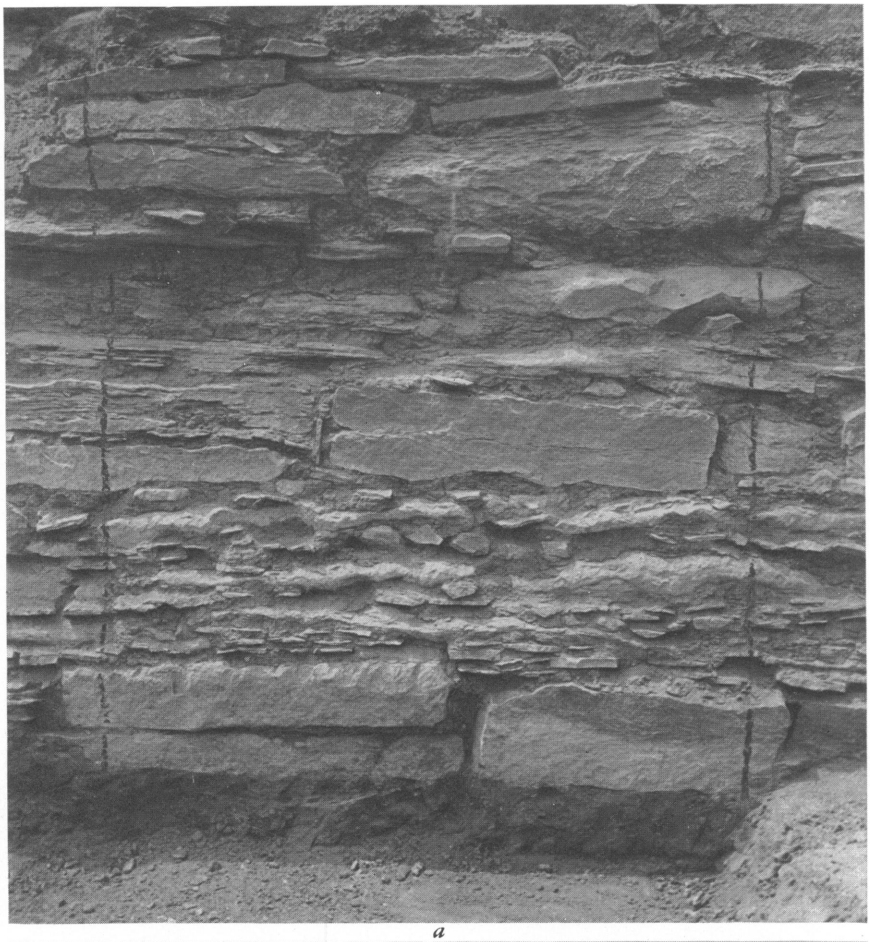
PLATE 6

a. Site RB 551. Room 4, detail of masonry in northwest wall. The interval between vertical black lines is three feet.

b. Site RB 551. View, from the southwest, of the stratigraphic trench through the refuse mound.



a

b

PLATE 7

a. Site RB 551. Northwest corner of room 3, showing the passageway into room 2 and the remains of the "stairway."

b. Site RB 551. South wall of room 3, showing vertical "steppingstone" set in the floor.

a

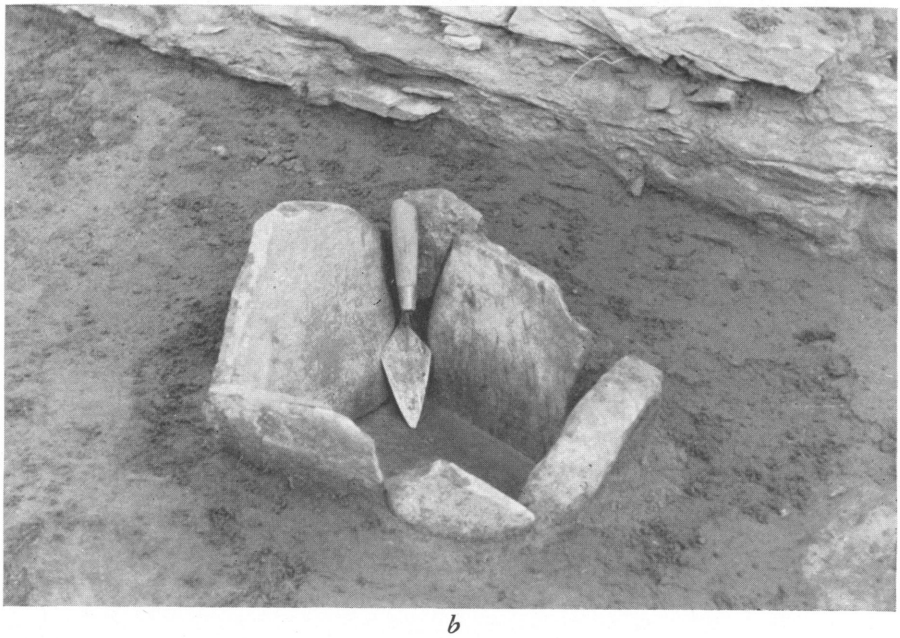
b

PLATE 8

a. Site RB 551. View of room 2 from the south, showing mealing bins and vertical "steppingstone."

b. Site RB 551. Fire box in floor 3 near southwest corner of room 4.

a



b

PLATE 9

a. Site RB 551. View of room 4, from the southwest, showing the base of the southeast wall, three floor levels, and fire pits in floors 1 and 3.

b. Site RB 551. View, from the north, of the kiva after excavation.

a

b

PLATE 10

a. Site RB 551. View of the kiva from the north, showing deflector and fallen roof beams in place (partly excavated).

b. Site RB 551. View of the granary from the south, showing floor paving and vertical slab walls surmounted by coursed masonry.

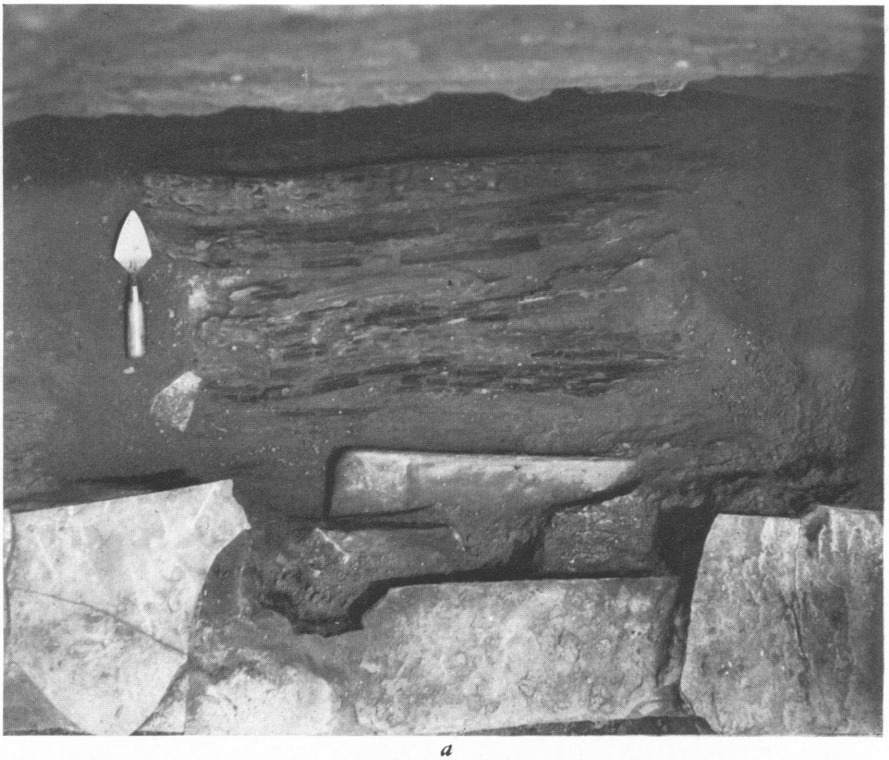
a

b

PLATE 11

a. Site RB 551. View into the kiva from above, showing the wooden beams supporting the roof of the ventilator tunnel under the banquette. The earth fill above the beam has been removed.

b. Site RB 551. View of the kiva after excavation, showing a rabbit skeleton in place in a stone-lined box under the floor (A in fig. 10). The slab covering has been removed. A mano is at the upper left, but an underlying sherd is not visible. The deflector is in the background.



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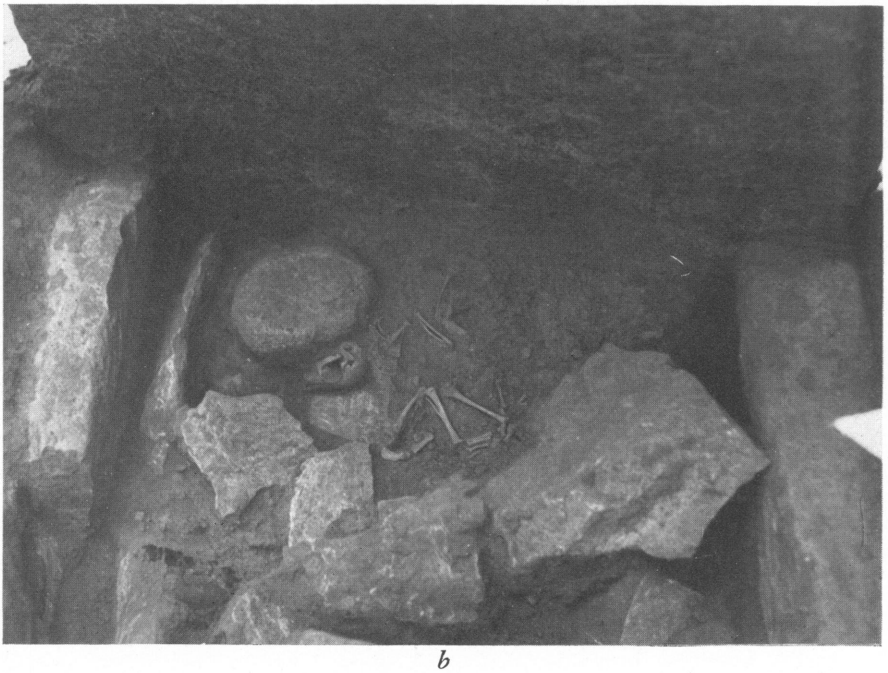
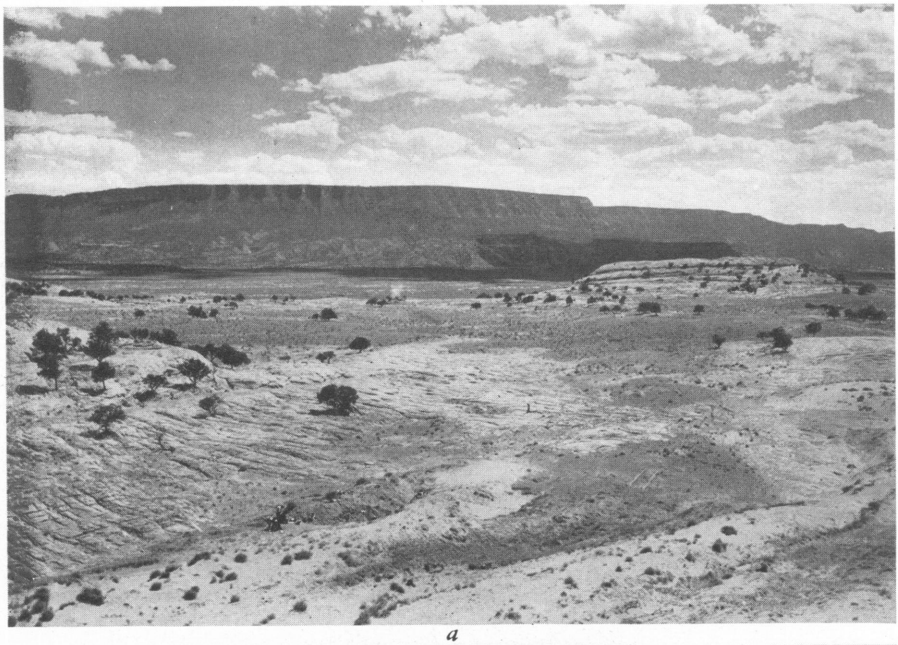


b

PLATE 12

a. Site RB 568. General view of the burial ground from the north, showing the valley of Laguna Creek and the escarpment of Black Mesa. The burial ground, partly excavated, is in the left foreground.

b. Site 551. General view from the east at the time of excavation of the stratigraphic trench, prior to the excavation of the surface structure.



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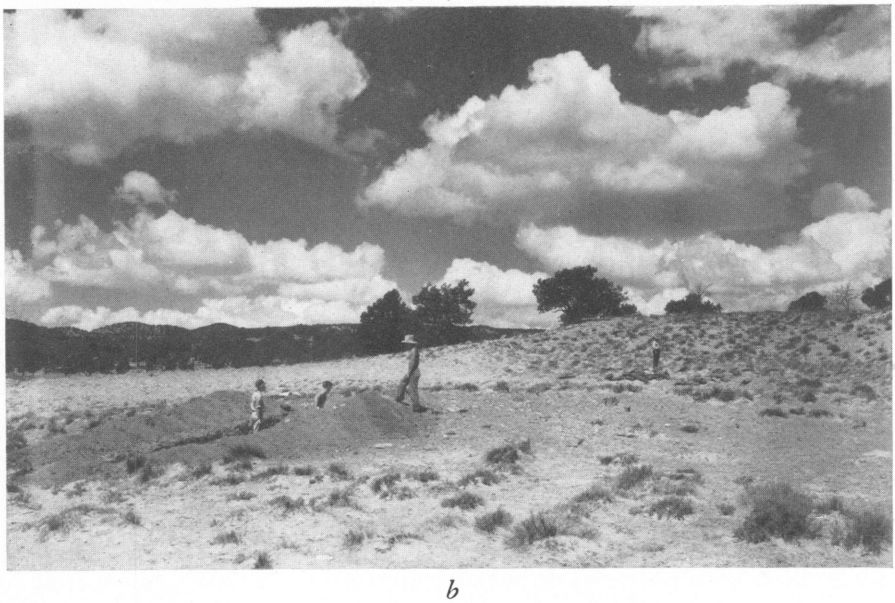


b

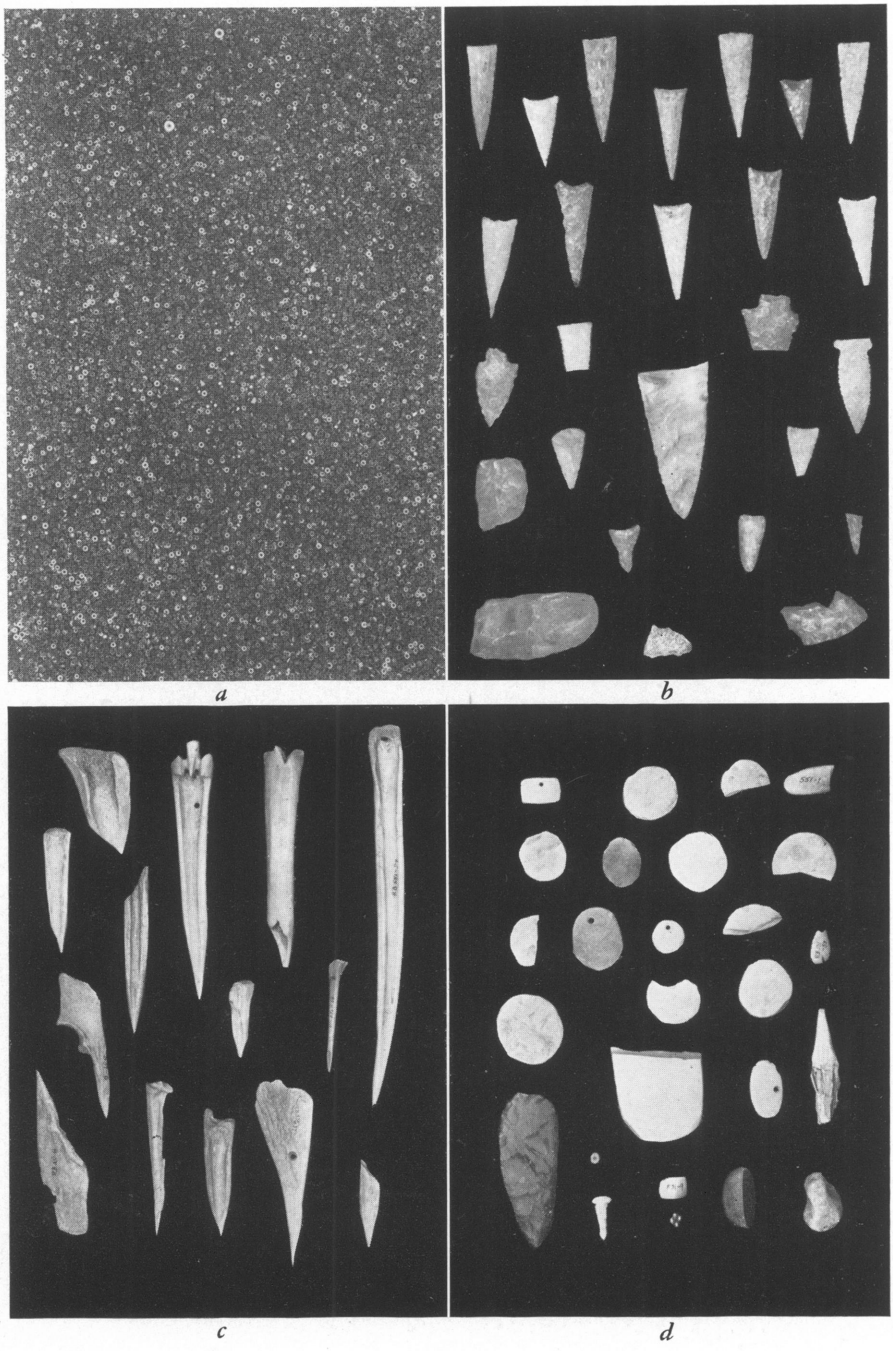
PLATE 13

a. Site RB 568. A portion of approximately 100,000 stone beads found in two burials. About one-eighth actual size.

b. Site RB 568. Characteristic projectile points and scrapers from various burials. About one-twelfth actual size.

c. Site RB 551. Bone awls and drills from the refuse mound. About one-eighth natural size.

d. Site RB 551. Miscellaneous objects of stone. About one-twelfth natural size.



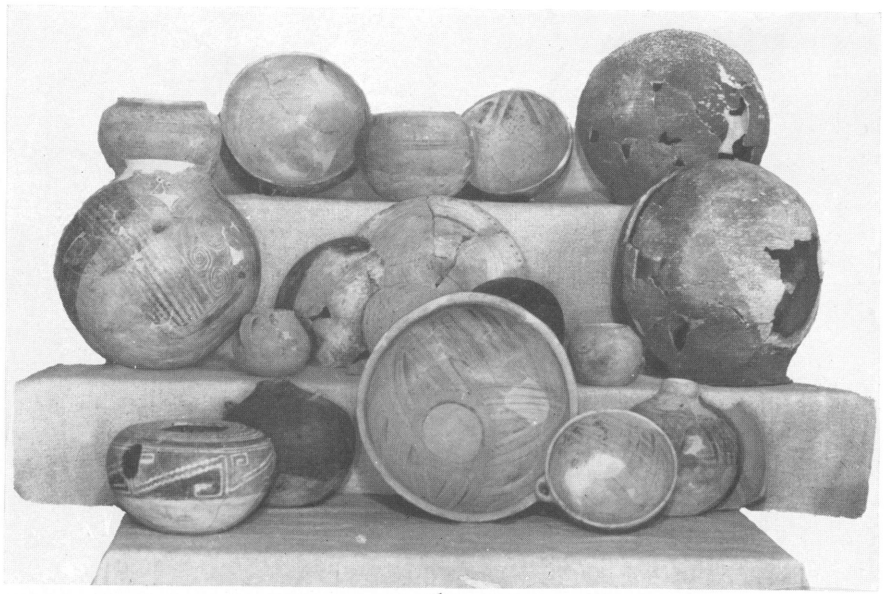
a *b*

c *d*

PLATE 14

a. Site RB 568. Pottery from burial 38, showing the variety of types and styles from a single burial.

b. Site RB 568. Typical bone implements found in burials. About one-eighth natural size.



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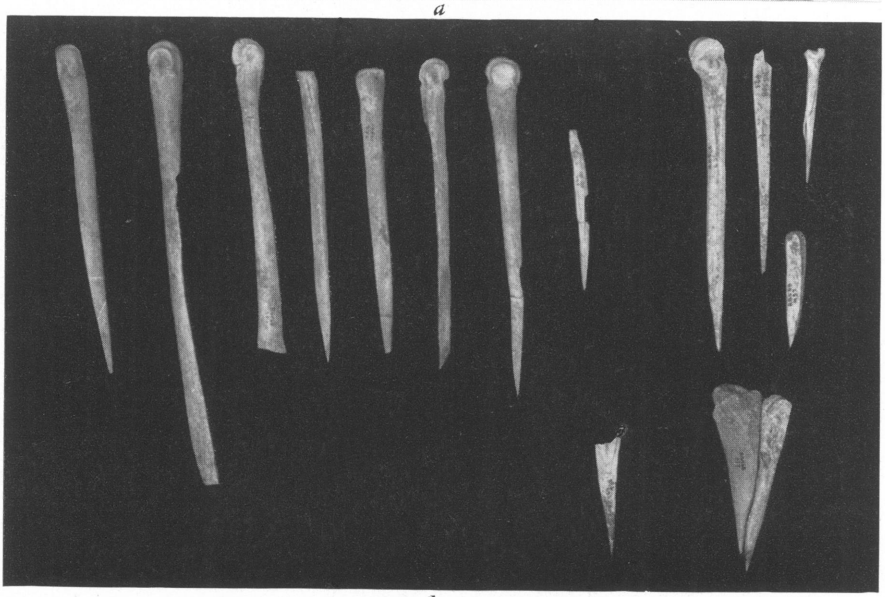

b

PLATE 15

a. Site RB 568. General view of part of burial ground, showing moving dune in which burials were made.

b. Site RB 568. Burial 40, partly excavated, showing wooden beams placed over the skeleton.

a

b

PLATE 16

a. Site RB 568. Burial 40, showing flexed burial on side and a variety of pottery styles.

b. Site RB 568. Burial 37, showing partly flexed burial on back.

a

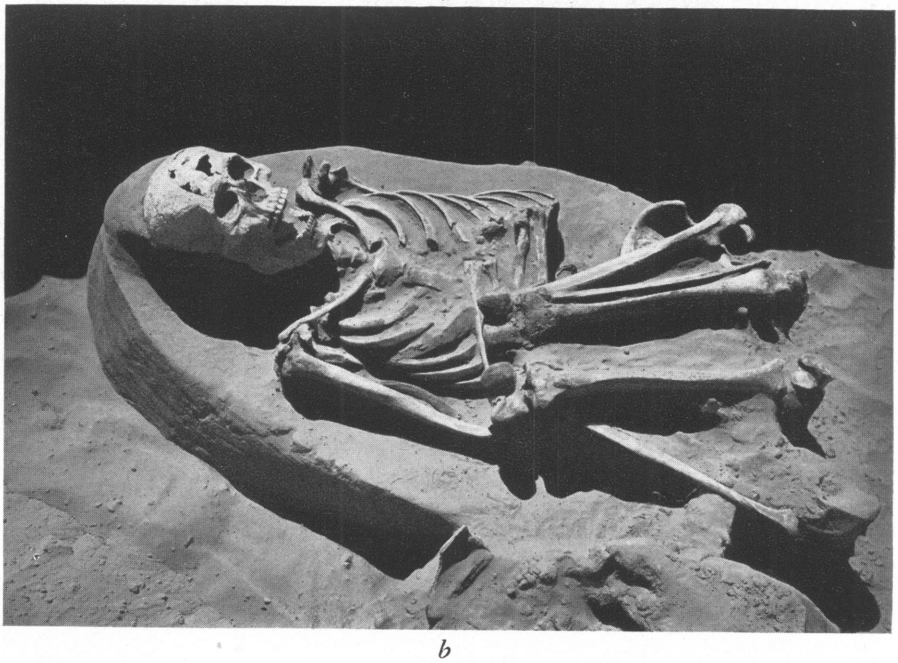

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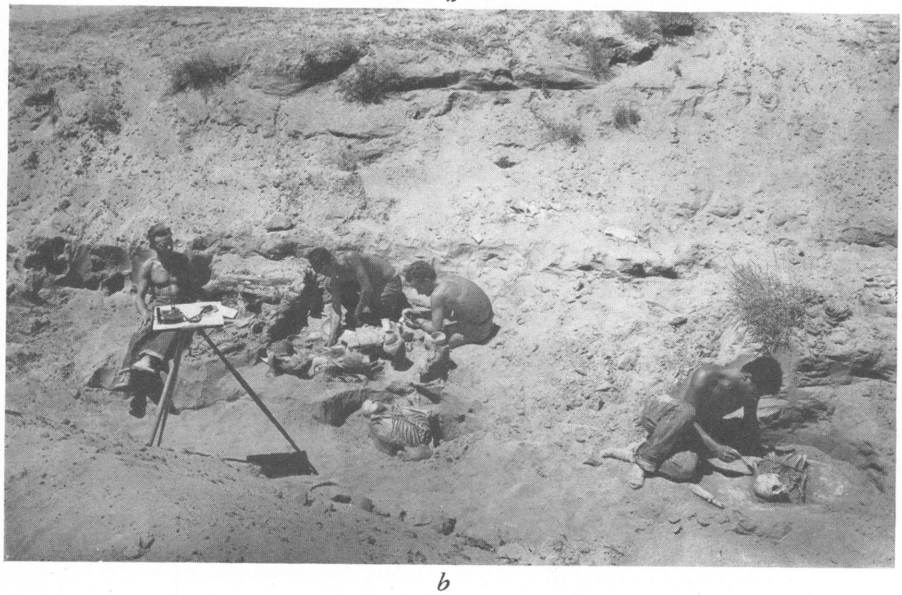
PLATE 17

a. Site RB 568. Burials 36, 38, and 39, showing flexed burial on face.

b. Site RB 568. Burials 36, 38, 39, and 35, in process of excavation.

a



b

PLATE 18

a. Site RB 568. Burial 22, showing flexed burial on side. Observe the turkey leg behind the skeleton, while the offerings are mostly in front.

b. Site RB 568. Burial 14, flexed burial on side, offerings behind.

a

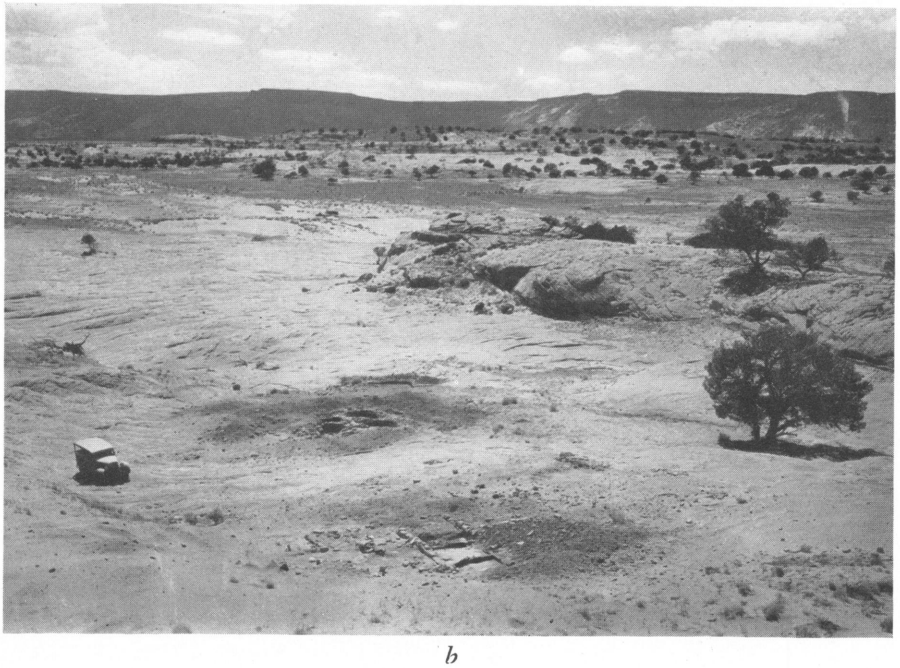
b

PLATE 19

a. Site RB 568. General view showing, at left center, location of main architectural group, and at right, a niche in the sandstone bluff in which masonry rooms had been constructed.

b. Site RB 568. General view from the north showing architectural groups II and III partly excavated.

a



b

PLATE 20

a. Site RB 568. Areas B and C in architectural group III, showing adobe walls.

b. Site RB 568. Rooms P and Q in architectural group II, showing character of masonry, ventilator orifice, and groove in the side wall of room P.

a

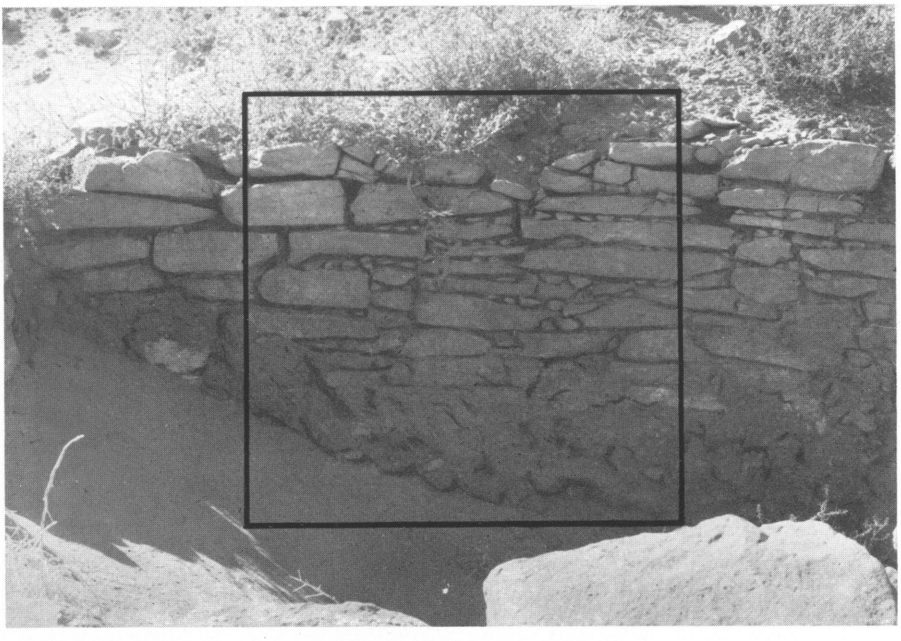
b

PLATE 21

a. Site RB 568. Ax-sharpening stone in place in architectural group III.

b. Site RB 568. The wall of room P in architectural group II. The black lines represent a three-foot square.

a

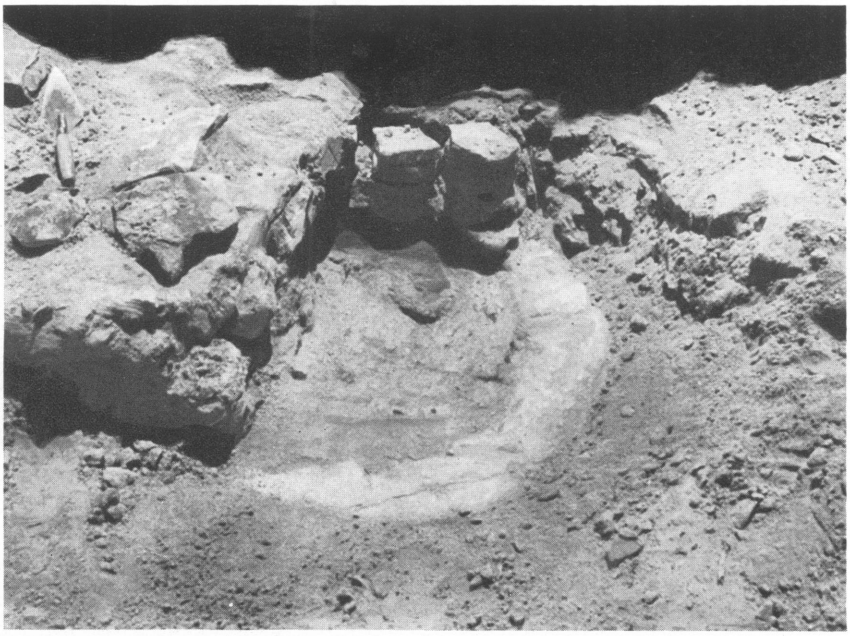


b

PLATE 22

a. Site RB 568. Hearth or rimmed pit built against the north wall of area L in architectural group III.

b. Site RB 568. Black-on-white olla set in a stone-lined box in the floor between areas G and K of architectural group III.

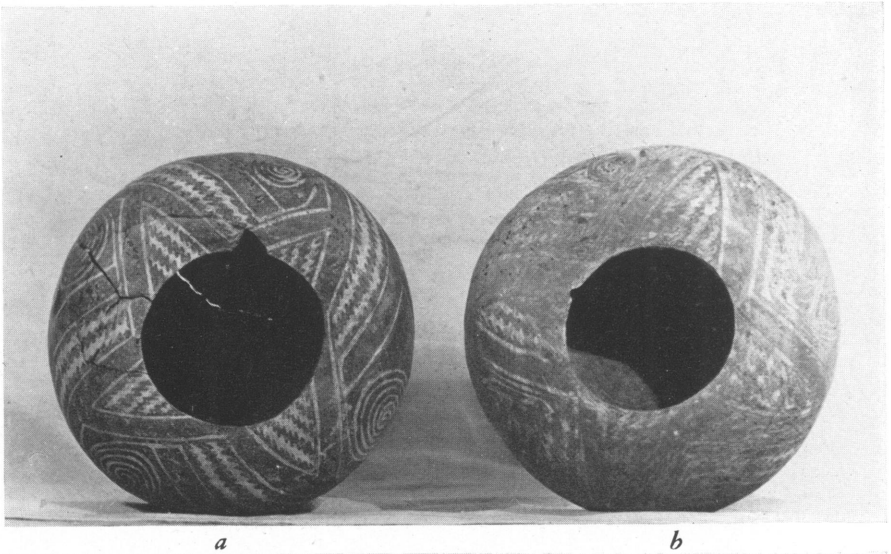


a

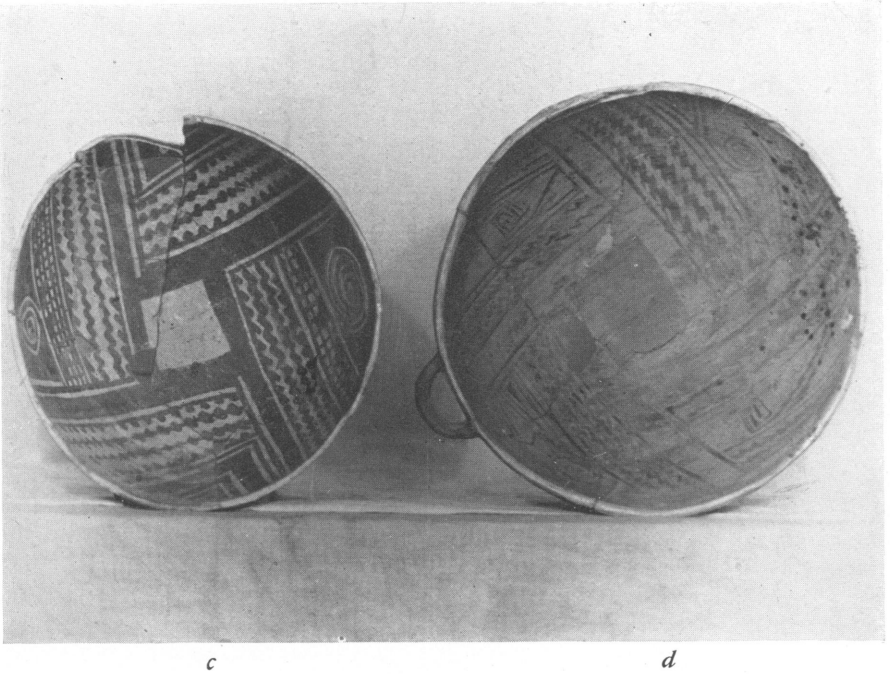
b

PLATE 23

Site RB 568. Tusayan Black-on-white seed jars and bowls from burials: *a*, RB 568–248; *b*, RB 569–246; *c*, RB 568–168; *d*, RB 568–89. Diameter of *a* is 23 cm.; of *c*, 19.5 cm.



a *b*



c *d*

PLATE 24

Site RB 568. Pueblo III jars and pitchers: *a*, RB 568–245; *b*, RB 568–244; *c*, RB 568–18; *d*, RB 568–459; *e*, RB 568–174. *a* is Kayenta Black-on-white; all others are Tusayan Black-on-white. Heights are: *a*, 16 cm.; *b*, 7.8 cm.; *c*, 6.4 cm.; *d*, 22.2 cm.; *e*, 17 cm.

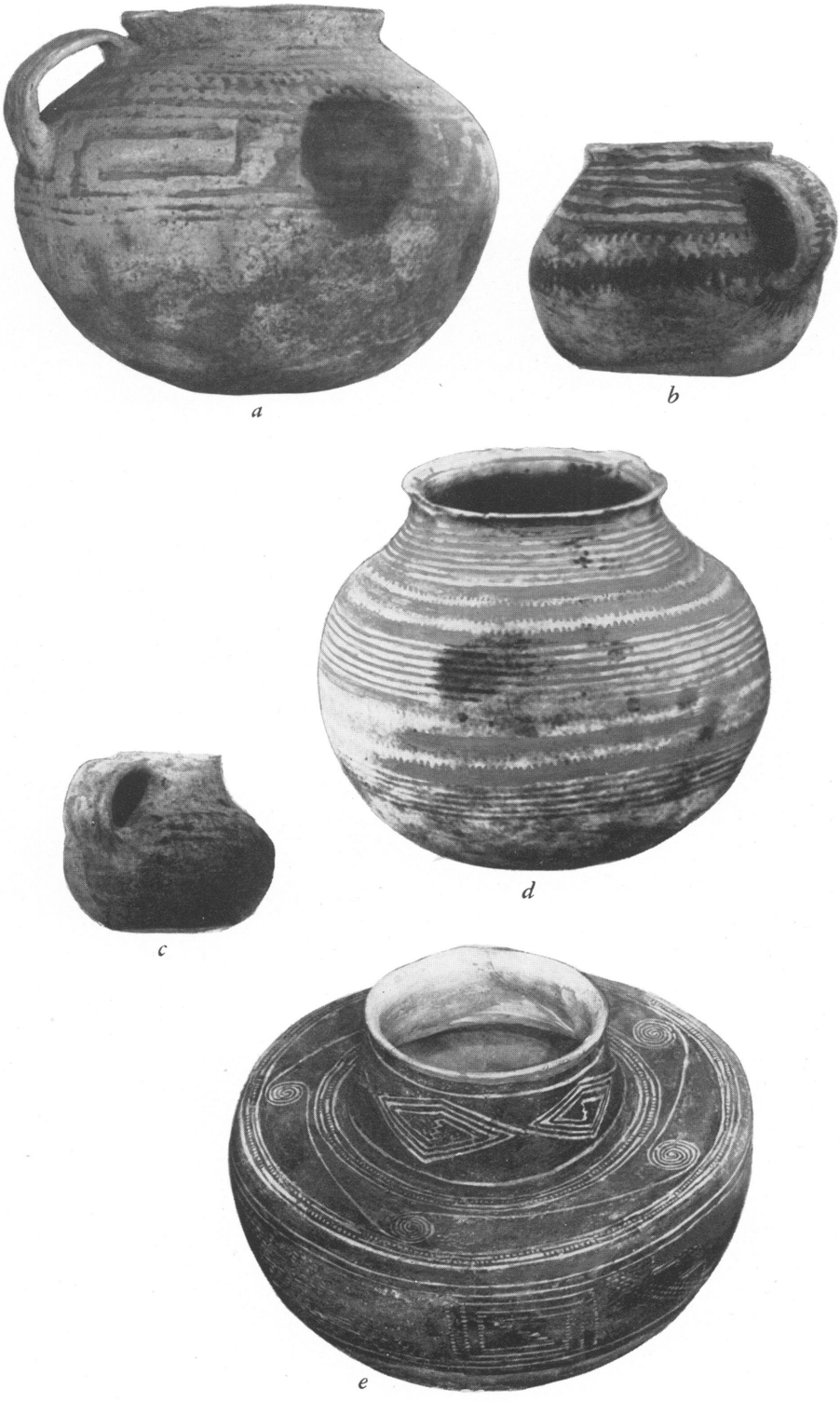


PLATE 25

Site RB 568. Tusayan Black-on-white large ollas. *a*, RB 568–225; *b*, RB 568–95.

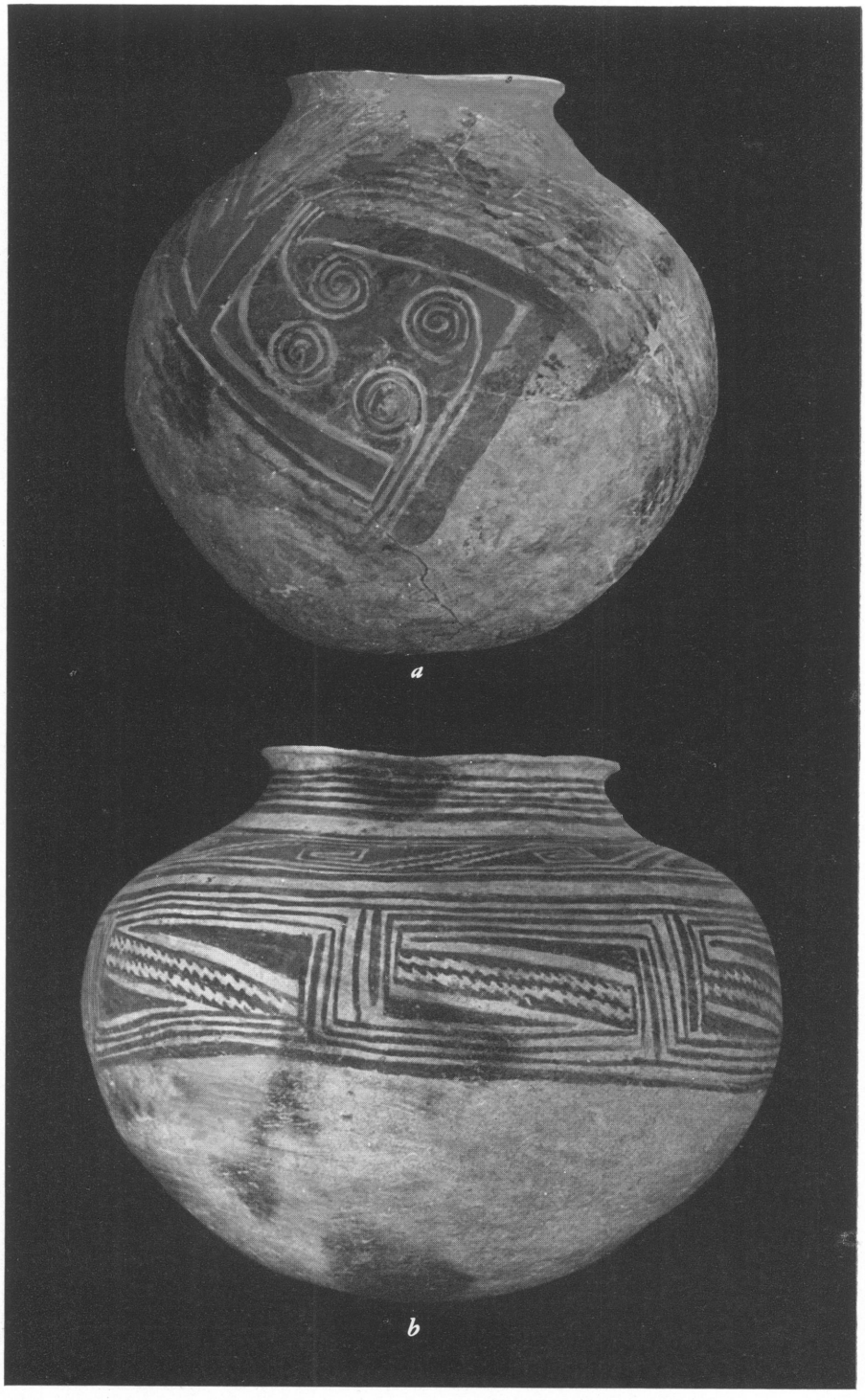
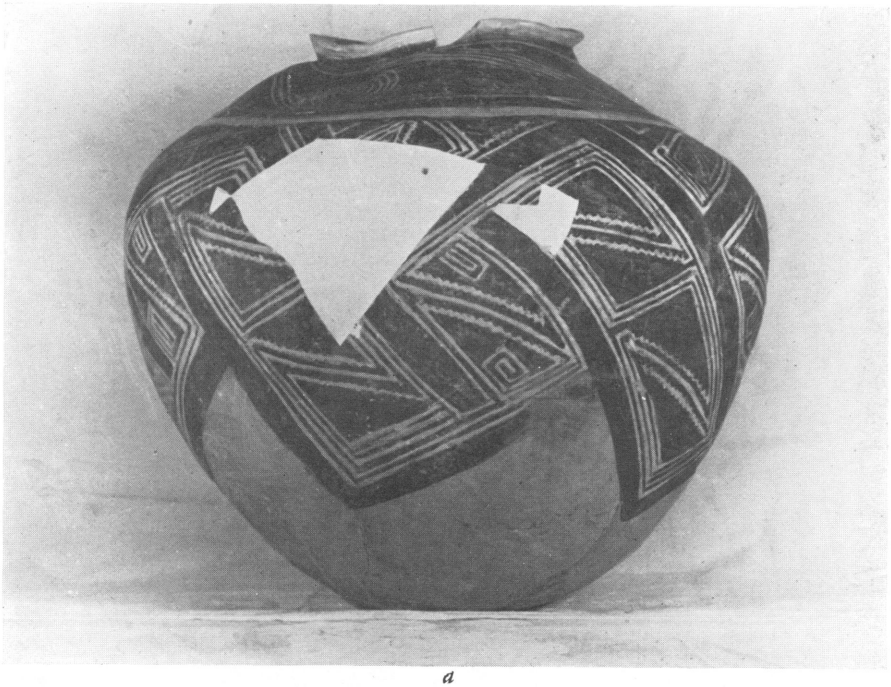
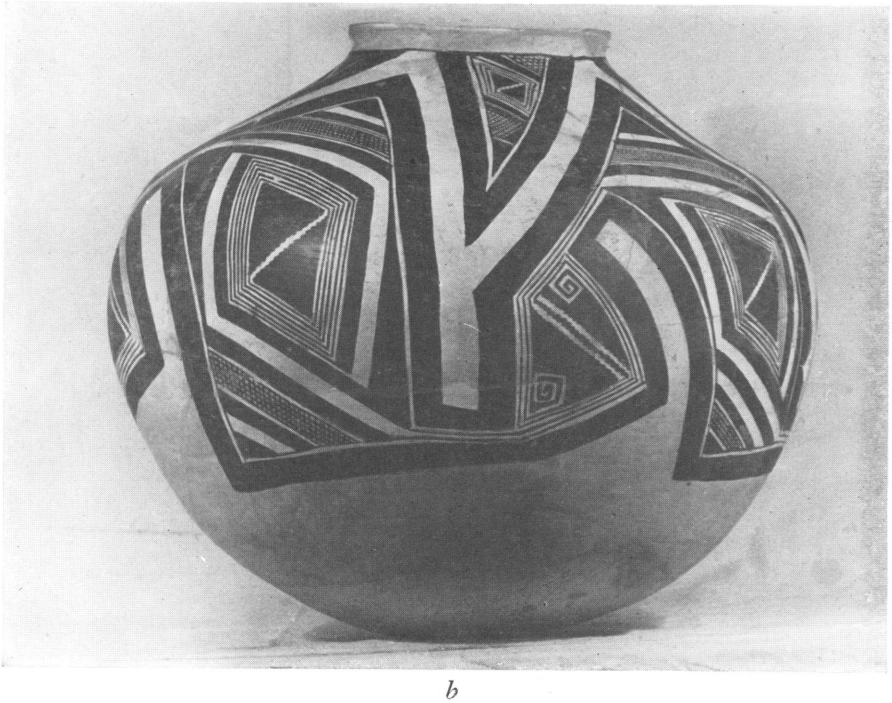


PLATE 26

Sites RB 568 and RB 432. Tusayan Black-on-white large ollas: *a*, RB 568–177; *b*, RB 432–3.



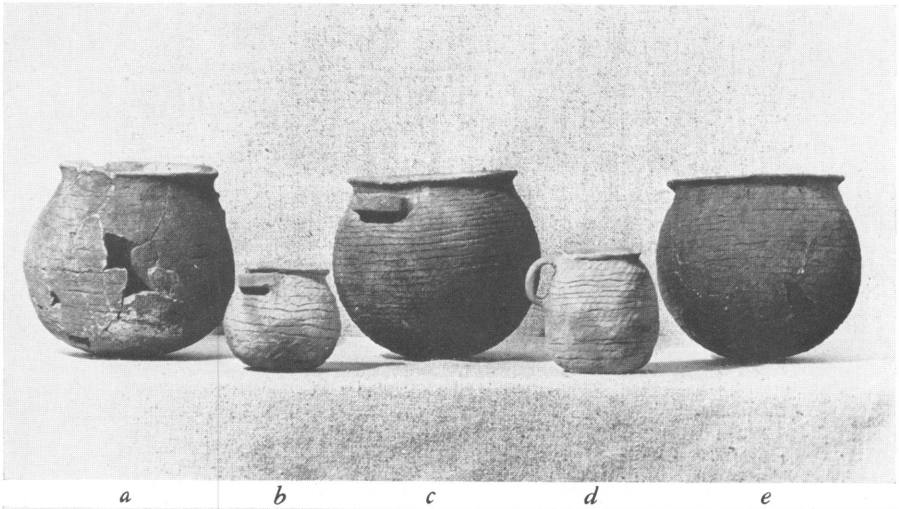
a



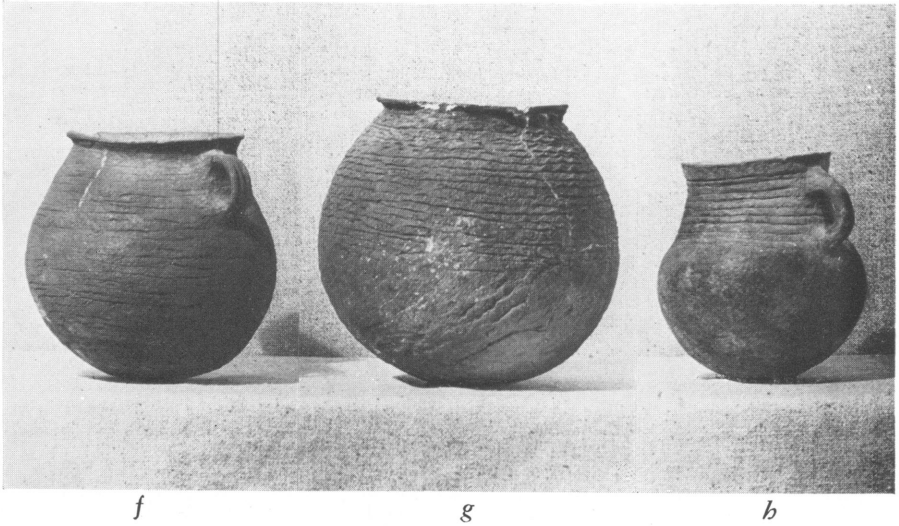
b

PLATE 27

Sites RB 568 and RB 1006. Corrugated gray-ware jars and pitchers. *a*, RB 568–252; *b*, RB 568–138; *c*, RB 568–238; *d*, RB 568–199; *e*, RB 568–211; *f*, RB 568–58; *g*, RB 568–192; *h*, RB 1006–B–5. *h* is Kana-a Gray and shows unobliterated neck coils characteristic of Pueblo I. All others are Moenkopi Corrugated, with coils flattened in varying degrees. *a* is 17.4 cm. in height; *f*, 21 cm.



a *b* *c* *d* *e*



f *g* *h*

PLATE 28

a. Site RB 551. Large Tusayan Corrugated jar of unexampled thinness and regularity (RB 551–56). Height, 33 cm.

b. Types of corrugated ware. Beginning with the upper left-hand group, these are:

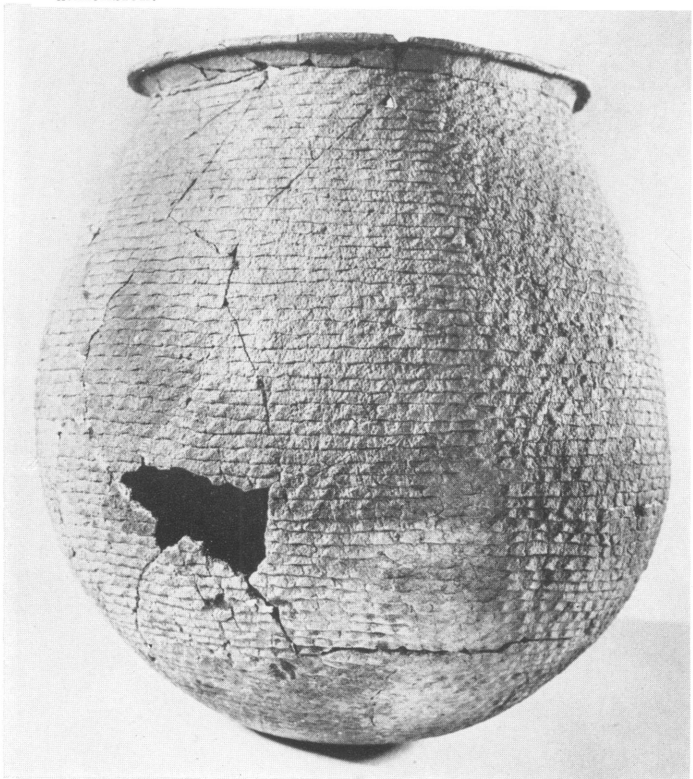
I. Coils unmanipulated (Kana-a Gray, Coconino Gray).

II. Coils with sharp finger indentations, and overlapping in clapboard style.
  a. Clear-cut edges (Tusayan Corrugated).
  b. Softened edges (not exactly described by Colton and Hargrave; included within Kiet Siel Gray).

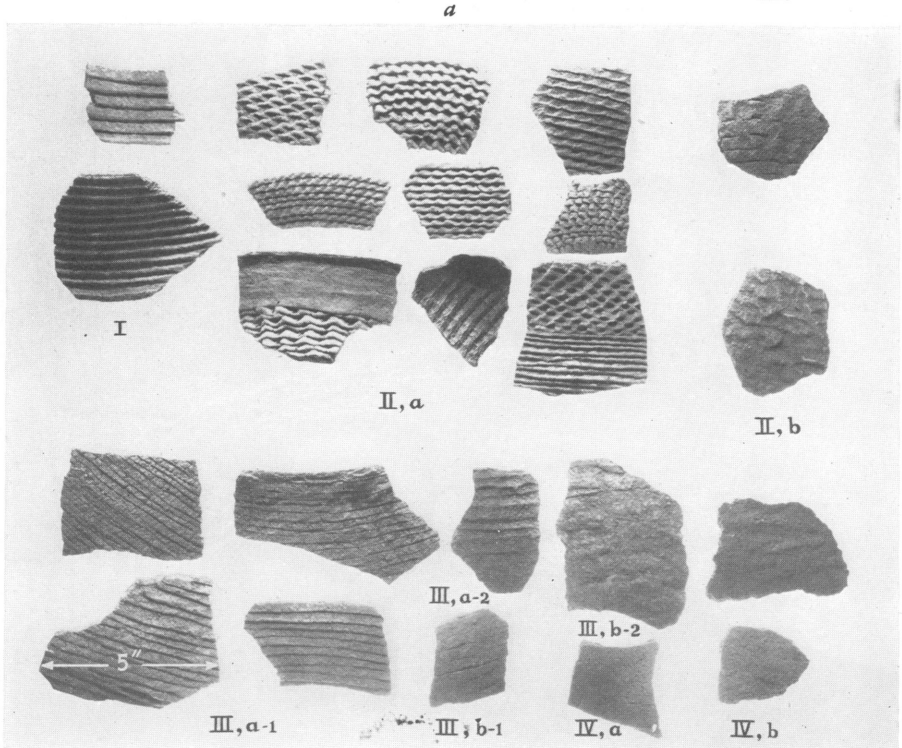
III. Coils flattened and without noticeable finger indentations.
  a. Coils overlapping in clapboard style.
    1. Clear-cut edges (subdivision of Moenkopi Corrugated).
    2. Softened edges (subdivision of Kiet Siel Gray).
  b. Coils not overlapping, but having a groove between them.
    1. Clear-cut edges (subdivision of Moenkopi Corrugated).
    2. Softened edges (subdivision of Kiet Siel Gray).

IV. Coils completely obliterated.
  a. Surface showing small sharp-edged grooves or abrasions, as if made by a hard scraper (Lino Gray).
  b. Surface rough but without such clearly marked abrasions, as if wiped with a soft wet substance (typical Kiet Siel Gray).

The lower left-hand sherd is 5 inches in greatest horizontal dimension.



a

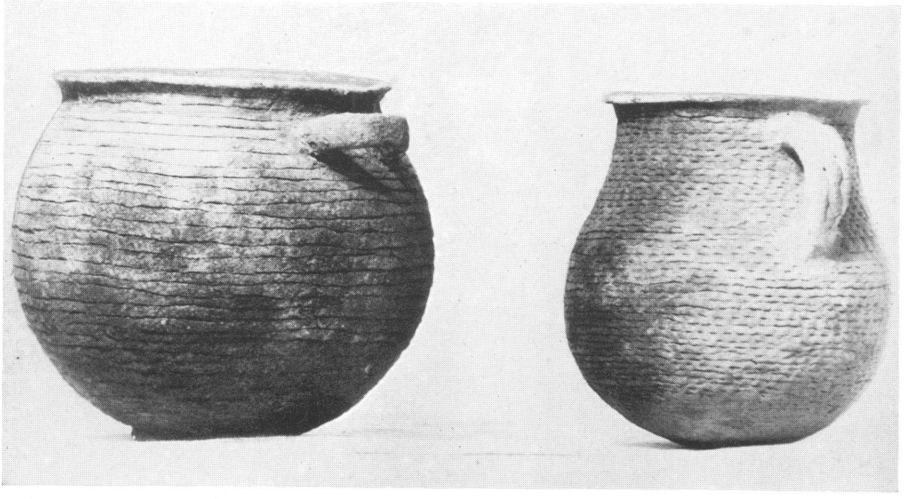


b

PLATE 29

Corrugated jars. *a*, RB 568–131; *b*, RB 564–238; *c*, RB 551–79. *a* and *b* are Moenkopi Corrugated; *c*, Tusayan Corrugated. *a*. is 30 cm. in height; *b*, 15.6 cm.

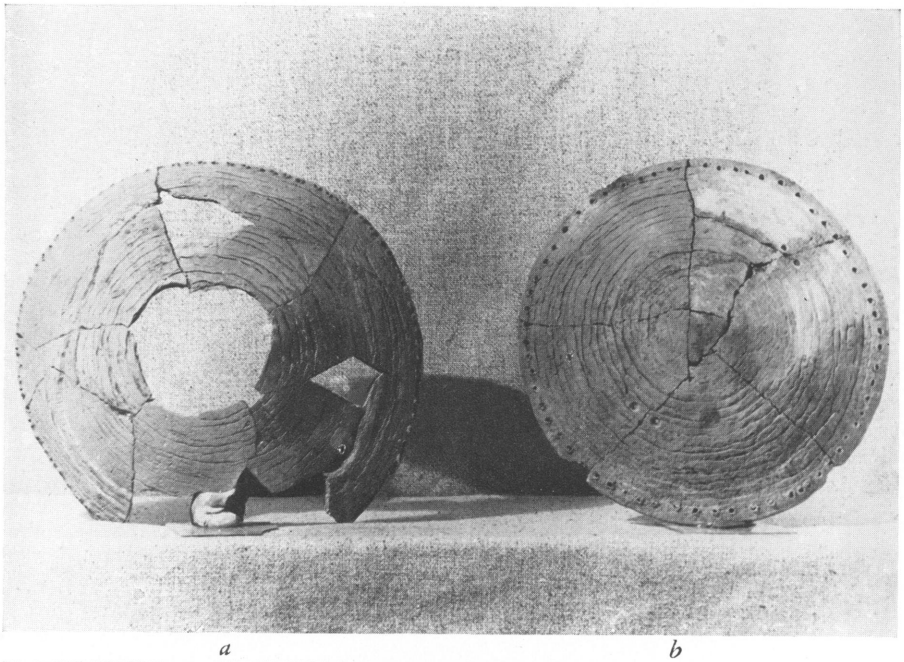
a



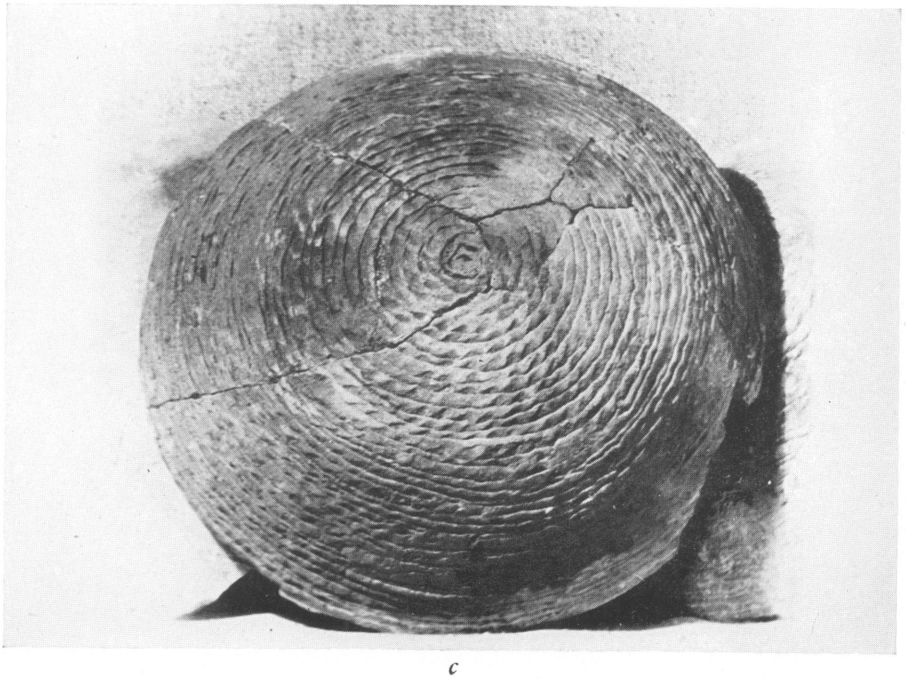
b *c*

PLATE 30

Site RB 568. Corrugated plates. *a*, RB 568–72; *b*, RB 568–204; *c*, 568–443. *a* is Tsegi Orange ware and shows the imprint of a large irregular sherd in which the plate was formed. It is 33.2 cm. in diameter. *b* is Moenkopi Corrugated. *c* is Tusayan Corrugated.



a *b*

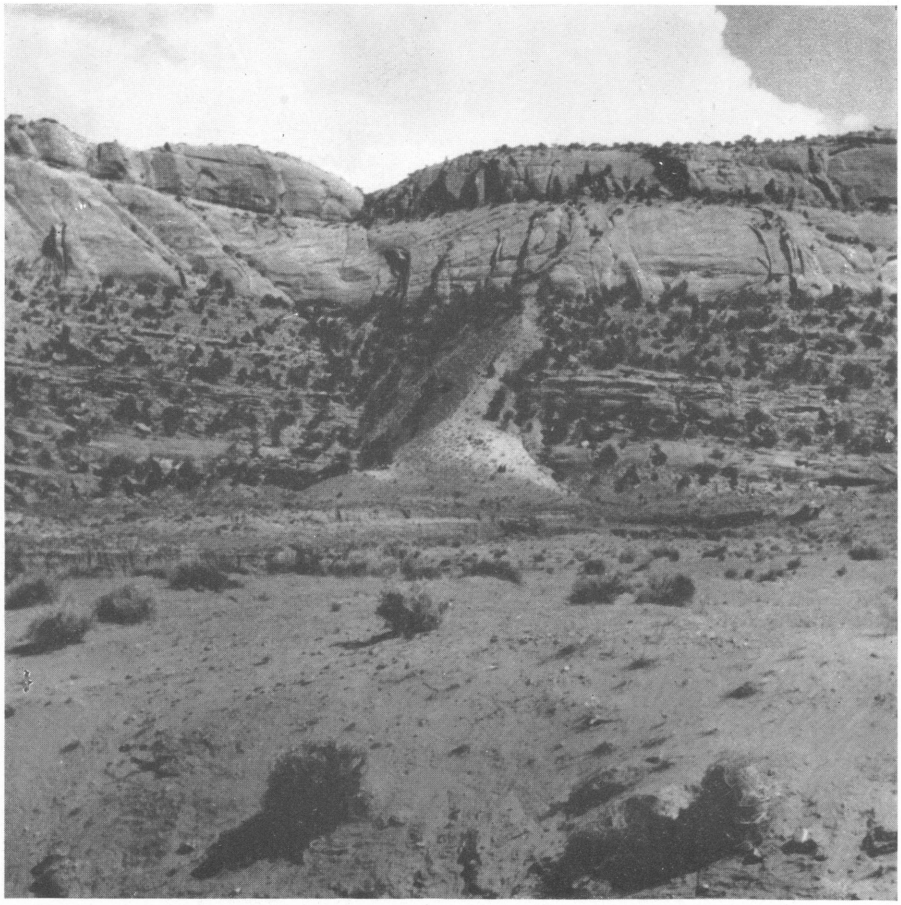


c

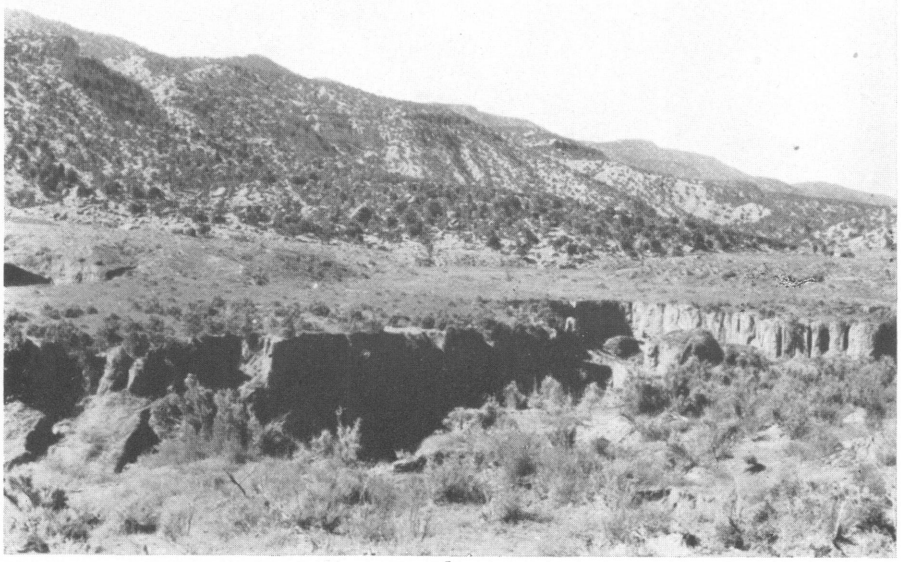
PLATE 31

a. View of southwest wall of lower part of Tsegi Canyon, showing a falling dune. The arroyo winds along the canyon floor in the center of the picture.

b. View of the valley of Laguna Creek a few miles below the mouth of Tsegi Canyon, showing the Naha Terrace adjacent to the arroyo in the foreground, and the higher Tsegi Terrace on either side in the middle background. At this place the modern arroyo (foreground) does not follow the old channel of the Naha Terrace (center).



a



b