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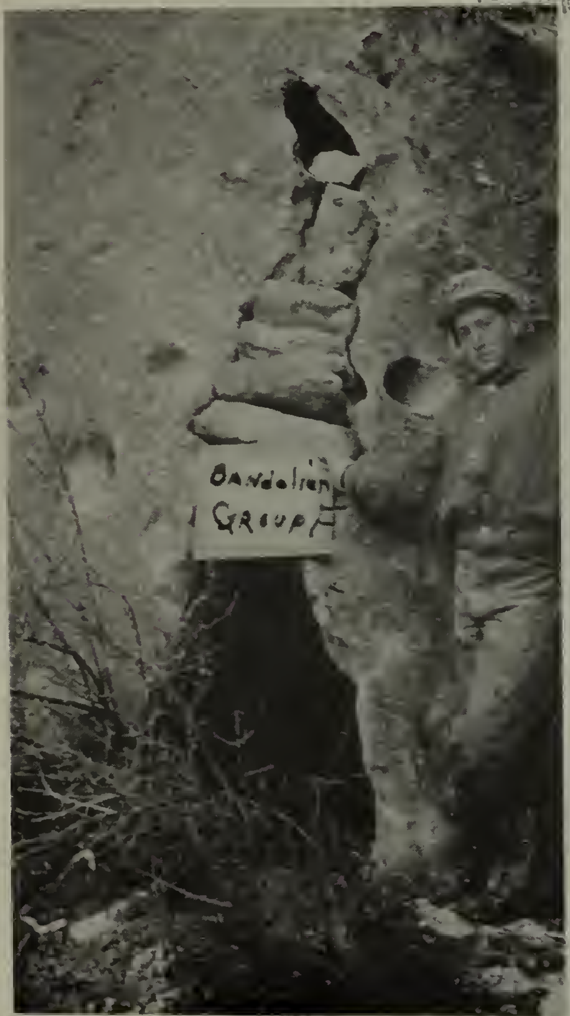
ANTHROPOLOGY PROGRAM

An Analysis of Variability and Condition of Cavate Structures in Bandelier National Monument

H. WOLCOTT TOLL



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An Analysis of Variability and Condition of Cavate Structures in Bandelier National Monument

By H. Wolcott Toll

With contributions by
Peter J. McKenna and June Crowder

Contribution #3 of the Bandelier Archeological Survey

Anthropology Program
U.S. Department of the Interior
National Park Service

1995

Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration.

CONTRIBUTIONS OF THE BANDELIER ARCHEOLOGICAL SURVEY

1 **MATHIEN, FRANCES JOAN, CHARLIE R. STEEN, AND CRAIG D. ALLEN**
1993 *The Pajarito Plateau: A Bibliography.* Southwest Cultural Resources Center Professional Paper No. 49. Santa Fe.

2 **KOHLER, TIMOTHY A. (editor)**
1989 *Bandelier Archaeological Excavation Project: Research Design and Summer 1988 Sampling.* Reports of Investigations No. 61. Department of Anthropology, Washington State University, Pullman.

3 **TOLL, H. WOLCOTT**
1995 An Analysis of Variability and Condition of Cavate Structures in Bandelier National Monument. Intermountain Cultural Resources Center Professional Paper No. 53. Santa Fe.

4 **MATHIEN, FRANCES JOAN**
1991 Glimpses into the History of the 1908 Fieldwork at Yapashi, Bandelier National Monument. In *Puebloan Past and Present: Papers in Honor of Stewart Peckham,* edited by Meliha S. Duran and David T. Kirkpatrick, pp.121-132. Papers of the Archeological Society of New Mexico: 17. Albuquerque.

5 **KOHLER, TIMOTHY A. (editor)**
1990 *Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo.* Reports of Investigations No. 62. Department of Anthropology, Washington State University, Pullman.

6 **KOHLER, TIMOTHY A., and MATTHEW J. ROOT (editors)**
1992 *Bandelier Archaeological Excavation Project: Summer 1990 Excavations at Burnt Mesa Pueblo and Casa del Rito.* Reports of Investigations No. 64. Department of Anthropology, Washington State University, Pullman.

7 **WHITE, JOSEPH COURTNEY**
1992 *In the Land of the Delight Makers: An Archaeological Survey in the American West.* University of Utah Press, Salt Lake City.

8 **KOHLER, TIMOTHY A., and ANGELA R. LINSE (editors)**
1993 *Papers on the Early Classic Period Prehistory of the Pajarito Plateau, New Mexico.* Reports of Investigations 65. Department of Anthropology. Washington State University, Pullman.

9. **POWERS, ROBERT P., and JANET D. ORCUTT (editors)**
In preparation *The Bandelier Archeological Survey.* Intermountain Cultural Resources Center Professional Paper No. 57. Santa Fe.

Foreword

In 1916 Bandelier National Monument was established by proclamation of President Woodrow Wilson to protect and preserve for public enjoyment and education the large Pueblo settlements and spectacular cave dwellings of the southern Pajarito Plateau. At the time, the monument and its archaeological resources enjoyed considerable national prominence both in the public eye and within the discipline of archaeology, largely as a result of the pioneering explorations of Adolph Bandelier and the later excavations and preservation efforts of Edgar L. Hewett. Since then the monument has ceded much of its prominence in southwestern prehistory, as the focus of archaeological research has shifted to other regions. Although sporadic investigations have occurred over the last 75 years, the extent to which Bandelier has been forgotten is exemplified by the modest number of documented sites. In 1985 fewer than 500 were known in the 51 square miles of the monument. Knowledge of even these was poor at best.

The present volume by H. Wolcott Toll represents the third of several National Park Service and Washington State University contributions that report the findings of the Bandelier Archeological Survey. Through these publications we hope to reestablish publicly and professionally the monument's important place in late Pueblo prehistory. The ten-year Bandelier Survey was begun in 1985 with the goal of recovering both research and cultural resource management data, so that the Park Service may better understand and interpret the monument's archaeology, and also better preserve it.

These objectives provided the impetus for the present study of cavate architecture, undertaken in 1986 under the able direction of Wolky Toll. Cavates--cave rooms excavated into tuff cliff deposits--occur along the entire eastern slope of the Jemez Caldera from Tsiping in the north to the vicinity of Cochiti Pueblo in the south. Within Bandelier, cavates are concentrated primarily, but not exclusively, in Frijoles Canyon and at Tsankawi, where they are primarily late (post- A.D.1400 to 1600) and contemporaneous with the nearby, large Classic Period pueblos of Tyuonyi and Tsankawi. Outside of these settings, in the prehistoric as well as modern backcountry, cavates are isolated and smaller, ranging from single rooms to modest pueblos, and temporally span virtually the entire Pueblo occupation of the plateau (A.D. 1190 to 1600). Because these smaller sites were not known in 1986, the study necessarily concentrated on the larger, Frijoles and Tsankawi groups.

Although cavates have drawn more popular attention than any other Pajaritan settlement type, they have received comparatively little scholarly study, despite the wealth of architectural features preserved within their walls. Because past work had frequently focused on a few rooms in a particular cavate group, we felt that a new, more expansive approach was necessary--combining recovery of relatively detailed information with a larger, multi-site sample of cavate rooms. Such a study would identify the range of room variability and function, and also document the condition of the rooms as a basis for future preservation. The sample of more than 350 cavate rooms from 4 cavate groups in Frijoles Canyon and 1 cavate group at Tsankawi provides a strong foundation for archaeological inference and preservation planning.

Because the focus of the investigation is the architecture of cavate rooms, the study differs in important ways from the 1987-1991 inventory survey. The inventory goal of surveying 40 percent of the park required investigation at the broader scales of component and site, an approach that minimized our ability to examine smaller units, such as individual rooms and their features. In this respect the two studies are at once different and complementary. Four of the five cavate groups recorded in 1986 and reported here were later inventoried by the survey. At these groups the availability of both small- and large-scale architectural data provides a level of architectural documentation rivaled only at inventory sites later excavated by Tim Kohler of Washington State University. Plane table plan and profile views of three of the Frijoles cavate study groups (Groups F, I, and M) prepared during the inventory have been included in the present volume. Original sketches produced during 1986 for the remaining two sites (Group A and Tsankawi) have been retained, since the first of these sites was not included within the inventory sample areas, while the second was recorded, but not instrument-mapped.

Rapid, systematic, and comprehensive recording of several hundred rooms containing not only floor and wall features but also roof features is a professional challenge most of us have never faced, but one that Toll has met with ingenuity. One particular problem was how to document hundreds of often dark interior surfaces in a manner that would establish a condition baseline that could be used by future investigators to measure deterioration. Videotaping each room, with a running audio commentary, was the solution. Many field projects should evaluate this technique as a backup to notes, maps, and still photography. Metal-based videotape, now widely available, provides long, nearly archival tape life, and tape digitization ensures a virtually permanent record.

Robert P. Powers, Director
Bandelier Archeological Survey
June 1994

Acknowledgments

The number of people participating in the cavate recording project was pleasantly small, so that each person's contribution forms a substantial part of the result. The fieldwork was carried out full time by Barbara Mills, Bruce Panowski, and myself. Working with Barbara and Bruce was a genuine pleasure. Barbara was a steady source of thoughtful input, hard work, and good spirits; Bruce accepted his consignment to the field and commuting with his usual good cheer. Especially warm and heartfelt thanks are due to the four volunteers who all traveled great distances in various ways to contribute their skills and time. Bill and June Crowder, Betsy Fuller, and Liz Bayer all helped us accomplish a great deal more than would have otherwise been possible. The park staff was uniformly pleasant and helpful, making Bandelier an even nicer place to work. Ed Greene's rapelling into a few hard-to-reach cavates kept us all in suspense in more than one way. Peter McKenna and Bob Powers conducted surface inventories of the cavates to attempt to date the cavate groups studied. Peter provided the section on ceramics and dating and continued to provide advice on chronology and ceramics during preparation of this report. The Crowders quickly put all their photos and records in good order and June prepared the summary of her detailed rock art study.

Bruce Panowski continued to spend a good deal of time on the project after we left the field. He coordinated the data-entry phase, helped to locate and fix problems, and generated the preliminary outputs. He and Tony Tagliaferro also helped bring the data back to the NPS system after its sojourn at UNM. Mary Padilla, Suzette Lopez, Sophia Ulibarri, and Betsy Fuller all struggled nobly with entering the forms into the computer (especially those left-handed ones). Several members of the staff of the University of New Mexico Computing Center were very helpful. Without Mike Prine's help, there is some question as to whether the data could have been transferred to the UNM system at all. Dusty Teaf and Sandy Robinson cheerfully and energetically assisted with tape and disk management problems and SAS questions many times.

Robert Preucel made extensive and helpful comments on the draft and shared data and information from his involvement with the Pajarito Archaeological Research Project of the University of California at Los Angeles. Dr. Lys Ann Shore provided a careful, in-depth technical edit of the whole volume. Jerry Livingston drafted the final figures, and, assisted by Ernesto Martinez, helped with interim maps. Anne Goldberg did extensive typing and formatting of tables for the final version, and Sarah Chavez put the whole thing into camera-ready format. Kathleen Havill did the indexing.

Bob Powers was involved with the project throughout. As director of the Bandelier Survey, he initiated and administered it. He oversaw the contracts for write-up and completion, read drafts and made suggestions. In spite of ever-increasing duties at the Park Service, Bob continued to put in a great deal of time and thought during the editing and production phases of the report, exhaustively checking the text, and carefully redrafting figures. I especially appreciate his having arranged for follow-up contracts to cover my time during final edits.

The Office of Archaeological Studies, Museum of New Mexico allowed me to take time off to work on this report on numerous occasions. I was gone or grouchy at several points along its way (they were presumably glad when the two were simultaneous) Mollie Toll and our sons Nick and Spencer deserve thanks for their patience, understanding, and support during all phases of my involvement with the project and its write-up. Spencer was not yet born when the fieldwork was done for this report; he can now ride a bicycle.

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Introduction to Cavates and Their Study

The true character of the so-called "Cavate lodge" has not been fully understood.
E. L. Hewett, 1909

The Pajarito Plateau of New Mexico was formed largely by a series of gigantic volcanic ash flows. The ash consolidated into a soft rock called tuff, which was gradually dissected into many deep canyons by runoff from the Jemez Mountains to the Rio Grande. In the sheer cliffs formed by the tuff are literally thousands of "cavates," chambers hollowed out of the tuff by the prehistoric Pueblo people who flourished there in the twelfth through sixteenth centuries. Bandelier National Monument contains several canyons with abundant cavates. This study is the result of a pilot project to investigate this one type of archaeological feature in detail, as part of a larger project to inventory the park's archaeological resources.

What Is a Cavate?

It seems likely that archaeology provided the word *cavate* to the language, at least as a noun. Webster's definition of the term is "cut in soft rock: EXCAVATED < ~cliff dwelling>." Recent dictionaries, however, show the word only as a verb meaning "to hollow out" and list its use as "rare"; given this apparent trajectory, it seems archaeologists had better use the term or lose it. It is not known when the term first came into archaeological use, though Mindeleff (1896:217) provides a useful discussion of it as early as 1896:

> Cavate lodges comprise a type of structures closely related to cliff houses and cave dwellings. The term is a comparatively new one, and the structures themselves are not widely known. They differ from the cliff houses and cave dwellings principally in the fact that the rooms are hollowed out of cliffs and hills by human agency, being cut out of soft rock, while the former habitations are simple, ordinary structures built for various reasons within a cove or on a bench in the cliffs or within a cave.

The term seems to have had considerable currency around the turn of the twentieth century (e.g., Powell 1886, 1891; Mindeleff 1896; White 1904; Bierbower 1905; Beam 1906).

In this study, cavate features are defined as cavities in the canyon wall that are primarily the result of excavation of the rock. Both Mindeleff and Hewett recognized that there is variability in these features, how they are incorporated into structures, and how they relate to other sites lacking cavates. Hewett (1909a:438), however, contended that "this term is one that should be rejected from the nomenclature of Southwestern archeology." Siding with Mindeleff (1896) and Fewkes

(1913:193 Note 1), our position is that cavates are sufficiently different from other archaeological remains to be a useful separate category (see also Hall 1992:23-24). This is especially so in an area such as the Pajarito Plateau where these features abound.

Although it is not possible at present to draw the absolute limits of cavate distribution in northern New Mexico, there is little doubt that the line would follow the boundaries of the Bandelier Tuff, which is more or less coextensive with the Pajarito Plateau (Figure 1.1; Bailey et al. 1969; Ross et al. 1961; Mathien et al. 1993). On the north, cavates are present at the Tsiping Ruin at the north end of the Jemez Mountains near Cerro Pedernal (Dougherty 1980:17; Stuart and Gauthier 1981:104). It is unlikely that any cavates exist east of the Rio Grande. They are present as far west as the Jemez River and appear to extend south of Bandelier National Monument (Fliedner 1975; R. Preucel, personal communication, 1988), at least to Peralta Canyon northwest of Cochiti Pueblo.

Why Study Cavates?

The study of cavates serves two main purposes: adding to archaeological knowledge of these features and assessing their current condition as a means of caring for them. These concerns depend on the basic archaeological goal of recording these features in a systematic way in order to assess their variability. Knowledge of the variability of cavates will help archaeologists and interpreters understand the prehistoric functions of these features and may enable them to date cavates more precisely and determine whether the features changed through time. Cavate structures are unusual in the prehistoric Pueblo record, and they are better suited to recording without excavation than most architectural features. Cavates are much like dry caves, so that many fragile features--including plastering and even organic materials--are remarkably well preserved in cavates. Cavates also preserve information that is seldom available in excavated sites, since ceilings and full walls are present. This permits better estimation of room volume than is usually possible. Cavates have a great deal of archaeological information available for collection with little disruption of deposits and relatively little effort. In spite of the attention cavates have received, there has been surprisingly little formal recording of them. They are so numerous on the Pajarito Plateau that a thorough yet efficient means of recording them is essential to a well-rounded survey of Bandelier and the Pajarito Plateau.

On the management level, recording the cavates provides a basis for monitoring them for deterioration and for devising and assessing countermeasures. Cavates attract considerable attention from both visitors and vandals, subjecting them to both casual and intentional attrition. They are also probably more subject to several types of natural degradation than are other archaeological sites: more features are either exposed or very shallowly buried, the tuff is very friable, and there is possibility of collapses of canyon wall segments.

Past Work in Cavate Features

Cavates in Other Areas

Ideally, the cavates found in Frijoles Canyon should be placed in a broad anthropological perspective, but that endeavor is beyond the scope of this study. Rooms excavated out of the rock exist elsewhere in the Southwest and around the world. Studies of cavates in other places may contain information on labor, ventilation, storage, insulation, and maintenance relevant to those of the Pajarito Plateau. Kempe (1988) provides a more global view of cave dwellings, including substantial material on artificial caves, emphasizing Old World sites. Although he includes a chapter on

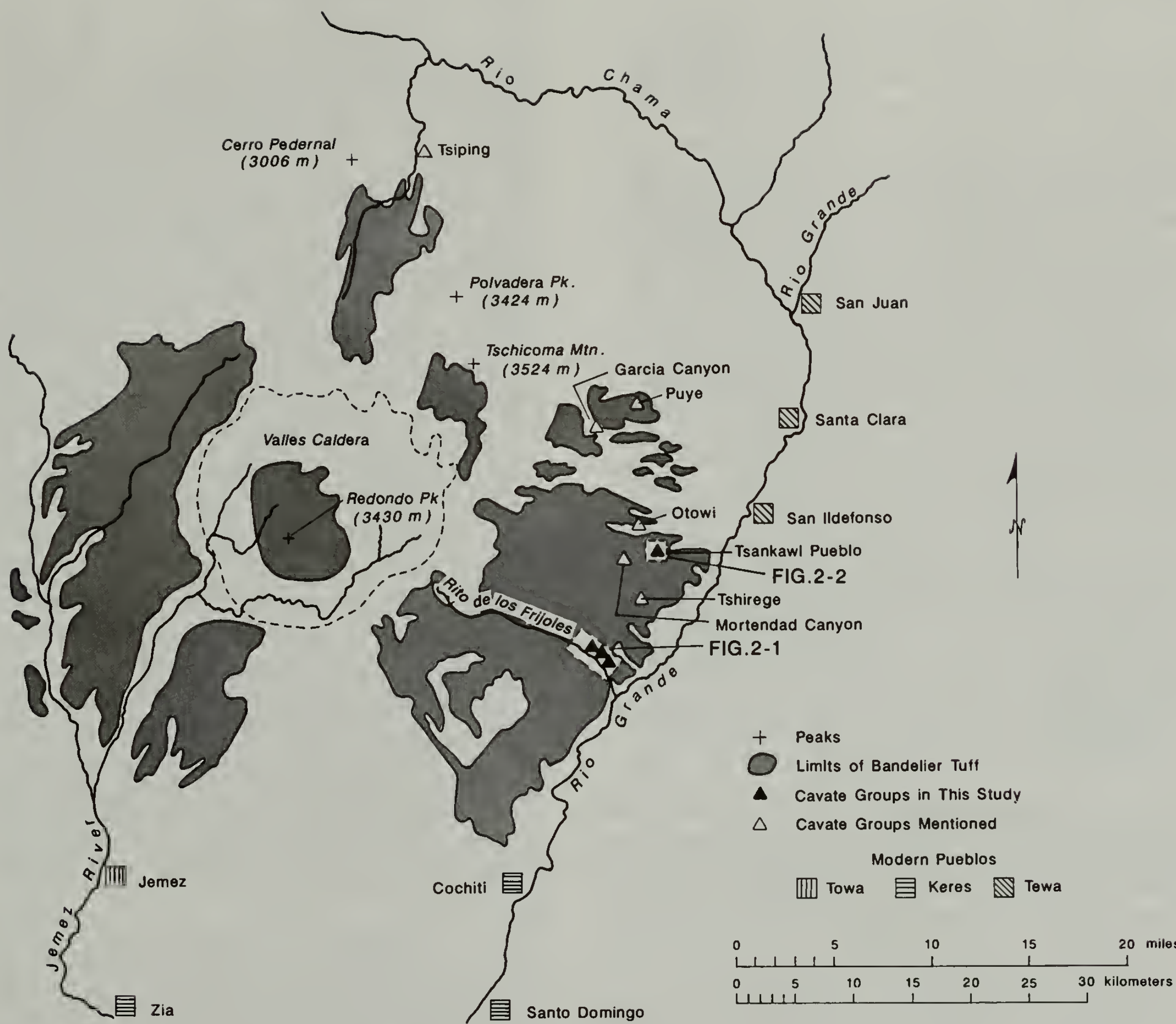


Figure 1.1. *Map of the Pajarito Plateau and environs, showing the locations of study areas (areas of figures 2.1 and 2.2 are indicated by dotted lines) and other recorded cavates, the distribution of the Bandelier Tuff, the Valle Grande Caldera, major streams, and modern pueblos. The elevation of the Rio Grande at the mouth of the Rito de los Frijoles is 1646 m. (Compiled from Bailey et al. [1969]; Dane and Bachman [1965]; Dougherty [1980]; Hyland [1986]; Ross et al. [1961]; USDA Forest Service Santa Fe National Forest Map).*

the Four Corners area of the American Southwest, he does not mention the cavates of the Pajarito Plateau, in spite of their similarity to excavated structures he discusses in other parts of the world.

Some striking parallels to the Pajarito Plateau can be found in Cappadocia, an ancient province in what is now central Turkey. The parallels are primarily geological rather than archaeological: Cappadocia has large expanses of tent rocks formed in a thick layer of volcanic tuff (Blair 1970; Heiken 1979; Fewkes 1910; Kempe 1988; Riboud 1958; Severy 1983:737). Cut into this tuff are thousands of rooms, ranging from small monastic cells to elaborate churches. From a distance many of the smaller rooms look very much like Bandelier cavates, but on the whole they are probably larger and more elaborate and ornate (e.g., Heiken 1979:568-569). Some of these sites are truly grand in scale; for example, "Vardzia numbers at least five hundred rooms and apartments, including chapels, banqueting halls, wine cellars, stables, all connected with a labyrinth of stairs and passages. It is made up of a number of storeys [*sic*], being cut out of a high vertical cliff face" (Lang 1966:125, also Plate 55).

Cosmos Mindeleff (1896) lists four areas of the Southwest where cavates are found: the Rio Grande, the lower San Juan River drainage including the lower Mancos River, the Flagstaff area, and the Verde Valley. Both the San Juan and Verde examples are excavated out of soft sedimentary deposits, while those in the Flagstaff area are dug into "cinders." Mindeleff (1896:217-235) notes that there are thousands of cavates in the Verde Valley, usually in small groups, but sometimes in groups of several hundred rooms. He devoted considerable care to recording some of the cavates in the Verde, including several individual structure plans, measurements, a map of a very large cluster, and photographs. Fewkes (1913:188-193) recorded other cavate rooms further up the Verde drainage, and discussed their relationship to nearby masonry structures. Mindeleff reports rooms as large as 3.7 x 6.7 m and series of rooms extending up to 14 m back into the bluff, far deeper than any artificial caves we encountered on the Pajarito Plateau.

Recording of cavates in the Verde Region, desultory since the time of Mindeleff and Fewkes (see Hall 1992:50-66), took a major step toward rigor with Susan Hall's (1992) recording and analysis. Hall's thesis focusses on the Mindeleff Cavate Site, providing plans and elevations for a large number of cavate suites and data on feature types and room sizes. In all, she collected data from 343 rooms in 89 cavate suites (Hall 1992:69). Hall also provides theoretical direction for the architectural study of cavates. Principle differences between the Verde cavates (at least at the Mindeleff Cavate Site) and those on the Pajarito Plateau seem to be that there is less use of exterior masonry on the Verde, and that the Verde examples are larger and have much more complex cavate plans, with many chambers linked together from a single exterior opening. Single chambers with exterior openings are the norm in the cavates we studied, with three chambers the maximum and the exception; in Hall's (1992:104) sample, most suites contained 2 to 5 rooms, and she recorded two cases with 10. Some of these rooms are small enough that we might have called them large niches, but the differences are marked.

Quoting the peripatetic Major Powell (1891), Mindeleff (1896:223-224) gives a brief description of two groups of structures east of San Francisco peak near Flagstaff. One of these includes about 150 rooms dug into a cinder dome, the top of which was walled and levelled to form a plaza. The cavate rooms were 3 to 4 m in diameter and 2 to 3 m high, arranged as a larger chamber central to smaller ones. The second group was built around the crater of a larger cone. Here a combination of free-standing masonry, utilized natural caves, and excavated caves formed a village which also had a formal plaza. Powell postulated that the builders of these villages were ancestors of the Havasupai.

Fewkes (1904:35-39; Whittaker n.d.) describes three different techniques of cavate construction in the Flagstaff area, providing some photos, a plan, and more detail than Mindeleff. At Turkey Tank Caves there are alternating layers of hard lava and breccia and sections of breccia have been removed, with the resulting cavities partitioned with walls. At the New Caves site, a number of cavate rooms were dug into the steep walls of an extinct crater, with masonry rooms in front. At Old Caves, there is an extensive single-story masonry pueblo many rooms of which have a subterranean component. Some of these "cellars" contain several chambers (see Fewkes 1904:37). Colton (1932:25; 1946:37-39) also recorded and mapped Old Caves, noting that "the curious underground chambers in nearly every room hollowed out of the cinders make it unique in pueblo architecture" (Colton 1932:25). He dates these structures to Late Pueblo III, A.D. 1250-1300.

Cavates are uncommon in the San Juan area. Prudden (1903:252-253) observes that "these examples [in the Mancos River drainage] are so small or so weathered away that one who should be tempted to make the long journey to the San Juan or lower Mancos for the sake of a study of cavate lodges would risk disappointment, especially in view of the more extensive, varied, and typical groups in the Verde valley . . . or those in the valley of the Rio Grande upon the eastern slope of the Valles." Prudden includes a photograph of a "weathered remnant of one of the cavate dwellings, showing the soft shale in which the shallow shelters were dug" (Prudden 1903:Plate XXX).

Pajarito Plateau

For a variety of reasons, people have been in and out of cavate structures on the Pajarito Plateau ever since their abandonment. Hendron (1943) found evidence of reuse in the seventeenth century (ca. Pueblo Revolt?) and later. Both the Tewa and the Keres have clearly used the area for centuries, and there can be little doubt that the caves were visited periodically after the large sites were abandoned and before there was a significant non-Indian presence in the area.

Extensively recorded visits probably began with Adolph Bandelier, who first visited Frijoles Canyon in 1880, making collections and observations. On his second visit in December, he slept in cavates in Alamo Canyon and near Tyuonyi. He found them quite comfortable in spite of some cold weather (see Lange and Riley 1966, especially 225-228). He appears to have selected large chambers in which to stay: he gave two height measurements of more than 2 m. He referred to the cavate where he stayed in Frijoles as the Room of the Cacique. At that time the rooms were well preserved and the ruins in general "very rich in fine fragments of pottery and manos"; the pottery was "prevailingly glazed." He visited many cavates and measured several of them. Many of his observations still hold, though artifacts and masonry are now considerably less abundant.

> The rooms are remarkably well preserved in most cases, and much stonework used. The goats have filled them with their dung. . . The floor is perfect in most cases, also the yellow plastering. The ceiling is generally smokey [*sic*] and sooty. . . There are, lower down, several of these large circular rooms like our present quarters. Were they estufas? The Indians say not; they are all houses, and the estufas were those below in the valleys. . . Every room has its fireplace, except such as were evidently used as storehouses. The ruins are in groups, and the deep recesses and reentering angles of the cliffs are avoided.

> . . . In general the rooms of the eastern half [presumably of the cavate group in which they were staying] are larger than those of the western section, there are even a number of very large ones. They are all plastered yellow, and smoky above. . .
>
> Many of the rooms contain carved walls, but while the carvings may have been made by Indians, they are certainly posterior to abandonment of the caves, as they are carved in the plastering. (Lange and Riley 1966:226-228)

Bandelier returned in 1885, checking his descriptions for *Die Koshare* (later translated and expanded into *The Delight Makers*). At that time there were three ranchos in the valley. One of his companions, named Pacifico, "found a black olla, entire, in one of the caves; also two stone axes" (Lange et al. 1975:76). They proceeded further north, noting large artificial caves in "Cañada Ancha" and many caves at "Tzirege." In 1886 Bandelier visited Puye, where he further showed his interest in caves:

> On the whole they are an exact repetition of the Rito, only their situation is different. They are plastered with yellow clay, and there is a smoke escape cut out above the doorways. Floors are everywhere black and about two inches thick. Many holes for beams. On the average, they are only one story, but I saw two and three stories also. There are also beam holes indicating porches in front of the rock. The caves are singularly distributed, and they are high, over all timber and plainly visible at a great distance. It is a good position for defense and watch. (Lange et al. 1975:160)

Bandelier detailed his vision of life and social organization in the cavates in *The Delight Makers* (1971), published in 1890.

At about the same time that Bandelier was pursuing his investigations, members of the Bureau of American Ethnology visited cavates on two occasions and briefly stated their findings in annual reports of that organization. James Stevenson spent a month in Frijoles Canyon in 1882.

> In many of the caves which were examined a flooring of fine red clay, very neatly and smoothly spread in several thin layers, is still seen, as also a plastering of red or yellow clay upon the walls. In some of them the lower part of the wall is of one color and the upper part and ceiling of another, the two colors being separated by a broad line of dark brown or black which runs around the cave about two feet from the floor. In the walls were found small niches.
>
> Beneath some of these caves, which were situated higher in the face of the cliff, were evidences of the former existence of annexed exterior chambers below. The cliff walls beneath these apertures had evidently been hollowed out to form the rear wall of the annexed chamber, and were nicely plastered with red and yellow clay. Rows of small round holes were seen which, it was thought, had been used as rests for the rafters, while large quantities of roughly squared stones used in building lay scattered about the base of the cliff. In some cases there appeared to be two and even three tiers of houses constructed in this manner. (Powell 1886:xxxvi-xxxvii)

J. W. Powell, the director of the bureau, visited the cavates (which he called by that term) in 1886. Powell (1891:xxi-xxiv) devoted several pages to discussing cavates. He considered them to be dwellings reached either by ladders or artificial terraces. He noted the presence of firepits, niches, and abundant potsherds. He made some chronological interpretations that differ from those now held:

> On more careful survey it was found that many chambers had been used as stables for asses, goats, and sheep. Sometimes they had been filled a few inches, or even two or three feet, with the excrement of these animals. . . Altogether it is very evident that the cliff houses have been used in comparatively modern times; at any rate since the people owned asses, goats, and sheep. The rock is of such a friable nature that it will not stand atmospheric degradation very long, and there is abundant evidence of this character testifying to the recent occupancy of these cavate dwellings. . . Every mesa had at least one ancient pueblo upon it, evidently far more ancient than the cavate dwellings found in the face of the cliffs. It is, then, very plain that the cavate dwellings are not of great age; that they have been occupied since the advent of the white man, and that on the summit of the cliffs there are ruins of more ancient pueblos. . . It was at once noticed that the potsherds of these cliff dwellings are, both in shape and material, like those now made by the Santa Clara Indians. . . While encamped in the valley below, the party met a Santa Clara Indian and engaged him in conversation. From him the history of the cliff dwellings was soon obtained. His statement was that originally his people lived in six pueblos, built of cut stone, upon the summit of the mesas; that there came a time when they were at war with the Apaches and Navajos, when they abandoned their stone pueblos above and for greater protection excavated the chambers in the cliffs below; that when this war ended part of them returned to the pueblos above, which were rebuilt; that there afterward came another war, with the Comanche Indians, and they once more resorted to cliff dwellings. At the close of this war they built a pueblo in the valley of the Rio Grande, but at the time of the invasion of the Spaniards, their people refused to be baptized, and a Spanish army was sent against them, when they abandoned the valley below and once more inhabited the cliff dwellings above. Here they lived many years, until at last a wise and good priest brought them peace, and persuaded them to build the pueblo which they now occupy--the village of Santa Clara. . . It is therefore evident that the cavate dwellings of the Santa Clara region belong to a people still extant; that they are not of great antiquity, and do not give evidence of a prehistoric and now extinct race. (Powell 1891:xxiii-xxiv)

In the early twentieth century a visit to the Pajarito Plateau became a vacation adventure. Susan Bierbower (1905) reported her visit to Puye. Her Santa Clara guide was apparently an astute, early cultural-resource conservationist, and Bierbower herself something less than a cultural relativist:

> The next morning . . . armed with a good staff and my kodak [*sic*], I again ascended to the dwellings. We had provided ourselves with a pick and shovel for excavating, and you can judge of our disgust when we ascertained that Juan had left them in Santa Clara. It is my firm belief that this was done with malice aforethought, as we learned that the Indians are very superstitious and unwilling to disturb these places. A small trowel was all we had. (Bierbower 1905:232)

Beam (1906) produced a more widely circulated report on the Pajarito, including several photographs of cavates at Puye (despite his title, "The Prehistoric Ruin of Tsankawi"). Both Bierbower and Beam concluded that the use of the cavates and pueblos in the region had ceased due to cataclysms, respectively earthquakes and "fierce and implacable enemies" or perhaps earthquake or eruption (Beam 1906:813).

The work done by Hewett in 1908 and 1909 in Frijoles Canyon included "clearing" cavate rooms, for some of which he gives measurements and locations (Hewett 1909a,b). Hewett also defined 13 groups of cavate/talus sites (A-M) along the north side of the canyon. These designations have been used by most later workers in Frijoles Canyon, and they are shown on the remarkable and still useful map and elevation prepared by Kenneth Chapman and published both by Hewett (1909a, 1938) and by Hendron (1940).

Hewett discussed cavates in several places. In the first of two 1909 papers in *American Anthropologist* he presented some exceptional panoramic photos of large segments of the north wall of Frijoles, showing three of the groups in which our crew later worked (A,F, and I). He also reproduced Chapman's reconstruction of Long House and the interior of a cavate in use. An interior photo illustrated many features of cavate rooms, such as digging stick marks, differential plastering leaving a band, a large floor-level niche, and a possible upper loom support. In the second article (Hewett 1909b) Hewett gave plans and measurements for some cavates in the eastern part of Group E (Sun House), but not for the others that he dug in the western part of Group E (Snake Village). Aside from a burial in the Snake Village portion, he made no mention of the contents or features of these rooms. He gave more attention to two "kivas," larger, heavily smoked rooms with loom anchors in the floor. The Snake Village received its name from an Awanyu painted on the plaster of the associated "kiva." Hewett also partially excavated an even larger cave kiva in the area but did not give its exact location. Hewett's later publication (1938) contains much of the material in the 1909 articles; in addition, it presents a sort of developmental sequence based on his estimation of quality of workmanship, in which a chronological element is implied but not specified.

The following discussion of burial placement suggests what Hewett may have found but did not report in detail:

> Crypt or cave burial was here secondary. Mortuary crypts were posterior chambers to pueblo-like cliff dwellings. They were receptacles for great quantities of disjointed bones, the rooms being filled with these unrelated remains to a depth of several feet. No utensils accompanied them. I consider these crypts to have been depositories for bones removed from, or washed out of, the cemeteries above. In individual cave burial as practiced in this region the dead are found in embryonic position and usually wrapped in feather robes or matting of yucca fiber. (Hewett 1938:134-135)

Chapman (1916, 1938) made a survey of the "cave art" of the "region of the Rito de los Frijoles;" he gives a breakdown of 106 prehistoric "works" by subject. He seems to have kept more extensive records as well, and he mentions an illustrated presentation, published at least in part as an appendix to Hewett's (1938) book on the Pajarito (see also Chapter 4 and appendix 4 of the present study). Chapman was especially intrigued by naturalistic figures and scenes scratched into plaster. While Bandelier attributed this style of rock art to postoccupational visits, Chapman clearly thought that at least some examples were done by residents of the cavates.

Hewett and Morley also worked at Puye, where a large number of cavate rooms are located below the mesa-top room blocks (Hewett 1908; Morley 1910). Stewart Peckham, formerly of the Laboratory of Anthropology, has devoted considerable effort to assembling Morley's notes from the Puye work, but in all his searches he has found no notes relating to the cavates (S. Peckham, personal communication, 1987). M. R. Harrington of the Southwest Museum worked in cavates in 1926; Peckham has found a map of several cavate rooms on three levels, with masonry rooms in front of the first level. Once again, however, extensive research and inquiry have revealed no further notes. Harrington's map shows floor ridges (which he calls sleeping ridges), "cook tables," firepits, partitions, vents, and three burials, one in a small, sealed back chamber.

Cavates were brought to the attention of the profession in other contexts in the early twentieth century. J. W. Fewkes made several references to Pajarito cavates in his presidential address to the Anthropological Society of Washington and included some photographs of cavates (Fewkes 1910). W. B. Douglass (1917) presented several sketch plans and sections of cavates in a paper for the nineteenth Congress of Americanists. His profiles show several cavate features, some quite common and some, such as benches and altars, rare.

Hendron (1940, 1943) did some of the most carefully recorded work in cavates. He excavated five masonry rooms and the four cavates associated with them in the center of Group M, above the NPS Residence Area. His intention was to thoroughly examine some structures in order to be better able to stabilize them. The rooms contained roofing material, cow bone, and Tewa blackware, indicating historic (ca. 1680 Pueblo Revolt) use of these particular structures. The uppermost walls were underlain by other wall alignments, some of which may have been used as foundations for the later walls. Hendron was very impressed by the fragility of the natural canyon walls, which led him to emphasize the danger of living in cavate rooms and to suggest that the walls probably receded very rapidly. He believed that the rooms visible at that time may have been preceded by earlier rooms later obliterated by erosion. Although the Bandelier Tuff is clearly a very soft material, it seems probable that Hendron overestimated the rate of cutting (see Carlson and Kohler 1989:59). Forty-five years after he worked there, the structures showed relatively little change. Hendron estimated the period of use of the sites as 400-500 years. He described firepits, plaster "dados," smoke vents, a basalt threshold, and depressions in the floor, which he said suggest sleeping spaces. Given the smoke blackening and the method of ventilation, Hendron was inclined to doubt that the cave rooms were used for habitation. He made some extremely nice drawings and sections (now in the park archives), but said little about recovery of cultural material. The rooms he stabilized are clearly visible today. Maxon (1969) reported a single tree-ring date of A.D. 1493 from Group M.

In his master's thesis, J. F. Turney (1948) wrote up the artifacts from Hendron's excavation as well as some further material from the excavation of a drainage trench in Group M. He noted that "it has been necessary to remove this material from its unfinished status and bring it to a conclusion as an aid to further research" (1948:i). The majority of the thesis is devoted to a discussion of pottery classification and description of types; the types identified by Turney are listed in Table 1.1. In connection with the present study, surface sherd counts from the same area were conducted and are presented in Table 2.3.

The faunal material includes deer, bison, turkey, and bear bone and a few worked pieces. Manos, metates, and axes were recovered, as well as bifaces and at least 10 projectile points. Obsidian is the most abundant chipped stone material (though Turney stated that "obsidian is brittle and not too well-suited for chipping" [1948:64]). Though the perishable materials

Table 1.1. Group M Ceramics Reported by Turney (1948) with Counts from Cavate Surface Material Analysis (See Table 2.3).

Ceramic Type	Turney	Group M Sample	Frijoles Sample
Santa Fe Black-on-white	57	5	16
Wiyo Black-on-white	24	1	3
Abiquiu Black-on-gray	30	-	-
Bandelier Black-on-gray	a	26	62[b]
Sankawi Black-on-cream	56	0	0
Tewa Polychrome	61	-	-
Agua Fria Glaze-on-red	2	4	9
Cieneguilla Glaze-on-yellow	5	1	1
Glaze B yellow	1	1	2
Glaze C	5	1	5
Glaze D	11	7	34
Glaze E	15	3	7
Glaze F	5	-	-
Zia Glaze	4	-	-
Early glaze	32	-	-
Middle glaze	203	-	-
Late glaze	55	-	-
Zia Polychrome	13	-	-
Kapo polished blackware	73	1	1
Culinary	c	469	1144
Total	652	519	1284

[a]Not given; presumably abundant: shown as "major occupation."
[b]Biscuit B.
[c]"By far the largest type"; "culinary ware is of little value" (1948:47).

seem to have come from the masonry rooms rather than the cavates, they are abundant and remarkably well preserved. The inventory includes a digging stick, two weaving tools, two bow fragments, several arrow shafts, "a meager three" fire hearths, some carved sticks, a cradle board, and other wood attributed to craft wastage. Basketry, cordage, yucca fiber, feathers, a feather blanket, and a piece of woolen textile were also present. Turney listed 24 pieces of leather, including moccasin fragments, sewn buckskin, and a thong. A small bowl of tobacco was found, analyzed, and partially smoked(!) by Hendron (Hendron 1946). Also recovered were corn plant parts (bundles of leaves, more than 600 cobs) and cucurbit peduncles and rinds. Following Mera (1932, 1934) and presumably Hendron, Turney concludes that a reoccupation, possibly during the Pueblo Revolt, was probable. The types of perishable materials and the degree of preservation indicate that they may relate to the later occupation suggested by some of the pottery types.

In 1939 and 1940, R. H. Lister conducted extensive stabilization work in Bandelier. Much of his time was spent at Long House (Lister 1939), but he also worked at Otowi and Tsankawi, west of Camp Hamilton, in Pueblo Canyon, and along the Rito de los Frijoles. In the area outside Frijoles he located 567 caves and worked on more than half of them. Most of his work consisted of building dams at the entrances of the cavates or diversions above them to prevent water from running through them. In Frijoles Canyon he did similar preventive maintenance and rechinked some masonry walls. Lister's dams are difficult to see today, but they are probably doing their job since water damage seems to be less a problem than human impact. The stabilization records for Long House deal only with masonry walls. The records for the work in "caves" (Lister 1940a,b) contain many before-and-after photographs of the cavates in which Lister worked (see Chapter 2), as well as brief descriptions of the tasks performed. The work done outside Frijoles (Lister 1940b) was concerned almost entirely with landform and drainage, though Lister did note and photograph some rock art and disperse some rock corrals in front of cavates.

The site group west of Camp Hamilton has an especially high density of cavates; Lister's map shows 161 in less than half a kilometer. Lister assigned numbers to cavates in each of the areas where he worked. In each area the numbers start with one, and C is used as a prefix in all areas (e.g., C35). He prepared a map for each area showing the configuration of the cliff. Lister's (1940a) descriptions of cavates in Frijoles Canyon are somewhat more detailed than those for the other areas, and the work he performed included some masonry pointing. The most common modification he made involved rearranging fill in front of cavates, but Lister makes no mention of artifacts in or outside of them. He summarized his cavate work in several notes in the Southwestern National Monuments newsletter.

In 1960 C. Johnson, a graduate student at the University of New Mexico, removed a secondary burial of a child from "Cave Room C54 Tsankawi Ruin." This room is located in the upper, gray tuff cliff, just below the main pueblo, and is part of the group our crew recorded at Tsankawi (LA 50976). Matting, cordage, a few sherds and lithics, and a Bandelier Black-on-gray bowl were present in the back corner of the room, under about 8 cm of fill. Since small bones were missing and the long bones were stacked below the cranium, this was quite clearly a reinterment. A floor pit, apparently unrelated to the burial, was beneath it (Johnson 1960).

In 1962 James Maxon, the park archaeologist at Bandelier, cleared the floor of a cavate in Mortandad Canyon, then in the Otowi Section of the monument (Maxon 1962). This is a fully enclosed, 3 x 3.6 m cavate with two doors, one blocked up; a firepit near the blocked door; four large niches; and abundant rock art. Because this room is the largest in its group, Maxon called it a kiva. Some corn remains and a few sherds were recovered from the excavation; the decorated sherds from the room and the area outside are Santa Fe Black-on-white and Wiyo Black-on-white. The petroglyphs in this cavate largely defined Steen's Mortandad style of rock art (Steen 1979).

Maxon analyzed material from two Los Alamos Archaeological Society excavations for his master's thesis (1969). One of the sites was the Tshirege Cave Site, consisting of 13 masonry rooms, 6 cave rooms, and a court area. Tshirege is located near the modern community of White Rock and is thus not far from Tsankawi. Like Tsankawi, Tshirege is a large masonry pueblo with cavates below it, including the "Tschirege Cave Site" (Maxon's spelling). Maxon stated that:

> available photographs indicate that these cave rooms were also typical of other cave rooms in the area. The rooms rarely exceed 10 feet square in size and ceilings are rarely more than 6 feet in height. Occasionally cave chambers which were used as ceremonial rooms or kivas were somewhat larger. . . Usually [they are] behind surface dwellings . . . rarely used alone.
>
> Cave rooms typically had adobe plastered floors, often showing several layers of plaster. The walls were also plastered to a height of about 30 inches. The plaster was often colored red or white. Above the plaster the walls are heavily soot coated from fires, either in the caves themselves or from adjoining rooms to the outside. In addition to the doorways, sometimes a small ventilator hole was located near the ceiling of the cave. The cave rooms were often interconnected...Apparently cave rooms were not excavated more than one row deep into the cliffs.
>
> Aside from their good insulation from both heat and cold, the caves had little to offer for day to day living. The lack of light, ventilation, and their generally small size made them less desirable than the rooms built in front. Nevertheless, evidence of use of fire, storage niches, and repeated refurbishing of the floors suggest that the caves were utilized as much as the outside rooms (Maxon 1969:49-50).

The ceramics suggest that this part of Tshirege was used from the late fourteenth through the early sixteenth century. Material consisted of fairly abundant pottery, some milling stones, mauls, and chipped stone dominated by obsidian. The only perishable mentioned from the collections is some leather.

Charlie Steen (1977, 1982) has assembled information on work done over many years on the lands of Los Alamos National Laboratory. Although he made "no particular effort . . . to locate groups of cavate rooms" (1977:3), he made several observations concerning cavates. He believes they relate to the period on the Pajarito Plateau when the larger sites were being occupied. He argues that cavates served primarily for storage and for ceremony. The argument for ceremony rather than habitation is based on several contentions: that cavates are intentionally smoke blackened rather than blackened by heating fires (replastered walls are sooty but not black), that hearths near doors are kiva features, and that cavates often have artwork in them (1977:15-17). He believes the very small, blackened examples were used for individual meditation. The larger blackened and plastered cavate rooms with rock art "served as religious or ceremonial rooms for basic families, and each was similar to a family chapel" (Steen 1979:42). Steen also defined a rock art style, the Mortandad style mentioned above, which he says is limited to a small subarea of the Pajarito Plateau and found strictly in cavates. He attributes it to the late fourteenth century. The style is characterized by incisions into blackened tuff and by the presence of Awanyus, birds, Kokopelli, and an anthropomorphic figure that Steen likens to the Toltec sun god. Steen's viewpoint concerning the Pajarito Plateau cavates found a wide audience in a 1982 issue of *National Geographic*, which has long been an outlet for discussions of cavates (Beam 1906; Canby 1982:578-579, 592).

The Pajarito Field House Project--a part of the Pajarito Archaeological Research Project (PARP) of the University of California, Los Angeles--excavated the shallow deposits in an isolated cavate (LA 52333) in the area south of Puye (Preucel 1985, 1986a; Hill and Trierweiler 1986). This single room contained three hearths. Both squash and corn remains were recovered. The few sherds associated with it and those on the talus in front were Santa Fe Black-on-white and Tesuque corrugated. Robert Preucel suggested that because of its isolation this cavate could have functioned as a field house. As part of the PARP, Justin Hyland collected data on features and room dimensions for a total of 44 cavates in 2 adjacent groups in Garcia Canyon, between Tsankawi and Puye. He presented the results of this recording and its analysis in his honors thesis (Hyland 1986). Although some of the variables measured were different, and the means of measurement also differed, Hyland's study is by far the most nearly comparable to the present one, and it monitored many of the same attributes. In addition to the cavates recorded by Hyland, PARP recorded the locations and some measurements for 431 other cavates in a total of 35 locations (R. Preucel, personal communication, 1988). The PARP survey also documented several large, Late Coalition pueblos with extensive associated "cavate villages" in the area south of Puye (Preucel 1986b:8; 1987).

As part of an excavation program related to the Bandelier survey, a Washington State University field school under the direction of Timothy Kohler excavated a single cavate chamber in Frijoles Group M near the rooms excavated by Hendron and outside the area recorded by our crew. The fill of this room was primarily disintegrated tuff, with sloughed wall plaster near the floor. Materials recovered were similar to those we observed during recording: a few cultivar remains and very sparse artifacts. Seven features were recorded, of which the three floor features--two bins and a cist--were rare or absent in our sample (in which there are relatively few floor features). A deep, heavily modified niche is unlike any recorded in this study (Carlson and Kohler 1989).

Cavates have long attracted attention, and it seems that in the past hundred years they have been found to contain little material. That situation, however, may well relate as much to their visibility as to the condition in which they were left (in some senses they have never been completely "abandoned"). Although most of the people who have studied cavates have noted replasterings, smoke blackening, and domestic features, they generally agree that for reasons of space and ventilation, cavates would be an undesirable place to live. Three functional categories have been defined: small, unsmoked rooms used for storage; rooms with smoke blackening and other features that may have been habitations; and the largest cavates, smoke-blackened and containing rock art and sometimes loom anchors, which have been called "kivas." Although the last category in particular is loaded with assumptions and inferential leaps, these categories may at least be tested with detailed data from cavates. The PARP study and the sample reported here are a beginning, but expanded research is needed if we are to make meaningful regional statements about function and variability.

The Present Project

In the summer of 1986 a crew of three National Park Service (NPS) archaeologists, assisted by four volunteers on varying schedules, spent six weeks recording measurements and features of cavate rooms in Frijoles Canyon and in the Tsankawi section of Bandelier National Monument. The locations of cavate features in Frijoles Canyon and at Tsankawi have been known for a long time (e.g., Hewett 1909a; Lister 1940b). This project recorded data on condition, measurements, associations, and visible features for a sizable number of cavate rooms. These data were collected as consistently as possible, recorded in a coded format, and entered into a computer data base so that they could be readily manipulated and easily recalled. The project produced location sketches and maps, along with photographs of feature openings and selected features, and videotapes of all rooms recorded. Immediately following the fieldwork, we entered the data into the computer and prepared a preliminary report, but we lacked funding and personnel for either checking or analyzing the data. A later contract permitted us to check for errors in coding and data entry and to prepare baseline data on cavate feature occurrence and measurement. This study is the result of the latter analysis combined with the preliminary report. In addition to the foregoing outline of previous archaeological work done in cavates, it describes the sites in which recording was done, discusses the recording procedures followed, and presents the results of descriptive and interpretive analyses using the data gathered. Beyond the goals of better cavate management and description, several higher level questions motivated this study.

Several interesting questions arise from the project. Can we group cavates based on size and features present, and can we interpret the possible functions of these groups? Do certain types of cavate tend to occur in certain locations? How do Tsankawi cavates differ from those in Frijoles, and can we attribute those differences to the cultural boundary between the Tewa and the Keres, which those groups traditionally consider to have existed between those areas (e.g., Hewett 1938; Steen 1977)? The data assembled here allow us to begin discussing these questions; *answering* them will require following them much further.

In capsule, then, this project was designed to establish: (1) an estimate of the ranges of variability and covariation of attributes in cavates; (2) a procedure for recording these features; (3) the current condition of a sample of structures as a baseline for future maintenance and for the types of disintegration that occur in cavates; and (4) the coherence and logic of various interpretations of cavates.

2

Context, Descriptions, and Chronology

Edgar Hewett (1938:27, 34) takes credit for naming the east flank of the Jemez Mountains the Pajarito ("little bird") Plateau, in spite of his peculiar statement that "the country is almost devoid of birds" (Hewett 1938:30-31). As he defined it, the plateau extends from the Chama River on the north to Cañada de Cochiti on the south and is bounded by the Rio Grande on the east. The name comes from Pajarito Canyon, which in turn takes its name from the translation of the Tewa word *Tshirege* (Harrington 1916:282-283; Lange et al. 1975:58, 77; Hendron 1946:89; also spelled "Tsirege," "Tschirege," and "Tzirege"), a large, Classic period pueblo ruin on the outskirts of modern White Rock.

The Pajarito Plateau is a place of great drama and beauty. Its geological history culminates in a huge explosion; its great elevational range and resulting moisture give rise to biological diversity and splendid panoramas; its human history is long and highly varied. This study examines a small spatial and temporal portion of this broader context. In addition to summarizing the setting, this chapter describes the areas in which we worked and how they were selected. It concludes with a discussion of the means and problems of the chronological placement of cavates.

The Setting

Geology and Environment

Even more than in most prehistoric settings, the geology of the Pajarito Plateau was of critical importance to how its inhabitants adapted to life there. The massive, relatively easily excavated tuff deposits exposed by the canyons of the plateau made possible the construction of cavate dwellings. The source of this tuff was a major geological event during the Pleistocene: the explosive eruption of the Valles Caldera followed by an ash flow that spewed forth a couple of hundred cubic kilometers of volcanic ash (Ross et al. 1961:141; Heiken 1979; Mathien et al. 1993). The singularity of the event accounts in large part for the limited occurrence of cavate dwellings. The Jemez Mountains were formed by millions of years of volcanism, but it was the "climactic and terminal stage" that formed the Tewa Group of tuffs and lavas in which the cavates were constructed (Figure 1.1; Bailey et al. 1969:12-15). The Tewa Group contains both the Valles Rhyolite and the Bandelier Tuff; the Bandelier Tuff is the formation into which the cavates were carved. The caldera left by the eruption, the ash flow blanket and its later dissection, are the main features of the landscape occupied by the Pueblo peoples in the twelfth through sixteenth centuries.

The Jemez Mountains rise to 3500 m (11,500 ft.). They form an effective moisture trap, and several streams flow out of them, including the Rito de los Frijoles. The presence of water, the sharp elevational differences, and the softness of the tuff have predictably led to dissection of the Pajarito Plateau by numerous deep, often sheer-walled canyons radiating from the caldera. The Bandelier Tuff has been divided into two members--the Otowi being overlain by the Tshirege--each of which consists of ash flow units resting on thinner pumice beds (Bailey et al. 1969:12-14). Cavates occur primarily in the Tshirege (upper) member, which consists of "a series of cliff-forming welded ash flows" (Bailey et al. 1969:13; Kelley et al. 1961:56-59). The lowest cavates recorded at Tsankawi are cut into a distinctive reddish tuff that is much softer than the overlying gray tuff and contains larger chunks of pumice. In this location Bailey and others (1969) describe the Tsankawi Pumice Bed at the base of the upper member of the Bandelier Tuff. The layer into which the cavates are cut, however, is thicker than their description of the pumice bed (they measure it at around 1 m). In any case, these cavates are also in the Tshirege member of the Bandelier Tuff, very near its base.

Grant Heiken (1979:569) notes that deposits at the base of pyroclastic flows are easier to excavate. In response to an inquiry about patina formation and, more specifically, the variability in the tuff at Tsankawi, he wrote the following:

> Most of the variations in the tuff at Tsankawi . . . are related to postdepositional processes. Obvious facies within the tuff, which are soft and easy to excavate, include nonwelded bases and pumice falls. Harder tuffs include those cemented by secondary minerals in the vapor phase zone (that zone near the top of the composite section of pyroclastic flows affected by hot gases rising through the cooling tuff deposit) and the thin, resistant layers cemented by zeolite cement. The latter were located at the top of the ground water table that was present before the canyons were excavated by erosion. Multiple resistant beds can represent a record of declining ground water as the canyons were growing deeper and wider with time. The flat benches at Tsankawi are tops of the more resistant zeolite-cemented tuff.
>
> Nearly all cavates are located within distal regions of the pyroclastic flows where the tuff is nonwelded. Closer to the source, for example above Ponderosa Campground, the tuffs are welded; these would have been impossible to excavate, being hard and dense. (G. Heiken, personal communication, 1986)

The well-watered uplands contain lush vegetation and associated montane fauna (Mathien et al. 1993:6-8). Because the elevation drops rapidly to the Rio Grande at around 1600 m, there is considerable biotic diversity in a fairly small area. Alpine tundra, spruce-fir-aspen, ponderosa-oak, piñon-juniper, and riverine plant associations are all found within 25 km of the study areas, depending on exposure and elevation (see Powers 1988 for more detailed discussion of environmental zones). Even in the lower elevations of the plateau, the growing season varies considerably, from 120 to 180 days (Hubbell and Traylor 1982:29).

Cultural Context

For an area seemingly well suited to supporting populations subsisting by hunting and gathering, remarkably few sites of the Archaic and early parts of the Pueblo eras are known on the Pajarito Plateau. David Stuart and Rory Gauthier (1981:48-49) found that fewer than 12 percent of all components in the state survey files date to before A.D. 1175. More sites from the earlier period have been and will be found as more comprehensive archaeological work takes place, such as the preceramic pithouse near Otowi (Lent 1988). Present samples, however, indicate relatively low human population and use in the area in early prehistory. This situation changed dramatically, however, at around 1175. At that time there was a sudden profusion of small pueblos characterized by rectilinear room blocks, pit structures, and ceramics dominated by Santa Fe Black-on-white: the Coalition Period (Stuart and Gauthier 1981:45-51; Cordell 1979:53-64; Preucel 1987; Powers 1988; Mathien et al. 1993:9-34). Judging from ceramics, it is probable that the first cavate structures were dug sometime during the Coalition Period (see below).

Following the Coalition Period, between about 1325 and 1540 the population of the area became increasingly aggregated, as seen in the archaeological record for much of the northern Rio Grande, including the Pajarito Plateau (Kohler and Linse 1993:3-5). At this time--the Rio Grande Classic--there were fewer but much larger settlements. Large, free-standing pueblos were built, such as Tyuonyi and Tsankawi, and on the Pajarito Plateau the large pueblos have large groups of cavates nearby. Other, well known sites having both cavate clusters and large, free-standing structures include Otowi, Navawi, Tshirege, and Puye. These associations and the predominance of ceramics, such as Bandelier Black-on-gray and Tsankawi Black-on-cream, on cavate sites suggest that at least clustered cavates are a part of the Classic Period aggregation. In the historic era, following the Classic Period, permanent habitation on the Pajarito Plateau shrank dramatically, and almost all Pueblo settlements were located in the major river valleys. The plateau remained an important subsistence and sacred resource area for the Pueblo peoples, as well as a refuge, but its time as a location for large human populations was over until the coming of the nuclear age to Los Alamos.

The Sites

Cavate Groups

Both Frijoles Canyon and the area around the main ruin at Tsankawi were very densely settled, so that the concept of discrete sites in these areas is somewhat suspect. Hewett and Chapman divided the cavates in Frijoles into Groups A through M based on breaks between clusters, which are often caused by drainages or stretches of cliff unsuitable for cavate construction. The separation between the groups they defined is only a few meters in several cases, and the groups vary considerably in size. Whether or not this long string of cavates was 14 or more settlements, as implied by this topographic grouping, can only be inferred by careful study. Our recording is a early step in making this inference.

In 1986 we spent time recording in five groups of cavates (Figures 2.1, 2.2). The Hewett-Chapman groups remain useful to the NPS as a framework for management, and we used them as the first stratum for our recording sample. Because of short time and small crew size, we recorded all of one of the Hewett groups and parts of three others. In addition, we worked at a fifth group in the Tsankawi portion of Bandelier National Monument, 11 straight-line km northeast of the cavates in Frijoles Canyon (Figure 1.1).

The sample of cavates selected was designed to assess several dimensions of variability. Within Frijoles Canyon we were interested in whether a number of locational variables influenced cavate morphology: upstream or downstream location within the canyon; vertical and horizontal proximity to the Rito; size of cavate group; location within a group. At the next level, we were interested in differences and similarities between the Frijoles cavates and a group of cavates outside Frijoles Canyon (the Tsankawi sample). In Frijoles, dimensions of locational variability are to some degree correlated; that is, cavates in the upper end of the canyon are closer to the Rito because of the canyon topography and the intersection of the stream with the tuff strata. Tsankawi Mesa has at least three major tuff types, and we studied some rooms from each.

The rationale for recording a stratified sample of groups rather than a random sample is grounded on both practicality and information yield. First, to accurately sample the whole Frijoles or Tsankawi population would require

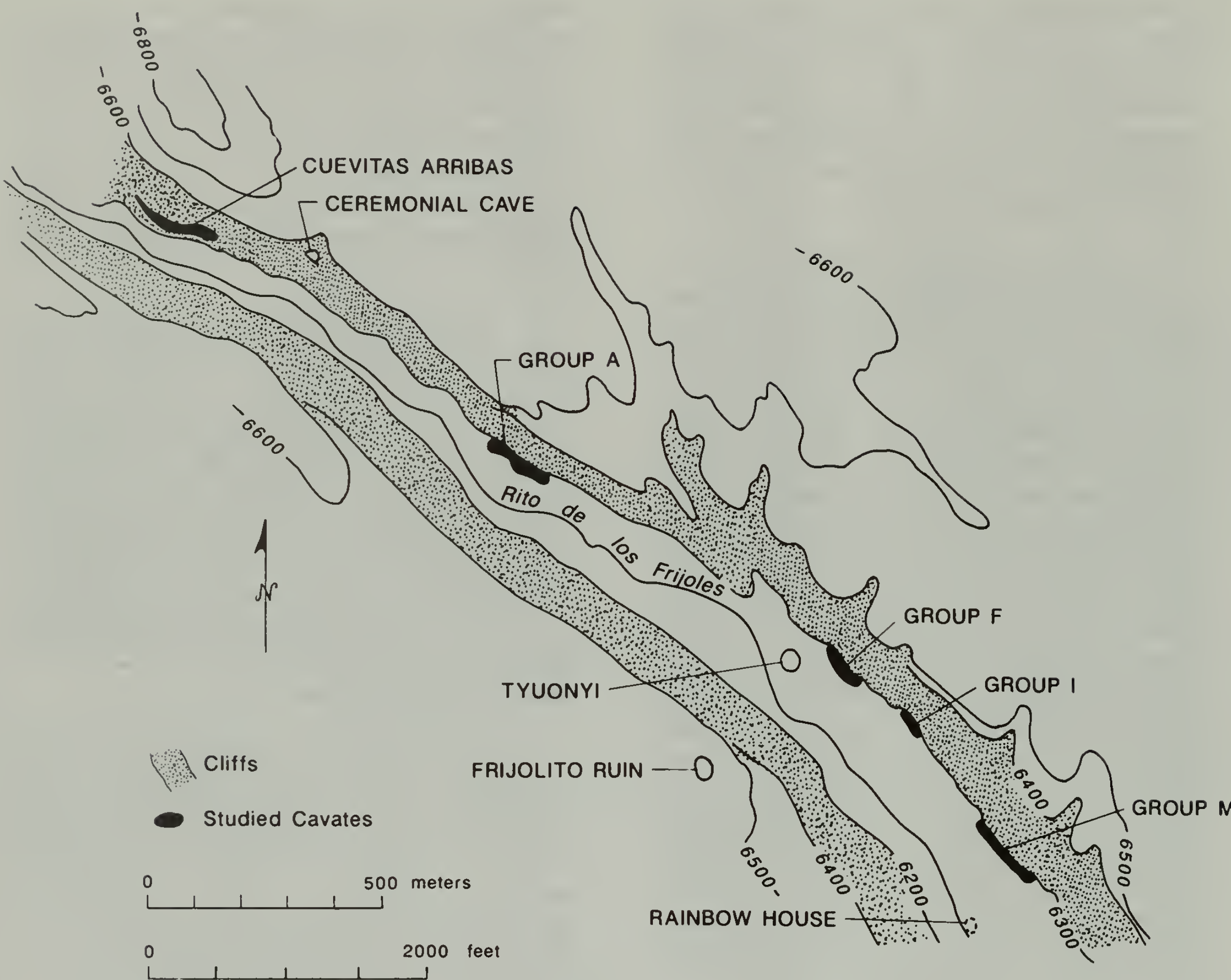


Figure 2.1. *Map of Frijoles Canyon showing the location of the cavate groups discussed in this study and other major sites. Only selected contours from the USGS Frijoles Quadrangle are shown, with the cliffs of the north side and the cliffs and steep slopes of the south side shown by shading.*

Figure 2.2 *Map of the Tsankawi section of Bandelier National Monument, showing the main pueblo of Tsankawi. LA 50976 and three groups of cavates mapped by Lister are scattered along the south edge of the mesa. By request of Bandelier National Monument, the locations of these fragile cavate groups are not shown. Selected contours and features are taken from the USGS White Rock Quadrangle.*

complete inventories of each, and those inventories did not exist in 1986. Second, locating randomly selected features would be time-consuming and it would be difficult to determine which other features should be included. Third and more important, there are good archaeological reasons for recording groups. It is extremely unlikely that any single cavate in either of these locations was a site unto itself in terms of prehistoric use. By recording groups, it is possible to gain some idea of whether size or functional groups are associated in a regular way. It might be possible to infer, for example, whether or not smaller groups of cavates can be considered individual-use units (see Figures 2.3, 2.4.).

Through an unfortunate oversight, the field crew was given an incorrect set of Laboratory of Anthropology (LA) site numbers for use in the field. These numbers were used on all forms, photo records, and notes, and on photo boards. Although the correct, official numbers are used throughout this text, the presence of the field numbers in so many places requires a concordance between official numbers and field numbers:

Group	Official No.	Field No.
M	LA 50972	LA 50020
A	LA 50973	LA 50021
I	LA 50974	LA 50022
F	LA 50975	LA 50023
Tsankawi	LA 50976	LA 50024

The field numbers have been retained in the computer data base for purposes of matching field records and photographs with final records. A plan map and elevation or profile sketch is included for each study group in the following descriptions. The variability in these figures is the result of three different recording techniques. During the 1986 fieldwork each Frijoles group was mapped using tapes and compass. Cavates in the Tsankawi group were placed on Lister's map. Rough field elevations were drawn showing locations, and then drawings were made on Mylar overlays on photographs. Groups F, I, and M in Frijoles were included in the later sample survey of the monument. During recording for the survey, plane table maps and careful elevations were made. When available, the more detailed maps and drawings from the park survey have been included here. When these were unavailable, drafted versions of the 1986 recording have been used.

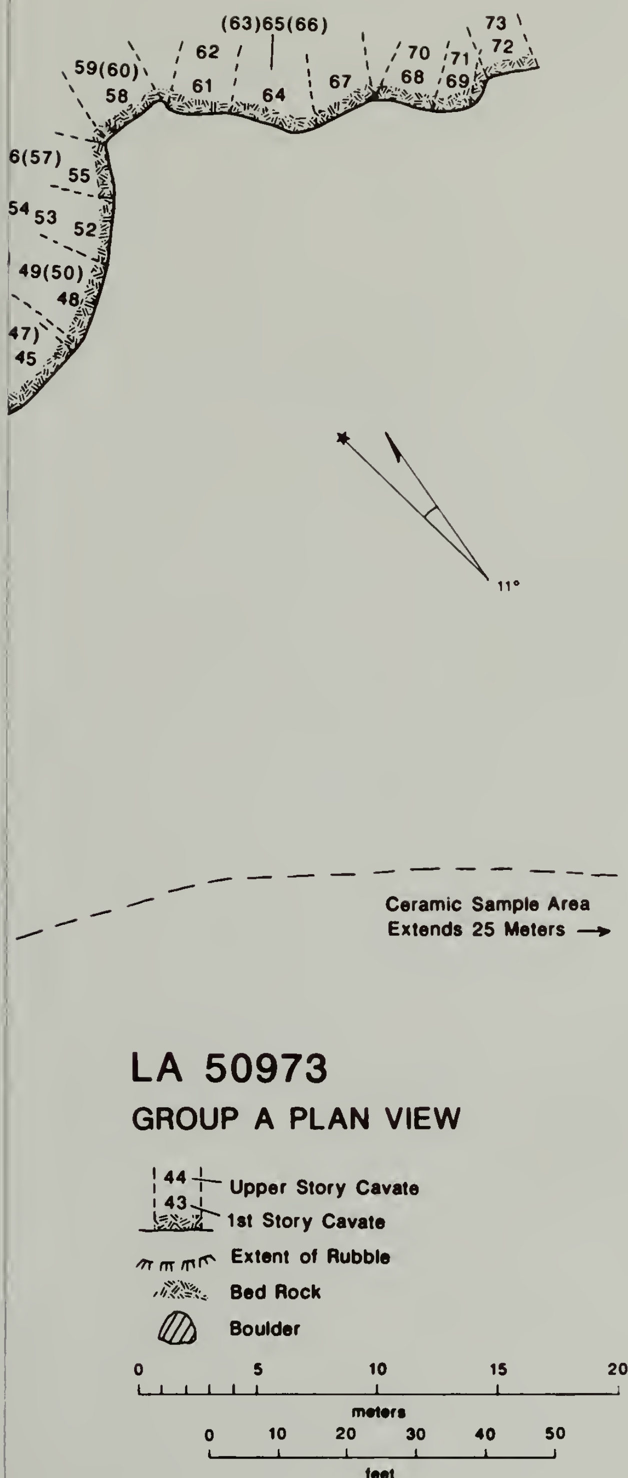
Frijoles Group A, LA 50973 (field no. LA 50021)

Group A is located in a lovely, park-like wide spot in the canyon. It is a large group, running a couple of hundred meters along the base of the cliff and consisting of around 130 cliff-associated rooms and several substantial rubble mounds representing masonry room blocks (Figures 2.5, 2.6). Group A is separated from Group B by a projection in the cliff, but the two are quite close together. In spite of its designation, which would seem to indicate that it is the first group of cavates in the canyon, there is a substantial cluster of cavates 1.1 km upstream from Group A (see the description of Cuevitas Arribas, below). Group A is located at the upper end of the fairly continuous string of locations with cavates that stretches for about 2 km through the central occupation area of Frijoles Canyon. Much of this distribution may be explained by canyon width: Group A is located in the last wide spot in the canyon as one proceeds upstream, the upper end of the wide part of the canyon where the Rito is not deeply entrenched. Like Long House (Group D), Group A is located very near the canyon floor rather than at the top of a talus slope, the location of most of the other Frijoles cavates.

The U.S. Geological Survey (USGS) quadrangle indicates that the creek is at an elevation of 6150 ft (1875 m) where it passes Group A. Altimeter readings at the cavates indicate a difference of 150 ft (46 m) from the Visitor Center benchmark, or about 6210-6220 ft (1893-1896 m). The cavates of Group A are all at about the same elevation because the base of the cliff is at the same level for most of the

Figure 2.3. *View of Group I from across the canyon. Masonry rubble is visible in front of the concentration of cavate rooms. The relatively recent rockfall on the righthand side of the group partially covers rooms 30-34. The group extends from the lower chamber on the left and there are two rooms out of the frame to the right.*

Figure 2.4. *Upper Group M viewed from across Frijoles Canyon. The area recorded extends from out of the picture on the left to the small tent rocks at the far right. Note both the extensive rubble and the heavy use of cavate chambers that had masonry closings.*



up A sample. Room numbers between dotted lines are
at the bottom of the stacked room numbers. Back rooms
ing a compass and tapes in 1986.

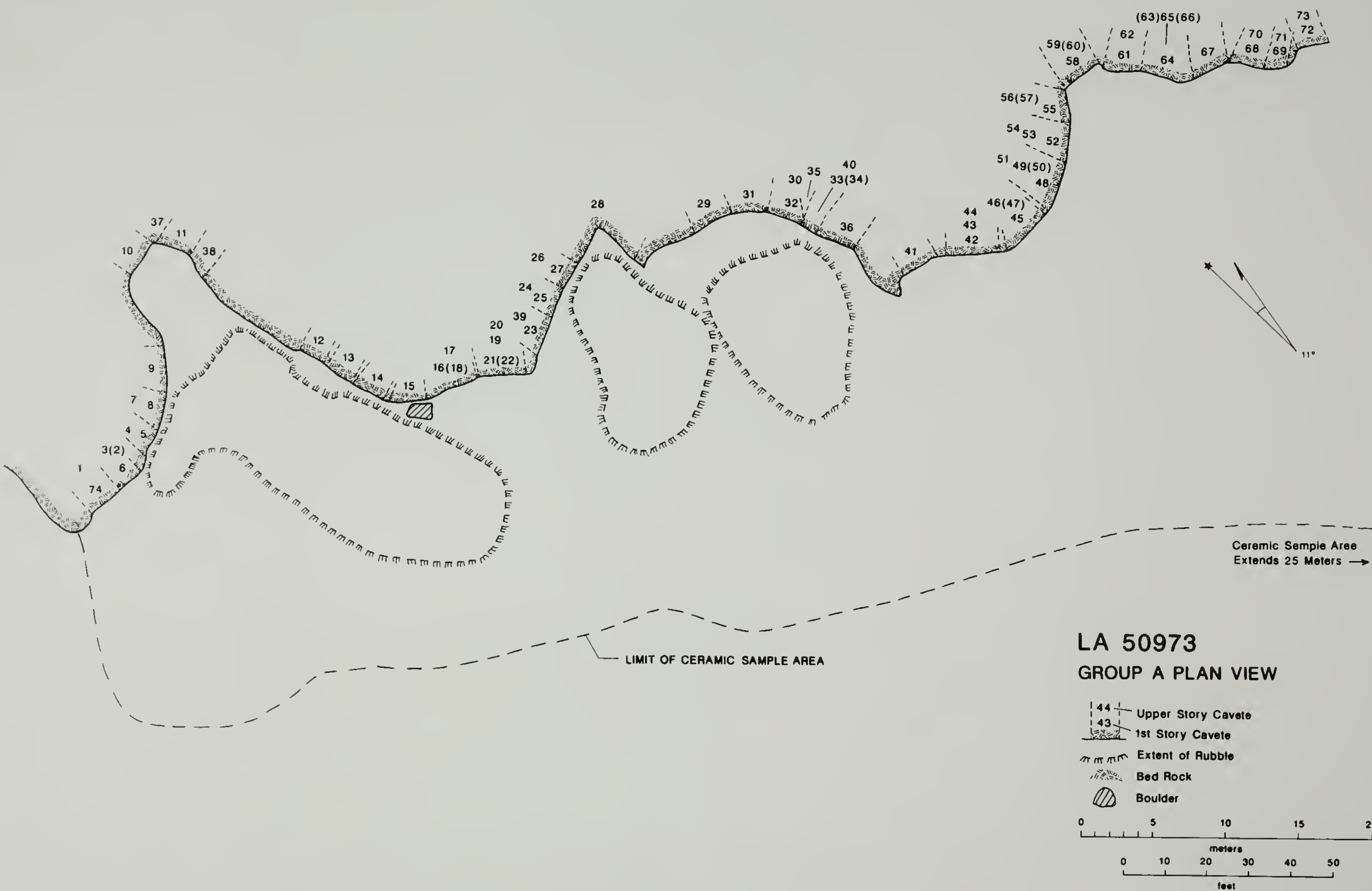
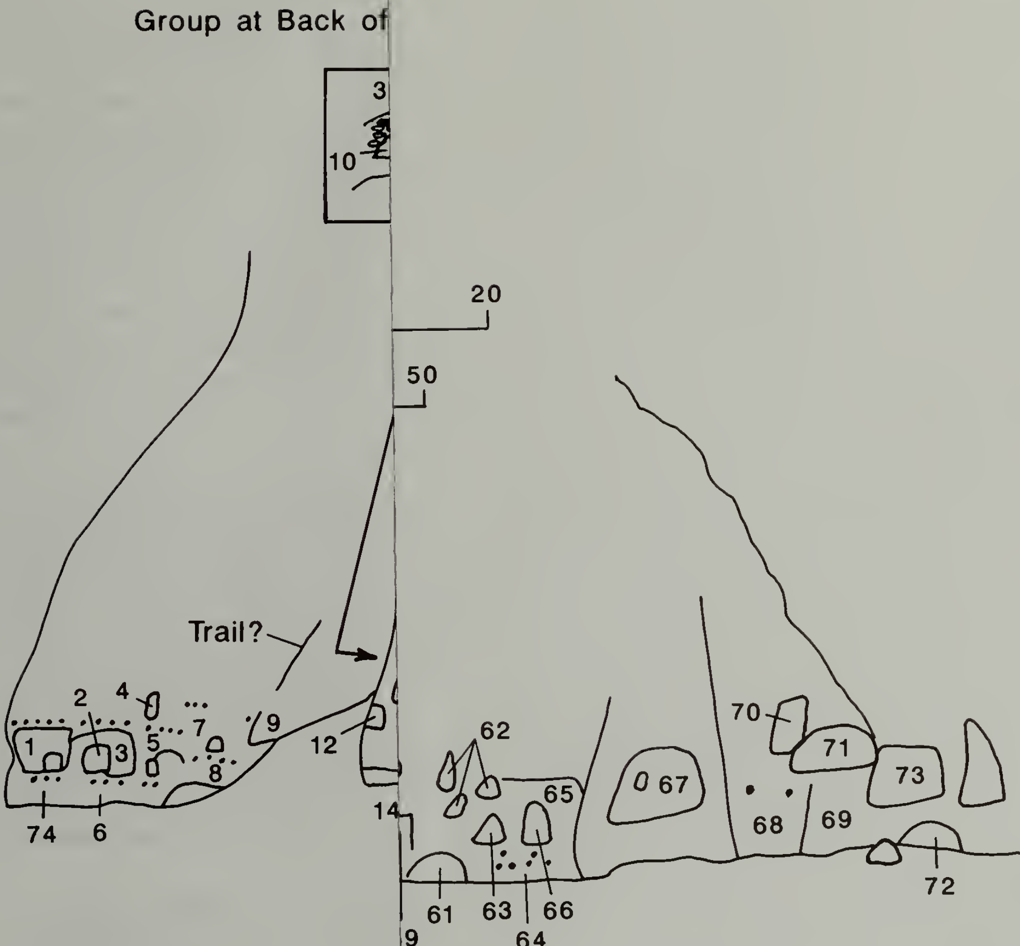


Figure 2.5. *Room plan view for the Group A sample. Room numbers between dotted lines are arranged with lowest story room at the bottom of the stacked room numbers. Back rooms are in parentheses. Drawn using a compass and tapes in 1986.*



sample. Drawn from field sketches and photos in 1986:
distance from Cavate 1 to Cavate 73 is approximately

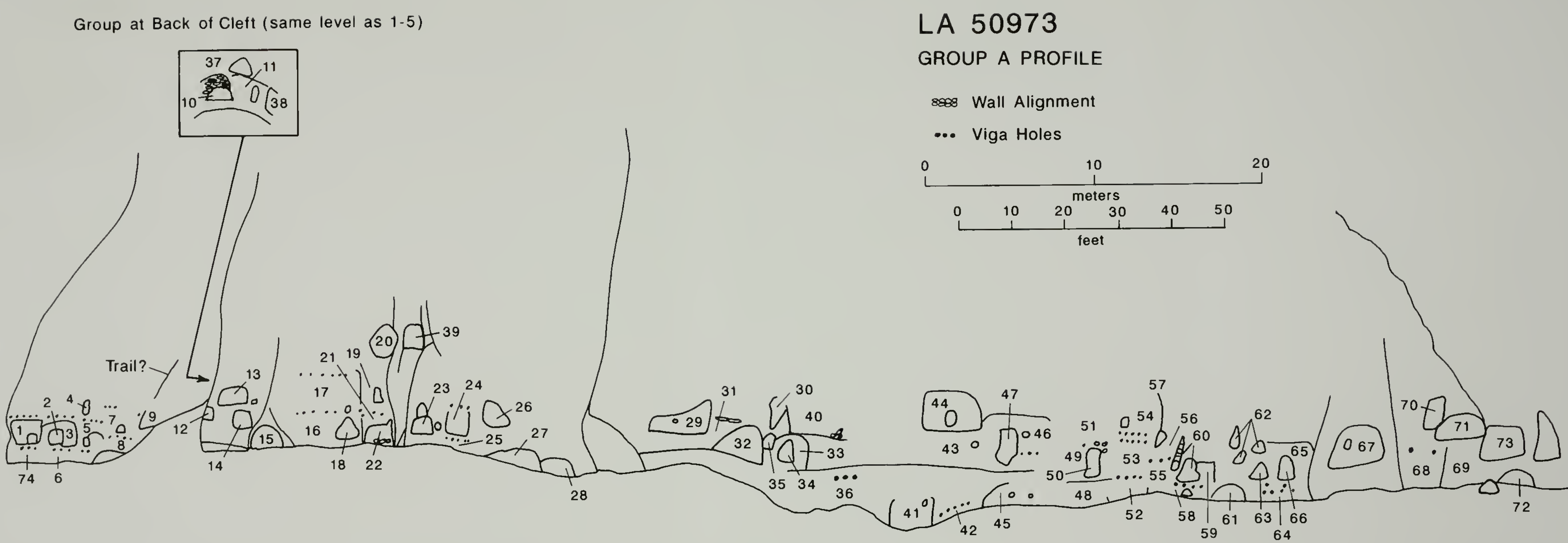


Figure 2.6. *Elevation sketch for the Group A sample. Drawn from field sketches and photos in 1986: scale approximate (straight-line distance from Cavate 1 to Cavate 73 is approximately 93 m).*

group. The USGS contours are quite confusing here. While converging contours are to be expected given the size of the cliffs, the fashion in which they converge here is enigmatic. Group A, as noted, is located in a relatively wide spot in the canyon. This fact is suggested by the contours, but the 6200 and 6300 foot lines converge just below A and show a much broader bench than appears to exist 200 ft (60 m) above the Rito. While the cavate symbols seem to be properly placed horizontally (there are three for all of Group A), the contours seem wrong, and the altimeter supports our disagreement with the contours. Therefore, we chose 6210 ft (1893 m) as an elevation for Group A and estimated the variations from that baseline.

The tuff at the base of the cliff is more variable in a shorter vertical section in the area of Group A than in any other area in which we worked. There are several layers that differ in color, texture, and durability, including a crumbly gray unit containing quantities of black rock, a coarse-grained but fairly compact white layer, a brownish layer, and the gray-white finer texture seen commonly elsewhere in Frijoles cavates. All of these units intersect the structural parts of Group A.

The portion of Group A that we recorded extends from the uppermost rooms about halfway through the group. The upper end of the group is quite well defined. There is a steep, deep cut in the canyon wall at the upper end of the wide area in the canyon, which contains several pockets well up the cliff. These could have contained rooms but do not appear to have had any, and no further rooms seem to exist between upper Group A and Ceremonial Cave (however, a thorough examination has not been made). The lower end of our study in Group A was defined more by the exigency of field time than by natural breaks within the group. Since the sample of Group A was small relative to the group and we had an extra day and a half at the end of the field season, the naturally defined subgroup extending to A-36 was expanded to A-73.

Our count of 130 rooms showing in some way on the cliff includes 40 rooms recorded in detail in July 1986 and 90 rooms below that stopping point. (The latter figure is based on three counts giving 90, 92, and 81; the count of 81 was made from a point well away from the cliff, from which vantage point many low rooms are not easily visible.) Usually the process of detailed recording revealed more rooms than were recorded with careful but necessarily more superficial counts, and this has a minor effect on the relative positions recorded for some cavates. The overall area of the rooms recorded is about 95 m along the cliff by 20 m, allowing for recesses in the cliff and rubble areas. It is not entirely clear whether the base of the cliff in Group A had a continuous structure along it or whether there were separations between structures. Rows of viga holes directly above one another show that major remodeling did take place in the masonry rooms of Group A, which makes determination of the presence of continuous built structure even more difficult. Whether or not the building was at some time continuous, most of the cliff did have some structure placed against it. The amount of building rubble now visible varies considerably along the base of the cliff, with greater quantities present in recessed areas in the cliff. The total number of rooms is probably more than twice the number visible on the cliff. Considered as a site, then, Group A was probably at least as big--and as long--as Long House and was probably comparable to Group M. Particularly at the lower end, but elsewhere as well, much of the site was multiple stories; in some places it was at least two, and quite often four. Its location near the canyon floor probably made it easier to erect taller structures here than on higher, steeper talus slopes at other cavate groups.

Several other archaeological features are present in the vicinity of Group A. The most notable is a masonry-lined kiva below the approximate center of the group. This structure is shown on the Hewett-Chapman map and remains distinctly visible, which indicates that it has probably been at least partially excavated, though Park Archaeologist Bill Sweetland says there is no record of such an excavation (personal communication, 1986). Visible structural remains are otherwise scarce on the relatively flat canyon bottom below the group. This absence of structures is probably related to the conservation of watered bottomland for crops, though the presence of a low terrace would have required a substantial ditch to irrigate much of this part of the canyon; pot irrigation would certainly be easier here than in most of the Southwest. On the first ledge above the base of the cliff are several petroglyphs. We did not venture up, but the ledge looks large enough to have had some structures on it. Two constructed routes seem to extend at least as far up as the ledge at the upper end of the room group (vicinity of rooms A-9 and A-10). Routes to the canyon rim above this ledge as well as slightly up-canyon are suspected, but none of these has been actually climbed. The only other known recorded archaeological work at Group A is the repairs made by Lister in 1939 (Lister 1940a).

Considering the size of Group A, there seems to be remarkably little trash present on the surface. Some of the other groups have steep slopes below them, which may accelerate removal of trash by washing, but this is less a problem at Group A. Based on casual observation and McKenna's more systematic study, Group M has more trash on the slope below it than does Group A. Lower visibility due to the denser vegetation of Group A is probably one reason for this, but a more important one is its heavier tourist traffic. Excavated tests of trash quantities (and qualities) at any of the cavate groups would be of considerable interest.

This area has been closed to visitation for some time (Sweetland, personal communication, 1986). Nonetheless, Group A seems to have more graffiti than any of the other groups in which we worked, including Tsankawi, which receives heavier, unsupervised visitation. Group A clearly has visitors and has had them for a long time. Our presence there may have reduced illicit visits, but in the five or so days we spent recording there, we saw only two young boys going up to the rooms (they never saw us). It seems unlikely that the current level of visitation will lead to degradation of deposits, though it will continue to wear away at the structures. Further public education concerning the fragility of these resources and more frequent passes by rangers going to and from Ceremonial Cave might help reduce this source of erosion. Perhaps the discreet placement of a rain shelter somewhere in the area would cut emergency visits by walkers caught far from the Visitor Center in summer storms.

Natural deterioration at this group takes several forms. The most widespread results from the very friable nature of the lowest tuff unit in several parts of the Group (around A-1-A-9, A-23-A-29, and A-50-A-58, for example). This tuff erodes much faster than does the overlying stratum, and it forms the back wall to many rooms in the first visible story, as well as a possible, speculative story below that. The fact that it undercuts also threatens features in upper tuff levels, though this does not seem to be an imminent threat. Recent slumping of large tuff blocks has occurred in several places, most notably at A-72, parts of which seem to have fallen quite recently, and in front of A-15. In several places erosion and cliff deterioration seem liable to cause loss of features; this is true of the high rooms A-20 and A-39, where doors are very exposed and are becoming quite thin. A more severe loss could occur in rooms A-22 and perhaps A-18, which are connected, complete rooms. The front wall of A-22 is supported by a very fragile-looking pillar, and loss of much of the front wall is conceivable. This condition might be relieved by repair or replacement of the masonry wall that appears to have been present there prehistorically. This course would involve at least partial excavation on both sides of the wall.

Finally, there are three rooms with masonry closing portions of their fronts: A-10, A-13, and A-60, all of which were pointed by Lister in 1939. The small doorjamb in A-13 looks just as it did in 1939, and A-60 seems to be in reasonably good shape (Figures 2.7, 2.8). A-10 appears to be something of a miracle: a large piece of masonry appears to be supported mostly by fit and pressure; most of the wall has no foundation and forms a sort of arch (Figure 2.9). Even more remarkable is the location of the room at the back of a large pour-off, which looks as though it should have washed the whole thing away long ago. An area in the middle of the wall now lacks mortar; at least pointing, and perhaps detailed recording, seems to be indicated here. The rooms along the side of the A-10 drainage cut (A-9, A-11, A-12) are severely eroded.

In summary, the distinguishing characteristics of Group A are its proximity to the stream, its length, the presence of much rubble, an associated round masonry kiva in the flat area in front of the group, and highly variable tuff strata.

Frijoles Group F, LA 50975 (field no. LA 50023)

Of the groups recorded in 1986, Group F is central; it lies between Tyuonyi--of which it has a splendid overview--and the "Big Kiva." It also seems to have the most varied topography of the groups we studied, since it includes two large tent rocks and covers a considerable range in elevation (Figures 2.10, 2.11). The portion in which we worked may be considered the lower part in two senses--it is at the downstream end of the group and it is closer to the canyon floor. The area studied extends from a small, naturally sculpted arch at the upper end (this may well have been a room but was not recorded as such because it lacks features) along a stretch of relatively low cliff base behind two large tent rocks to just up the slope in the large embayment containing Group G. The tent rocks have remnants of rooms around their bases, and these rooms were included in the group both by Chapman and by our crew. The rooms from which data were collected can be contained in a trapezoid with a base of about 48 m along the cliff base, a height of 17 m from the cliff to the front of the tent rocks, and a top of about 20 m across the front of the tent rocks. The upper part of Group F is located on higher cliff bases and steeper slopes; we counted 46 rooms in this part of the group.[1] We recorded 48 rooms along the cliff base and 12 rooms around the tent rocks, so that the total number of cliff-associated rooms for Group F is 106. In counting rooms up- and down-canyon from specific rooms, the tent rock rooms were not included. Remnants of intact masonry exist, especially in the unrecorded part of the group; considering the centrality of this group both to Tyuonyi and to tourism, the rooms in this group seem to be in surprisingly good shape.

Below where it levels out (at about F-15), the part of Group F that we studied has a great deal of masonry rubble associated with it. This segment of the group appears to be better suited to building than the upper part because of less slope. Approximately in the middle of our study group (rooms F-19-F-30), there may have been as many as six stories against the cliff (Figure 2.11), and considerable rubble remains in this area. Four cliff levels are clearly visible here, with a fifth suggested by a depression in the cliff above the uppermost. In addition, the viga holes for the lowest visible story are close to the present ground surface, which is the top of a considerable mound, leaving the possibility of yet another, invisible story at the base. This area shows evidence of a considerable expenditure of human energy, in the form of room remodelings, hand-and-toe hold trails, and large petroglyphs. There appear to have been retaining walls made of large blocks between the tent rocks. Terraces may also have been constructed at the extreme downstream end of the group, where the talus becomes quite steep

Figure 2.7. *Comparison photographs for A-13, showing little change during 47 years. a, b. Before- and after-stabilization photographs taken by Lister in 1939. c. Photograph of A-13 taken in August 1986. Note the similarity of plaster and masonry condition; somewhat greater wear is probably present at the lower left of the opening, and there may be additional graffiti on the plaster of A-14 below the lower right of the opening.*

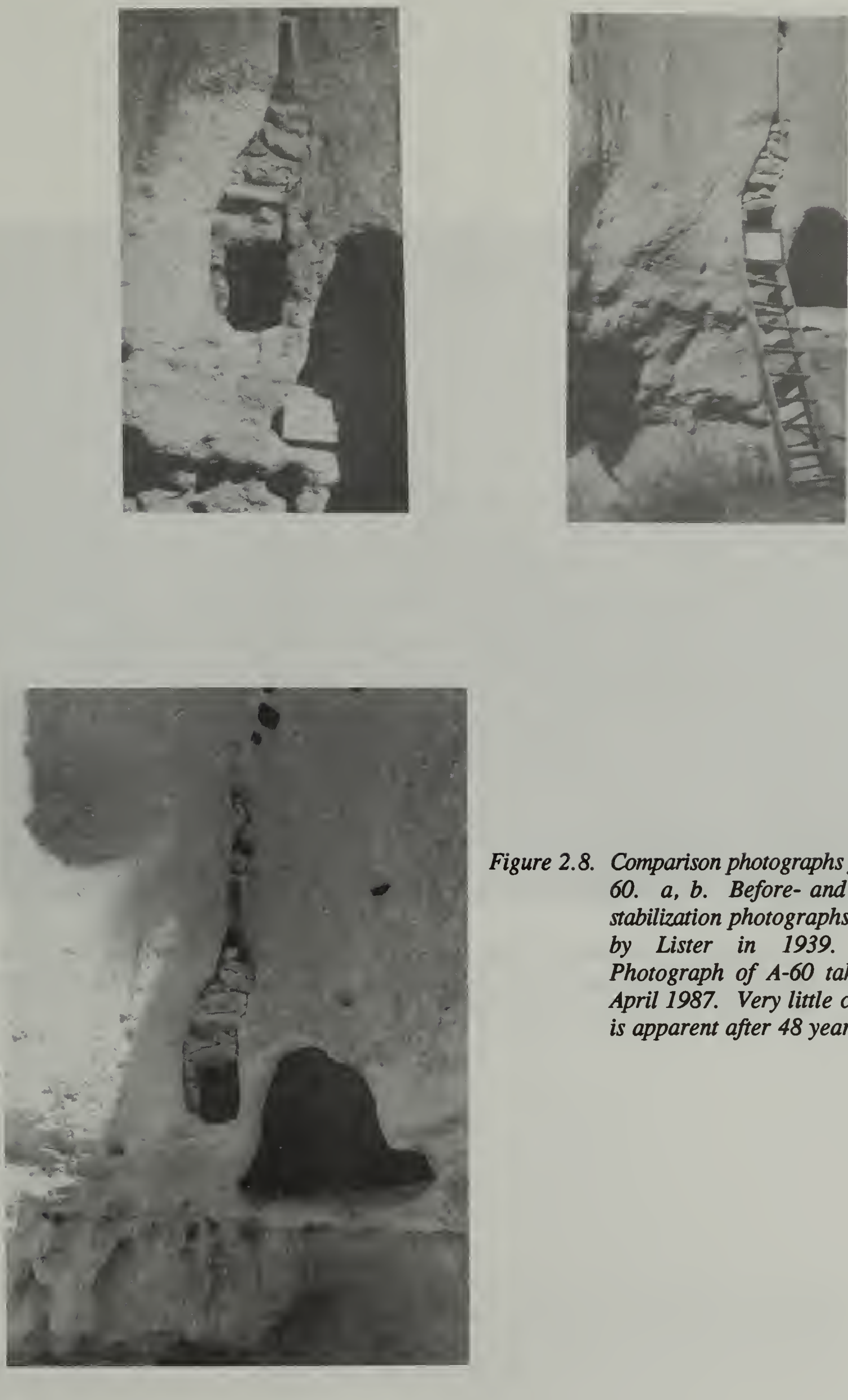
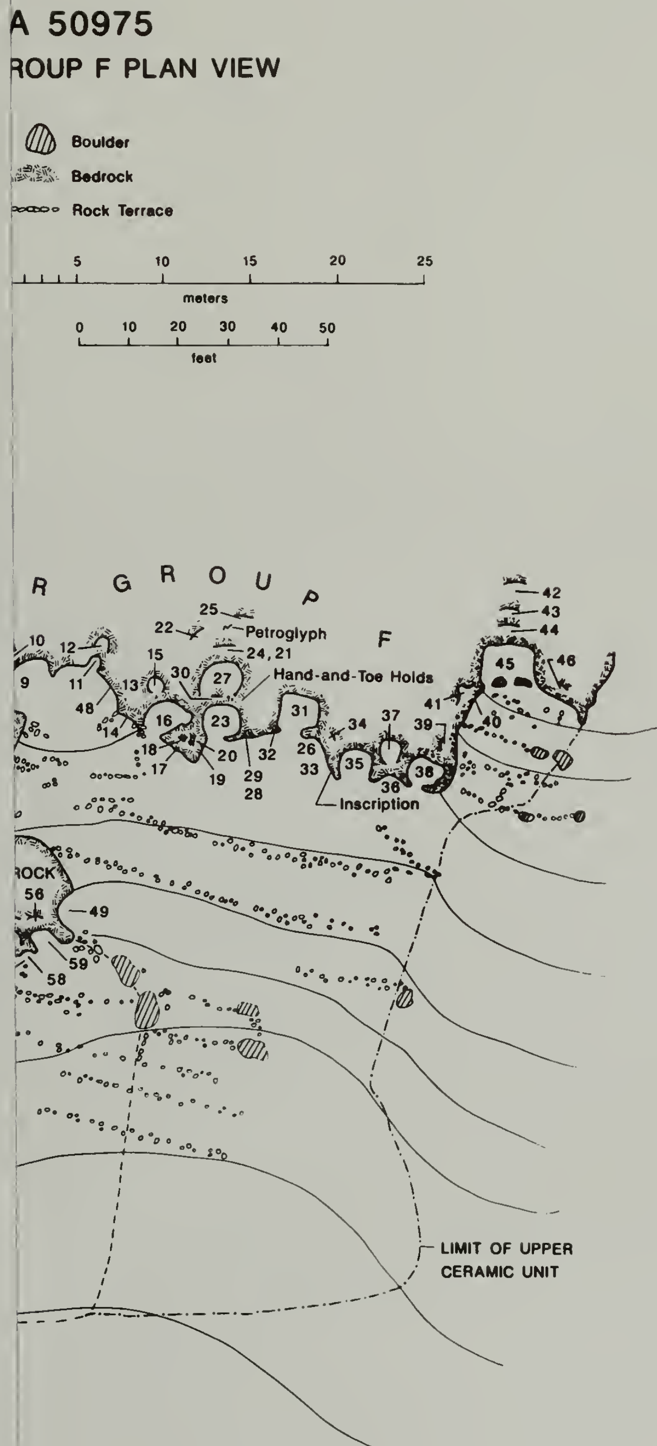


Figure 2.8. Comparison photographs for A-60. a, b. Before- and after-stabilization photographs taken by Lister in 1939. c. Photograph of A-60 taken in April 1987. Very little change is apparent after 48 years.

Figure 2.9. *Photograph of A-10 taken in 1986. Lister did stabilization work on A-10 but did not include a photo in his report. It is remarkable that the masonry of this room, located at the head of a drainage, has survived.*



sample. Shows Group F divided into upper and lower the rooms in lower Group F. Upper Group F has four ibers shown for Lower Group F are those used in this in 1990 by J. Snead.

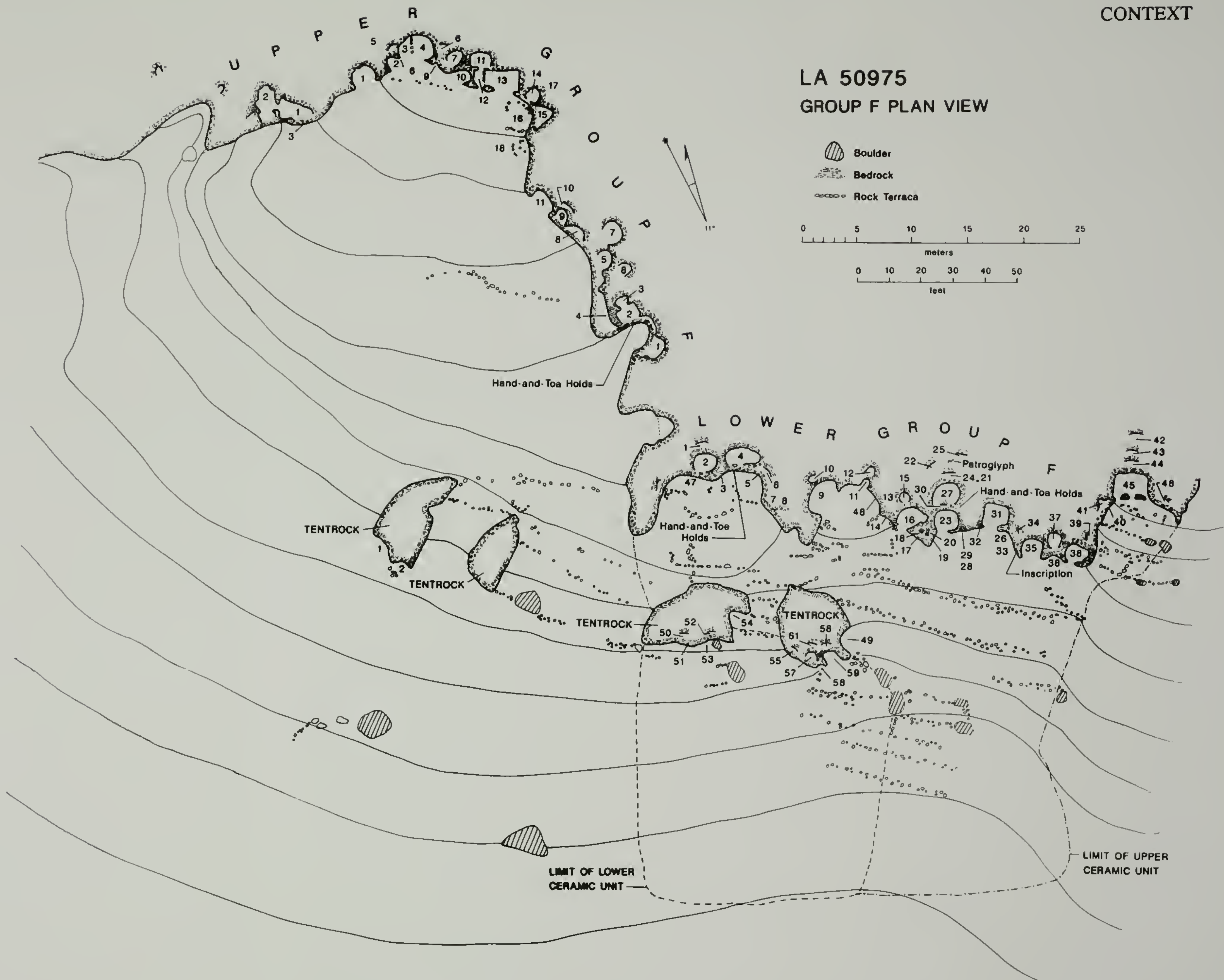


Figure 2.10. *Room plan view for the Group F sample. Shows Group F divided into upper and lower parts; this project recorded only the rooms in lower Group F. Upper Group F has four sets of room numbers; the numbers shown for Lower Group F are those used in this study. Redrawn with an alidade in 1990 by J. Snead.*

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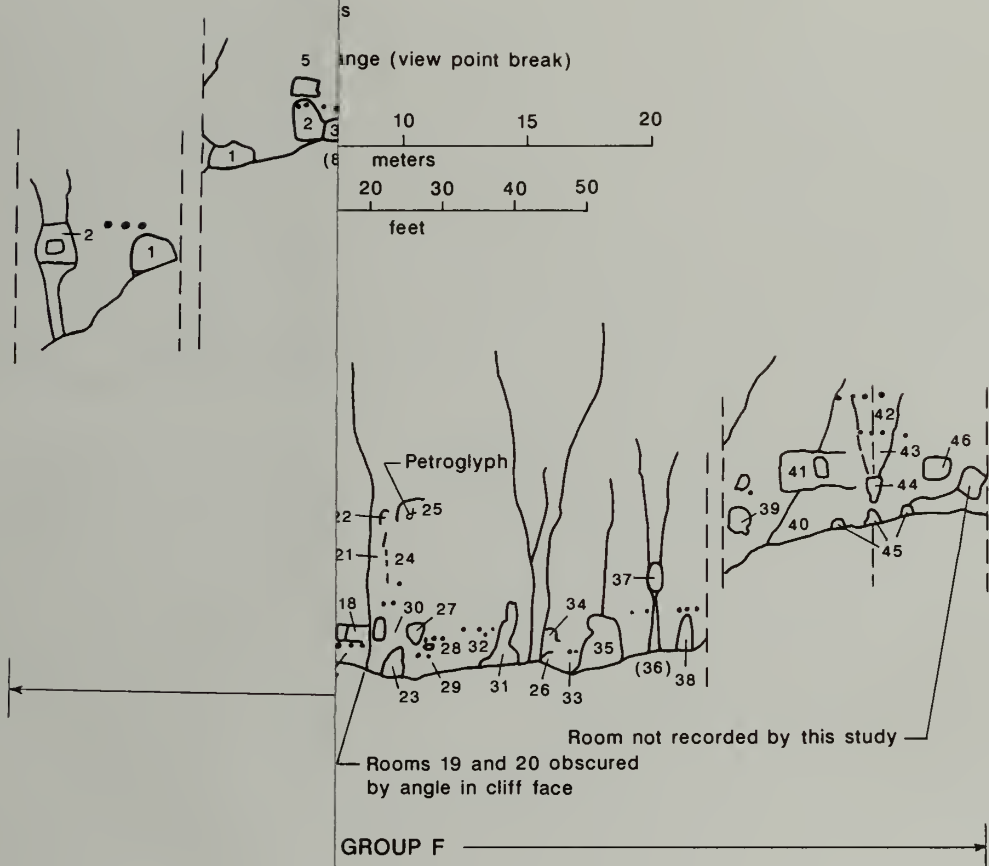
'ROFILE



sample. Shows Group F divided into upper and lower he rooms in lower Group F. Changes in cliff angle are es. Tent rocks with their cavate rooms are not shown. nd H. Newman.

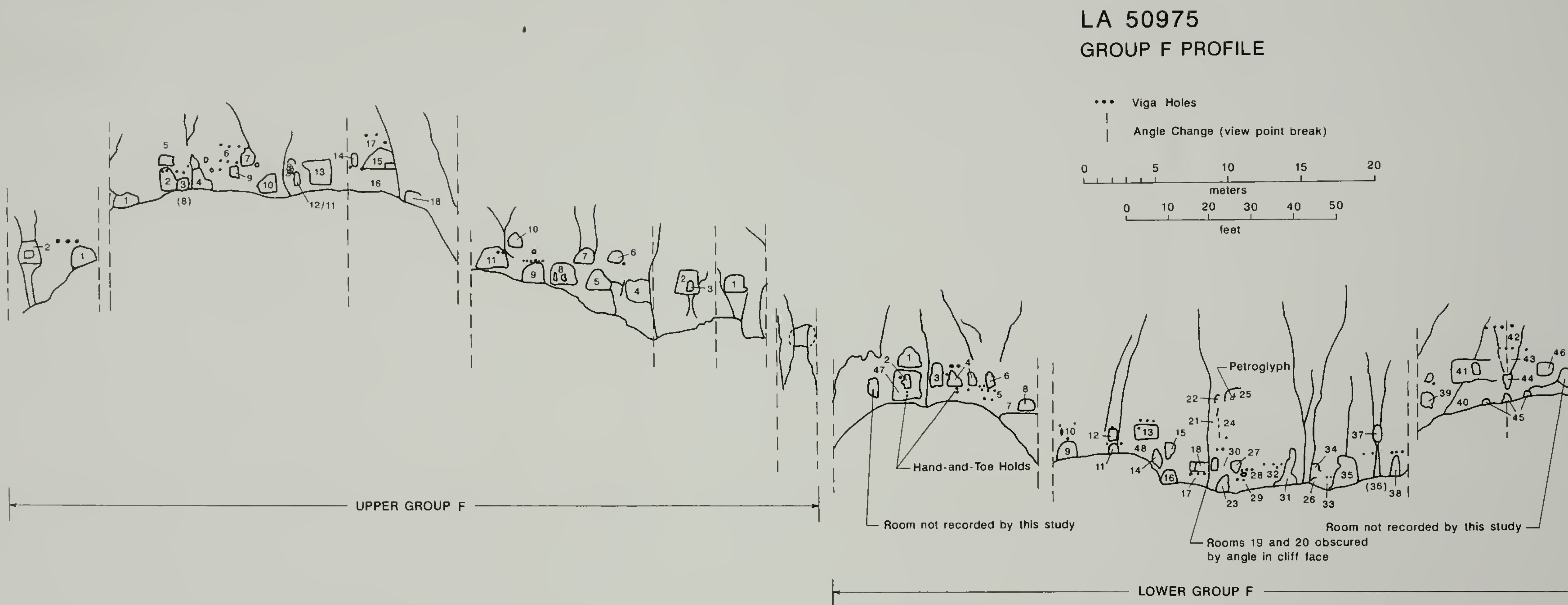


Figure 2.11. *Elevation sketch for the Group F sample. Shows Group F divided into upper and lower parts; this project recorded only the rooms in lower Group F. Changes in cliff angle are indicated by vertical dashed lines. Tent rocks with their cavate rooms are not shown. Redrawn in 1990, by J. Snead and H. Newman.*

as the cliff turns a corner into the recessed area containing the last few rooms of Group F (F-39-F-46) and then Group G. As at Groups A, I, and M, the distribution of rooms along the cliff base would have been very nearly continuous, though numbers of levels would have varied considerably. Especially above our study area, this distribution was accomplished in some places by heroic (if incomprehensible) room placements in drainages, in pour-offs, and on steeply inclined cliff bases.

The elevations recorded for Group F rooms are based on an altimeter reading of 6160 ft (1878 m) at the center of the sample. The quadrangle.in this area suggests 6180-6200 ft (1884-1890 m); the 6200 and 6300 foot contour lines are merged in this area. The 6160 ft (1878 m) reading has been used as a baseline with some elevation added for the ends of the study group and some subtracted for the tent rock rooms. The elevations, once again, are approximate. The elevation of the Rito opposite Group F is about 6080 ft (1853 m).

To my knowledge there are no records of excavation in Group F. Lister (1940a) did some stabilization in several Group F cavates, which we rephotographed (Figures 2.12, 2.13). Several of the walls he worked on have since collapsed. The proximity of these rooms to Tyuonyi and their ease of access makes it quite likely that they were among those used by field school students and earlier explorers, such as Bandelier. Indeed, in the vicinity of F-20, a row of nails has been driven into the cliff, presumably for clothes hooks. The old tourist trail passes below the Group F rooms, but not far below them.

Frijoles Group I, LA 50974
(field no. LA 50022)

Located at the top of a relatively steep and high talus, Group I is a compact group of rooms fronted by a reasonably level area around 10 m wide (Figure 2.3, 2.14, 2.15). The main group of contiguous rooms is 29 m long (rooms I-7-I-35). At the upper end of the group are six rooms located above a precipitous drainage (I-1-I-6). Most of these rooms are lower than the main group and face more directly east. The lower end of the group is defined by a rockfall consisting mostly of very large boulders. Six rooms were partially obscured by part of this rockfall (I-30-I-35), and it seems likely that the event occurred after the construction, and probably after the abandonment, of the rooms. In addition, three rooms stand almost exactly midway between Groups I and J. It is not entirely clear whether Hewett and Chapman included the sole complete one (I-36) on their map, and since they are slightly closer to Group I, we included them in our version of Group I. (The intact room, I-36, is the lowest of the three and is 18.2 m from I-35 and 16.8 m from the highest Group J chamber). By our count, then, 38 rooms can be seen on the cliff in Group I. All the rooms were recorded except I-15, a small, third-level chamber we were unable to reach. Other rooms may exist at the same level as I-15, but our inspection of some of these possibilities showed them to have no definable features and to be too ambiguous to be recorded as rooms.

The flat area in front of the center of Group I has a considerable amount of rubble on it. There may have been two rows of masonry rooms in front of the cliff rooms. In the area of I-24, I-25, and I-27, the cliff rooms are three levels high, with the bottom level substantially filled. These filled rooms may have well-preserved floor features.

By altimeter the elevation of the center of Group I is 6240-6250 ft (1902-1905 m). The map location is once again confusing. Converging contours are shown below the symbol that corresponds to Group I. This indicates a sharper, higher drop than is the case and suggests an elevation of around 6320 ft (1926 m). We used a baseline of 6250 ft (1905 m) for the records; with the exception of I-1-I-4

Figure 2.12. *Comparison photographs for F-31. a, b. Before- and after-stabilization photographs taken by Lister in 1939. c. Photograph of F-31 taken in July 1986. There has clearly been a dramatic change since Lister stabilized this feature. In addition to the collapse of the entire masonry fissure closure, the viga hole at each figure's shoulder is broken away in the 1986 photograph, suggesting that vandalism may be involved. Note the lintel stone in the precollapse photographs and the groove left after its removal.*

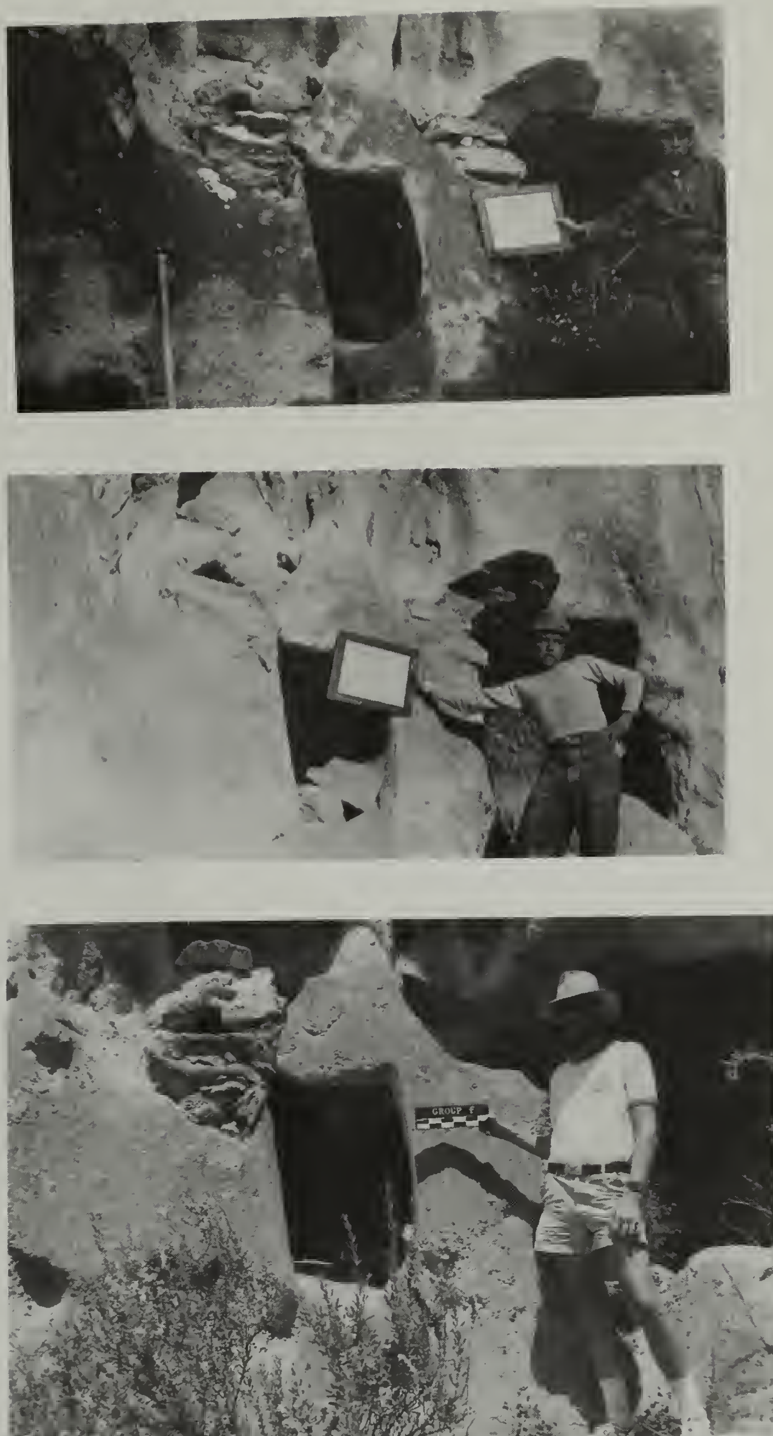


Figure 2.13. *Upper Group F, Room 12, a room not recorded by this project, as it appeared in 1939 and 1986. a, b. Before- and after-stabilization photographs taken by Lister in 1939. c. Photograph of the same cavate taken in July 1986. Note that the masonry plug to the right of the door is now gone and that the mortar has returned to its prestabilization state.*

ɔt all rooms are shown on the plan: some appear only , 21, and 29 are back walls and not shown). Redrawn lead and A. Prieto.

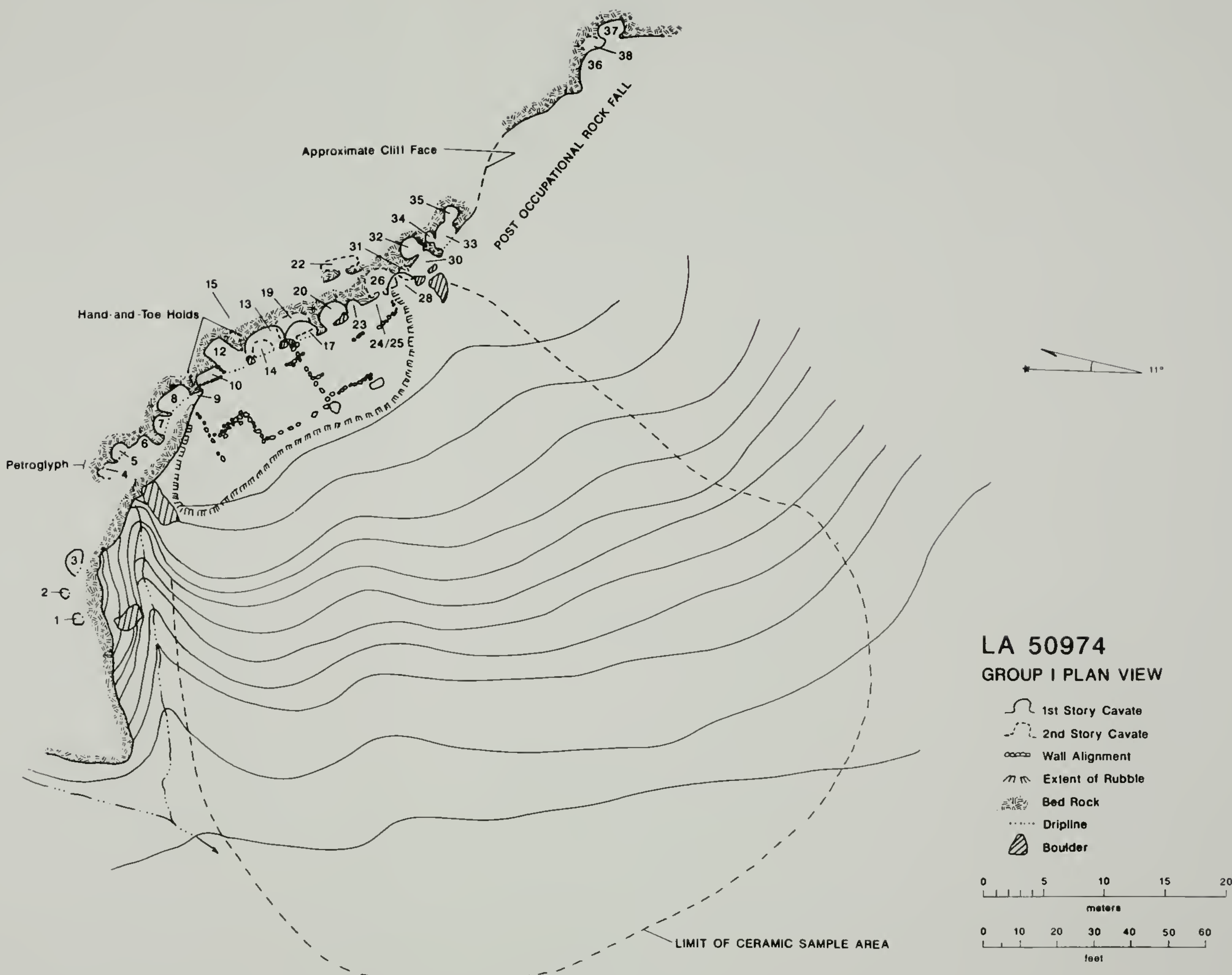
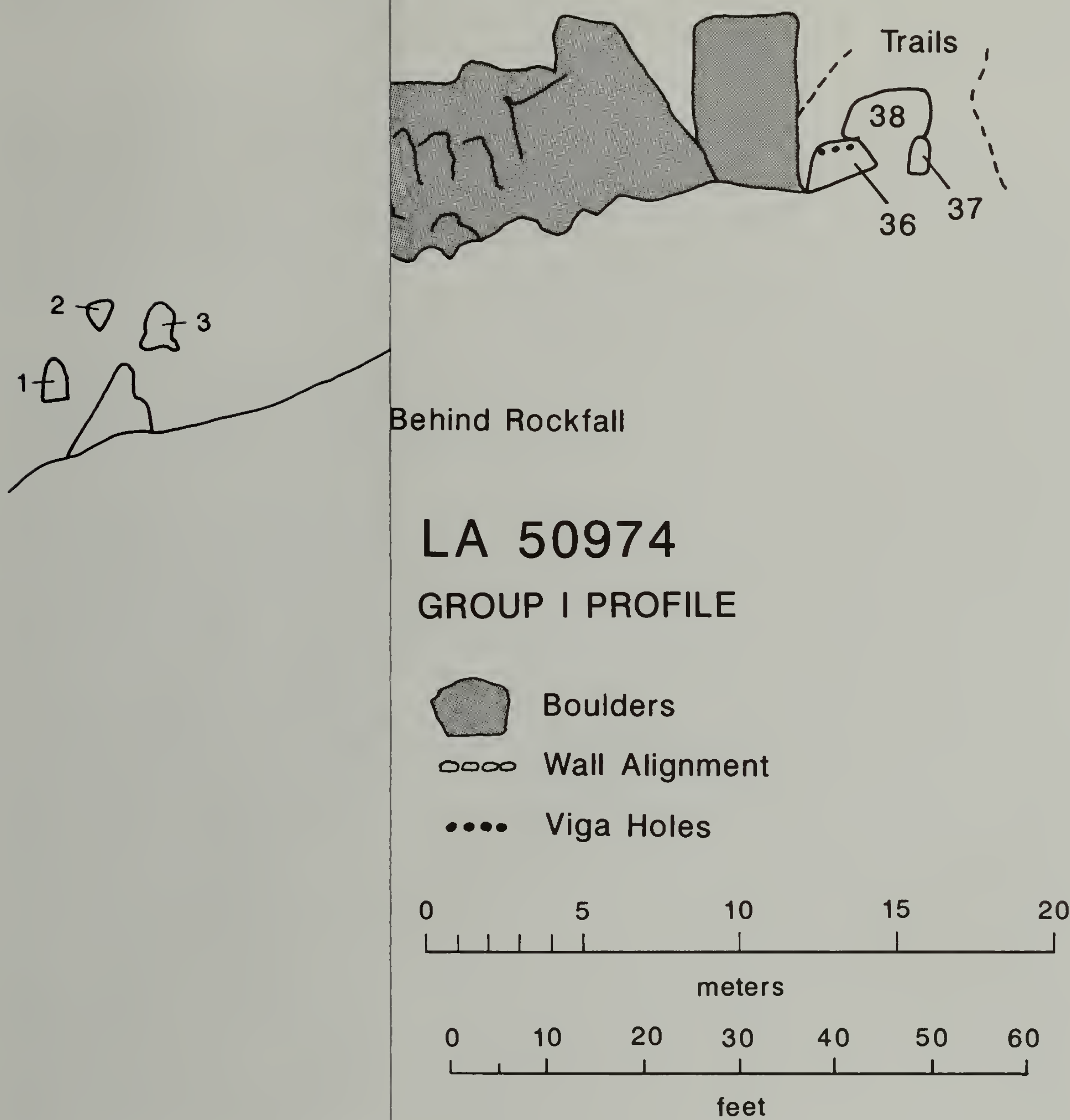


Figure 2.14. *Room plan view for Group I. Not all rooms are shown on the plan: some appear only in the elevation (Rooms 11, 16, 18, 21, and 29 are back walls and not shown). Redrawn using an alidade in 1990 by G. Head and A. Prieto.*



edrawn in 1990 by G. Head and A. Prieto.

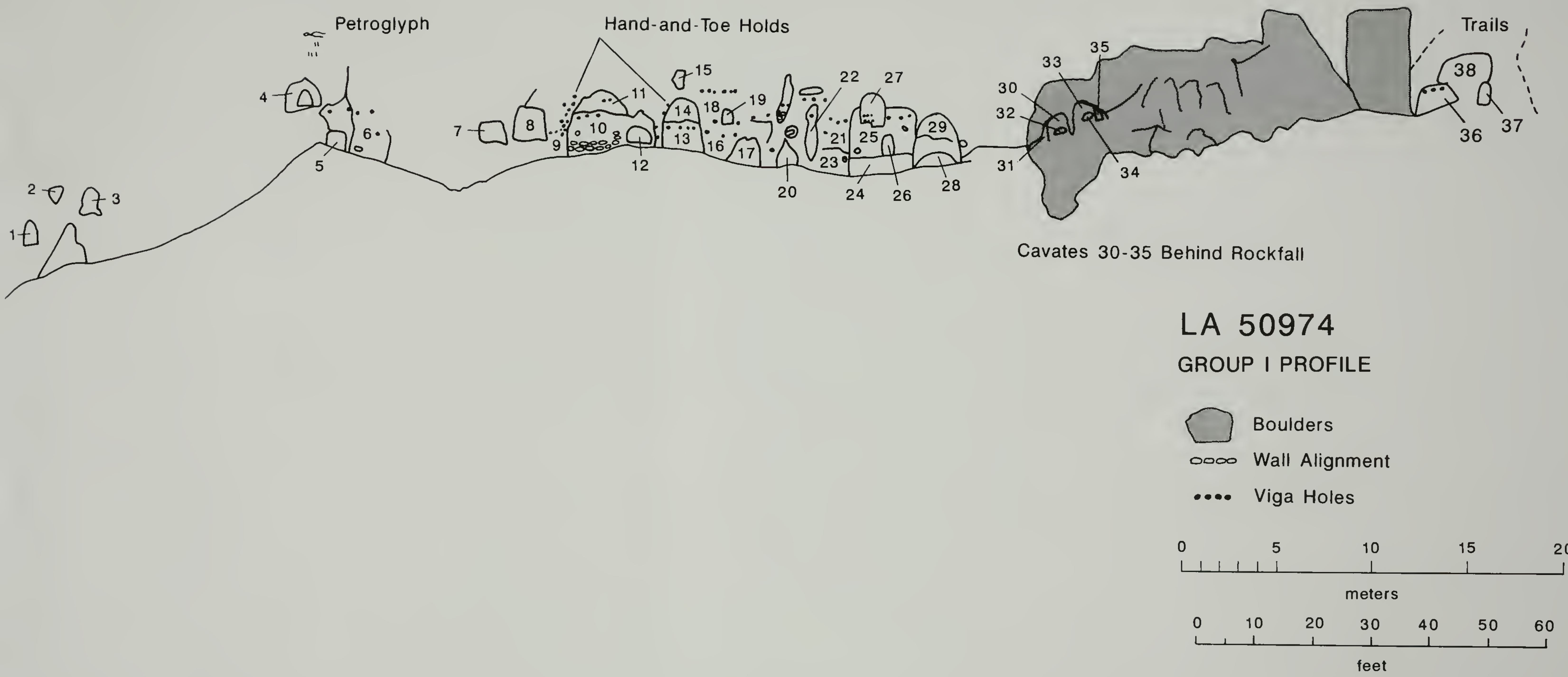


Figure 2.15. Elevation sketch for Group I. Redrawn in 1990 by G. Head and A. Prieto.

and a few third-level rooms, the rooms in Group I are at about the same level. The elevation of the Rito de los Frijoles below Group I is about 6100 ft (1859 m).

Trash is present on the slopes below the rooms, but as at Group M the quantity is fairly small. The length and steepness of the slope must again be considered, in addition to the possibilities of disposal elsewhere or in the rooms. Few artifacts are to be found on the surface of the masonry rooms or in the cavate rooms.

Known previous work in Group I is limited to some stabilization done by Lister in 1939 (1940a). Group I has several extant blocks of masonry, and he replaced mortar in some of these (including I-10 and I-22; Figure 2.16). Lister's photos of I-22 show that a ventlike hole was completely blocked in 1939 but is now only about half blocked (Figure 2.16). The Civilian Conservation Corps (CCC) trail passes considerably below the group. The climb to Group I seems to be arduous enough to discourage visitors, so that recent impacts are much less than at Group A. The graffiti here are about as numerous as at Group M or perhaps slightly more so. Deterioration in central Group I seems not to be severe, but the ends have suffered more damage. The upper end in particular, which is located above steep slopes and presumably lost the protection of masonry fronts early, is severely weathered. Although some damage must have resulted from the rockfall at the lower end of the contiguous rooms, burial by rockfall may have had the net effect of preserving the lower parts of these rooms.

There are two sets of hand-and-toe holds within Group I suggesting routes to the canyon rim. The first of these begins at around the middle of the group (above I-27) and probably relied on rooftops as a starting place (Figure 2.15). The second route is in the drainage in which the three isolated rooms (I-36-I-38) are located. There is a set of holds on each side of the rooms, leading to a bench and apparently on to the rim. Neither route was empirically tested. Other cliff features include sizable petroglyph panels at both ends of the contiguous cavates, a high petroglyph above I-4, and one above I-35.

Frijoles Group M, LA 50972
(field no. LA 50020)

Group M lies at the down-canyon extreme of concentrated sites of all types in Frijoles Canyon. The group is a long, fairly continuous set of cliff and masonry rooms above a sizable talus. The talus is neither so steep nor so high as that at Group I (Figure 2.4, 2.17, 2.18). In terms of overall length and number of rooms, Group M is probably the largest group in which we worked in 1986, though Group A is in many ways comparable. Kohler estimates Group M to have had more than 200 rooms between A.D. 1325 and 1375 (Kohler and Linse 1993:5), but Group M surface ceramics analyzed by the Bandelier Survey indicate that substantial occupation before 1450 is unlikely (Robert Powers, personal communication, 1994). Rainbow House (LA 217), a 50-60 room pueblo dating to the fifteenth century (see Table 2.2 at the end of this chapter; Caywood 1966), is directly below Group M and clearly visible from it. Some relationship is very likely to have existed between the two. Even closer to Group M is Saltbush Pueblo (LA 4997), an 11 room structure with a single pit structure. In terms of both architecture and ceramics, Saltbush Pueblo fits well into the Coalition Period, and the few absolute dates obtained fall in the thirteenth century (Snow 1974). David Snow suggests that occupation and construction of Group M took place during the latter stages of occupation of Saltbush Pueblo. His report compares the relatively low diversity of the faunal assemblage from Saltbush Pueblo (11 species) to the somewhat richer (14 species), very late Group M assemblage from Hendron's excavation, and to the very rich (23 species) Rainbow House assemblage. These three assemblages have little or no temporal overlap.

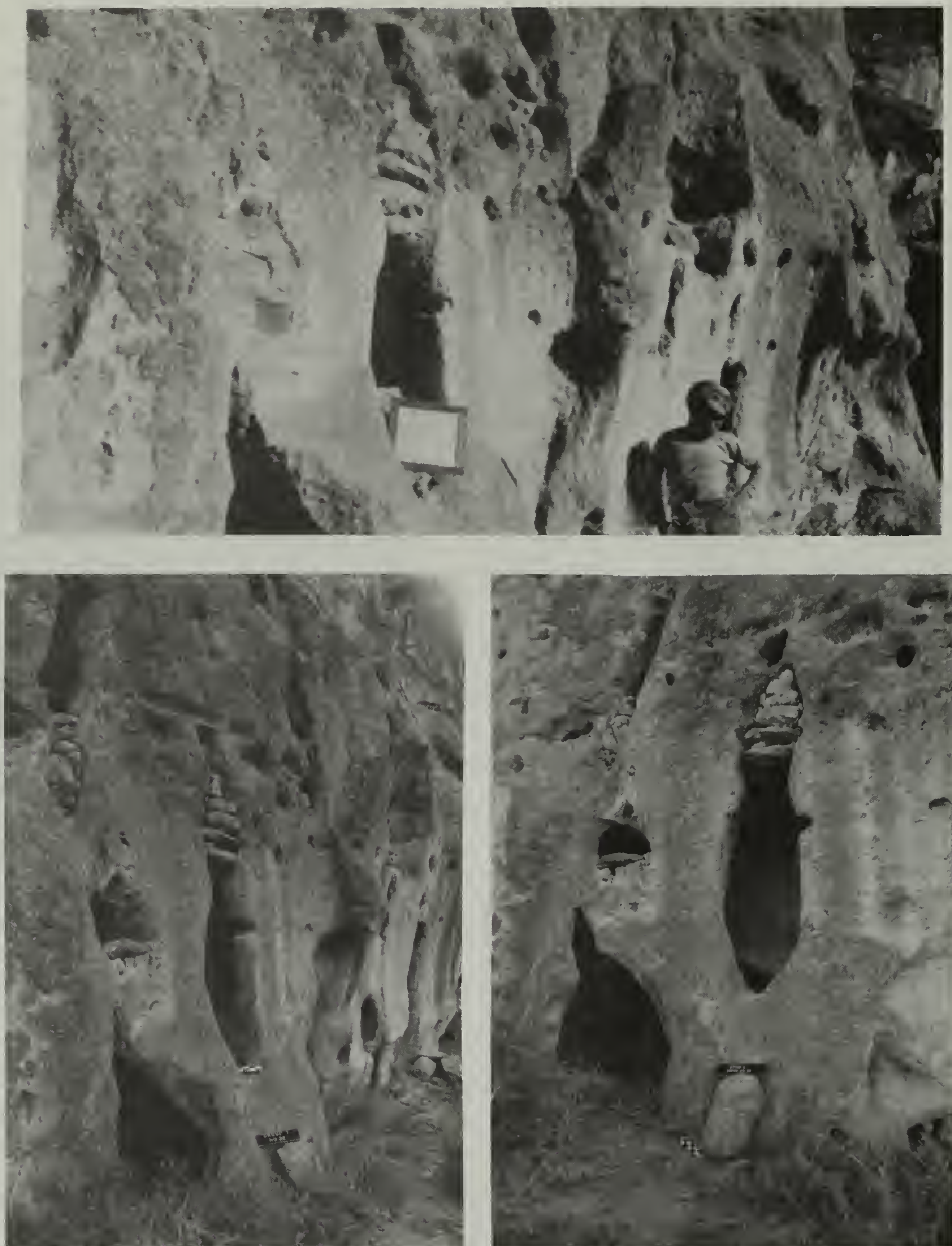


Figure 2.16. *Comparison photographs for I-22. a. After-stabilization photo taken by Lister in 1939. b, c. Two views of the door to I-22 and the opening to I-20, taken in 1986. Note again the lintel groove in the door; apparently the vent to the left of the door was completely closed in 1939, but most of the masonry is now missing. Much of the 1939 mortar is now gone, but the masonry above the door remains. The room may have had more fill in 1939 than at present; other change appears to be minimal.*

Figure 2.17. *Plan view for the Group M sample. Upper Group M; cavates continue down canyon (to the right). Redrawn in 1991 by K. Barthuli, J. Vint, and W. Bustard using an alidade.*

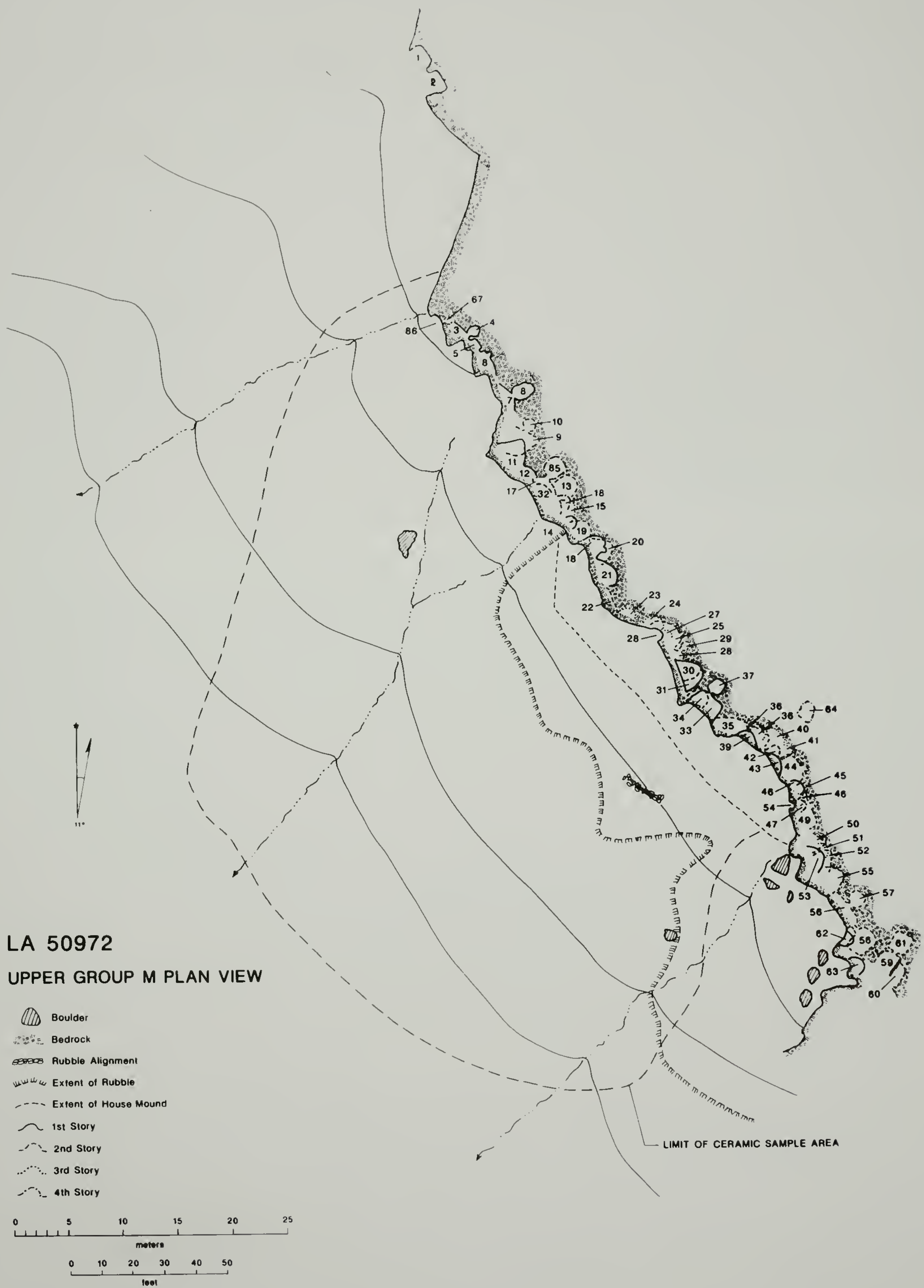
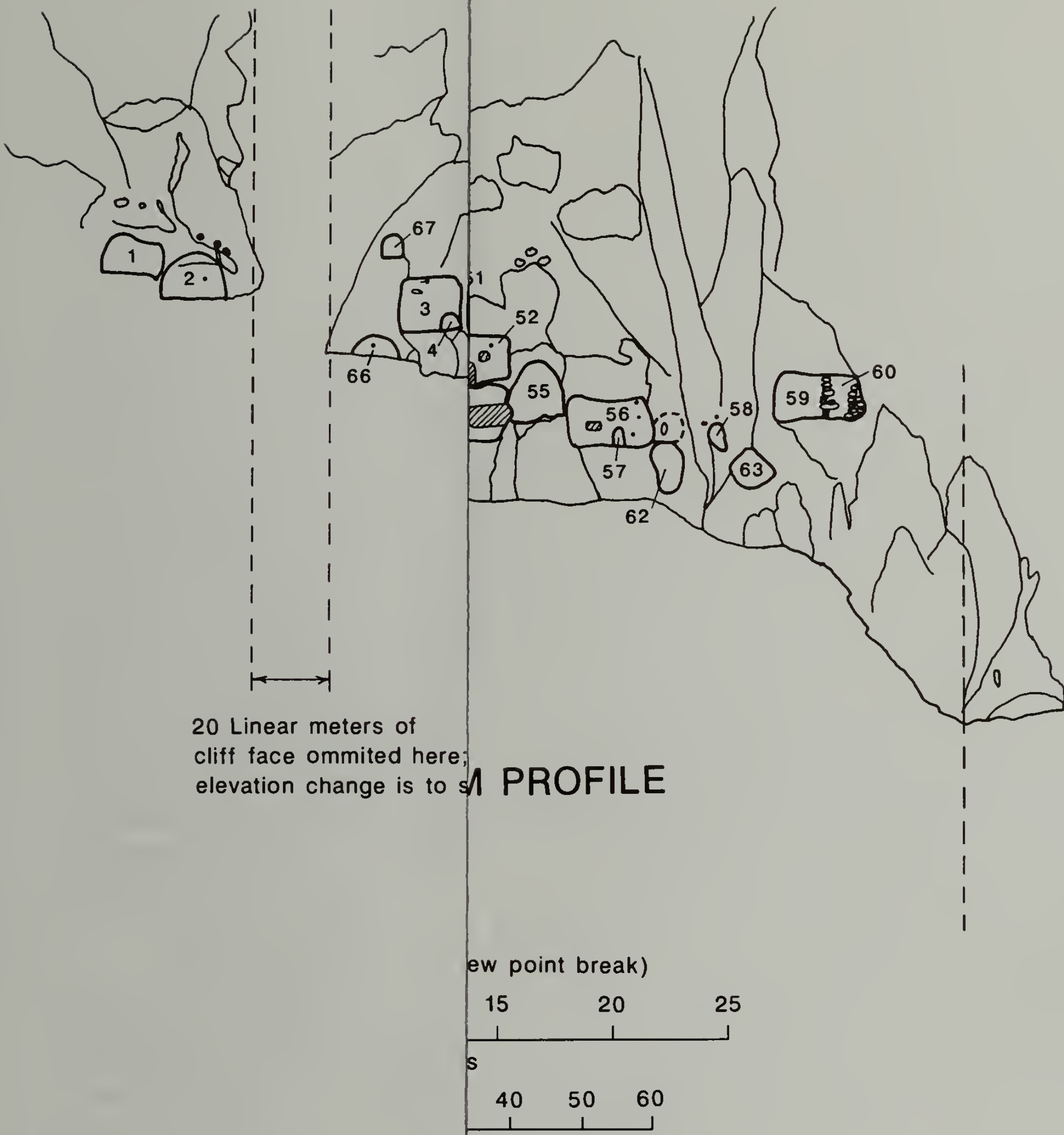


Figure 2.17. *Plan view for the Group M sample. Upper Group M; cavates continue down canyon (to the right). Redrawn in 1991 by K. Barthuli, J. Vint, and W. Bustard using an alidade.*



sample. Upper Group M with vertical dashed lines Rooms 10, 61, and 65 are back chambers not visible group. Possible rooms (not recorded) are indicated 1991 by K. Barthuli and S. Hall.

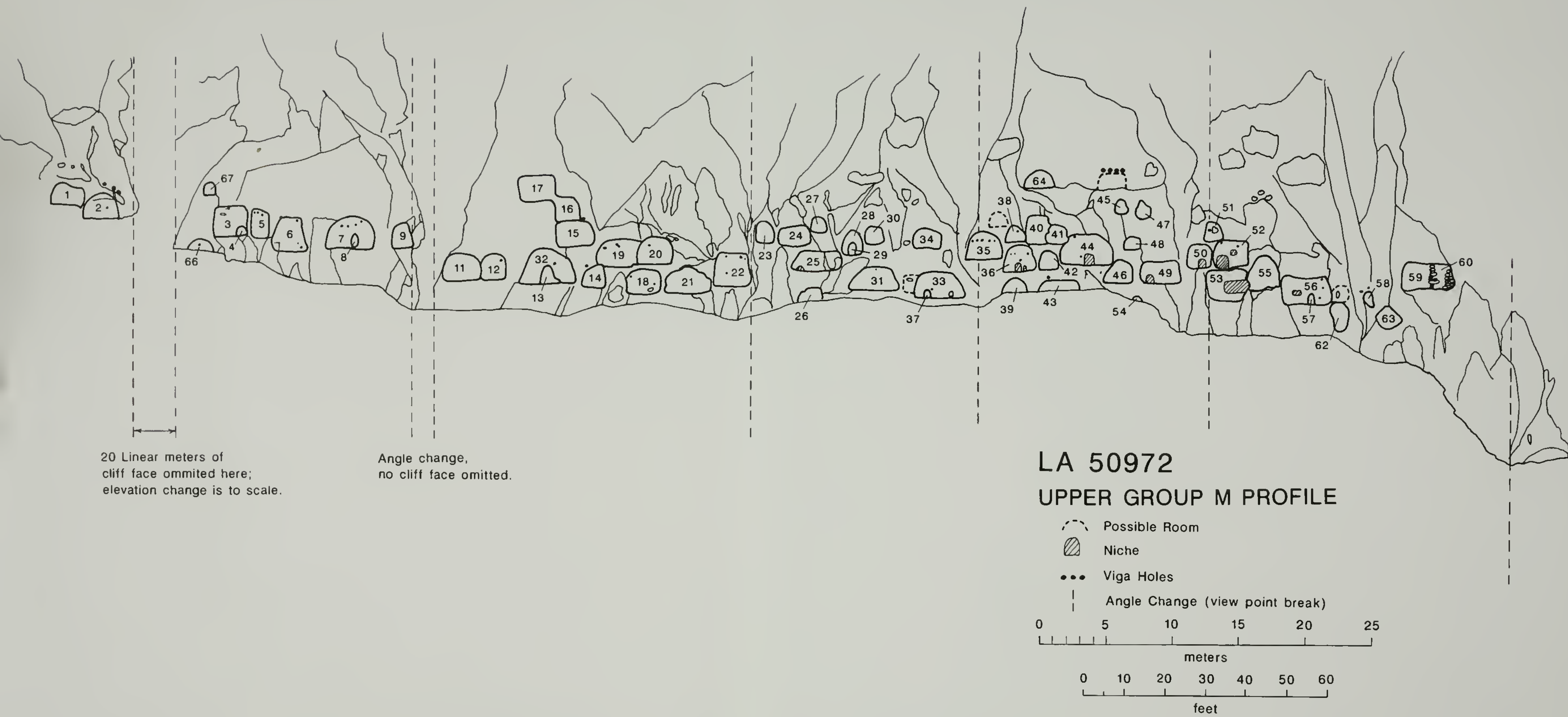


Figure 2.18. *Elevation sketch for the Group M sample. Upper Group M with vertical dashed lines showing changes in cliff angle. Rooms 10, 61, and 65 are back chambers not visible when looking at the front of the group. Possible rooms (not recorded) are indicated by dotted outlines. Redrawn in 1991 by K. Barthuli and S. Hall.*

The cavate group is well defined by large drainage cuts at each end. The portion of the group in which we worked (upper Group M) extends from the up-canyon end, where there are two isolated rooms amid a rockfall, to about midway in the group, where a natural break is formed by some small tent rocks, a steep talus, and a slight lowering in the elevation of the cliff-base rooms. Upper Group M has an overall length of 102 m (78 m excluding the two uppermost rooms, M-1 and M-2; Figure 2.17). Below the tent rocks multiple counts give an average of 73 rooms showing on the cliff. A total of 66 rooms out of 67 were recorded in the upper area, giving a total of 140 cliff-associated rooms in the group. Some high pockets in upper Group M have openings that look suspiciously like doors; those we were able to check were not rooms in our estimation, but some others may be. Recording of Group M in 1990 by the Bandelier Survey confirmed the count of 67 rooms in the upper area, but the survey crew saw an additional 24 rooms (for a total of 94) in the lower area. Although it seems likely that their count includes features or pockets we did not consider rooms, the count discrepancy also reflects the intensity of cliff modification in lower Group M, and the potential this maze of features affords for deriving different counts.

As at Group I, the width of the flat areas at the top of the talus varies. Toward the upper end (M-3-M-14) the talus is steep and hard and extends directly to the base of the cliff; in this area no evidence of masonry rooms remains, though they were unquestionably present. In front of M-18-M-20 the top of the talus is considerably flatter, and there are many suggested walls and strewn blocks. Here it is first possible to see three levels of rooms (M-17 and M-64). In front of M-25-M-31 the amount of rubble further increases, and in this area three levels of rooms are again visible on the cliff. M-33, once an elaborately decorated room, stands on the up-canyon edge of the largest concentration of rubble for the entire group, including the part below our study area. Here a slight embayment in the cliff contains Rooms M-35-M-49, and the rubble extends 9-10 m out from the cliff base with a relief of around 2 m. Wall alignments suggest as many as three rows of rooms out from the cliff, and there are as many as five levels of cavates (Figures 2.17, 2.18). Given the height of the mound and the level of rooms such as M-54, a large structure is indicated. Several cavate rooms in this area are larger and very heavily used and have many features. This area is "downtown" for Group M. Past the mounded area, in front of Rooms M-50-M-60, there is once again a steep, disintegrated tuff talus slope, though more masonry blocks are present on this slope than at the upper end. Even in this location, cliff evidence shows rooms on two to three levels, most of which seem likely to have had masonry fronts. Some large pieces of canyon wall have fallen here, which probably removed natural fronts of some of these rooms. The rooms above these steep slopes seem to have suffered the most from natural disintegration, presumably because masonry elements in these locations were far more prone to collapse.

Lower Group M contains several notable features. As discussed earlier, the best documented excavations of cavate rooms in the canyon are Hendron's (1943) excavation and stabilization of four cavates and five associated masonry rooms (see also Turney 1948 and Kohler's [Carlson and Kohler 1989] excavation of a single cavate chamber nearby). There are several exposed hearths in Lower M, two of which were sampled in a pilot archaeomagnetic study. At the bottom end of the group is a large chamber located above a major drainage; the chamber was probably subdivided during at least part of its use. This "kiva" contains rock art, including a relatively well-preserved, green Awanyu.

Almost all the rock art at this group is confined to room walls. Room M-33 contains remnants of red, yellow, black, and white wall paintings, as well as incised figures, on at least two walls and on several coats of plaster. Its condition is now rather fragmentary and warrants careful removal and expert study of what remains.

A route leads out of the canyon not far up-canyon from the group, but none seems to be located inside the room cluster. There is a set of six large holes above the four-level section of upper Group M (above M-41), but these seem to lead only to a ledge where possible room M-64 is located (Ranger Ed Greene reached this area by rope).

The cavates and features we recorded in Group M are on the same level to a remarkable degree. We did not use an altimeter for this group, but the contours here are reasonably clear, and the 6180-6200 foot (1884-1890 m) level seems to identify the location of the majority of the rooms (in several places there are multiple levels of rooms). Using 6200 ft (1890 m) as a baseline for the main level of rooms (M-14, M-18, M-21, M-23, M-33, M-39, M-43, M-53, M-56, and--though they are well above the base of the cliff--M-59 and M-60), we estimated other elevations. Most other rooms are within 5 m of this elevation. The general level of upper Group M is around 6 m higher than the lower half. Group M is *not* indicated by a symbol on the USGS Frijoles Quadrangle, but Group L is suggested and shows as 6300 feet (1920 m) because of merged contours. This is probably too high; the elevation of the Rito below Group M is about 6040 ft (1840 m). At Rainbow House the Rito enters a narrow and fairly deep inner canyon, making it much less accessible to irrigation than in the main part of the canyon.

Tsankawi Section, LA 50976 (field no. LA 50024)

Cavate rooms are abundant in many of the dry canyons north of Frijoles Canyon. With a few exceptions, such as Puye and Garcia Canyon, these features have received less attention from archaeologists than those in Frijoles. Lister (1940b) did some stabilization and mapping in several areas that were later divested from the monument, as well as at Tsankawi. Lister's work resulted in several maps, some of which cover long stretches of cliff and great numbers of cavates, as at Otowi and Tsankawi.

This area takes its name from Tsankawi Pueblo (LA 211), a major "plaza pueblo" located on the mesa top with a commanding view in all directions. The mesa (or *potrero*) is formed by Sandia Canyon on the south and Los Alamos Canyon on the north. Tsankawi is a Tewa word meaning 'the place [or gap] of the round cactus'. The orthography of Native American languages has been modified many times. Thus, a more recent, presumably more nearly correct, rendering of Tsankawi is Tsankawi'i, and earlier ones include Sankawi and Sankewi. The NPS and USGS use Tsankawi, and I have used that spelling for the ruin and as shorthand for the cavate group we studied, although there are cavates around Tsankawi Pueblo not included in this study. To make matters even more complicated, there is a pottery type named after LA 211; since it was named early, it has traditionally been spelled Sankawi Black-on-cream. The pottery name, too, has been rendered in many ways, usually without the initial tee (e.g., Sankawi'i [Kohler and Linse 1993:36]); the traditional spelling is used here.

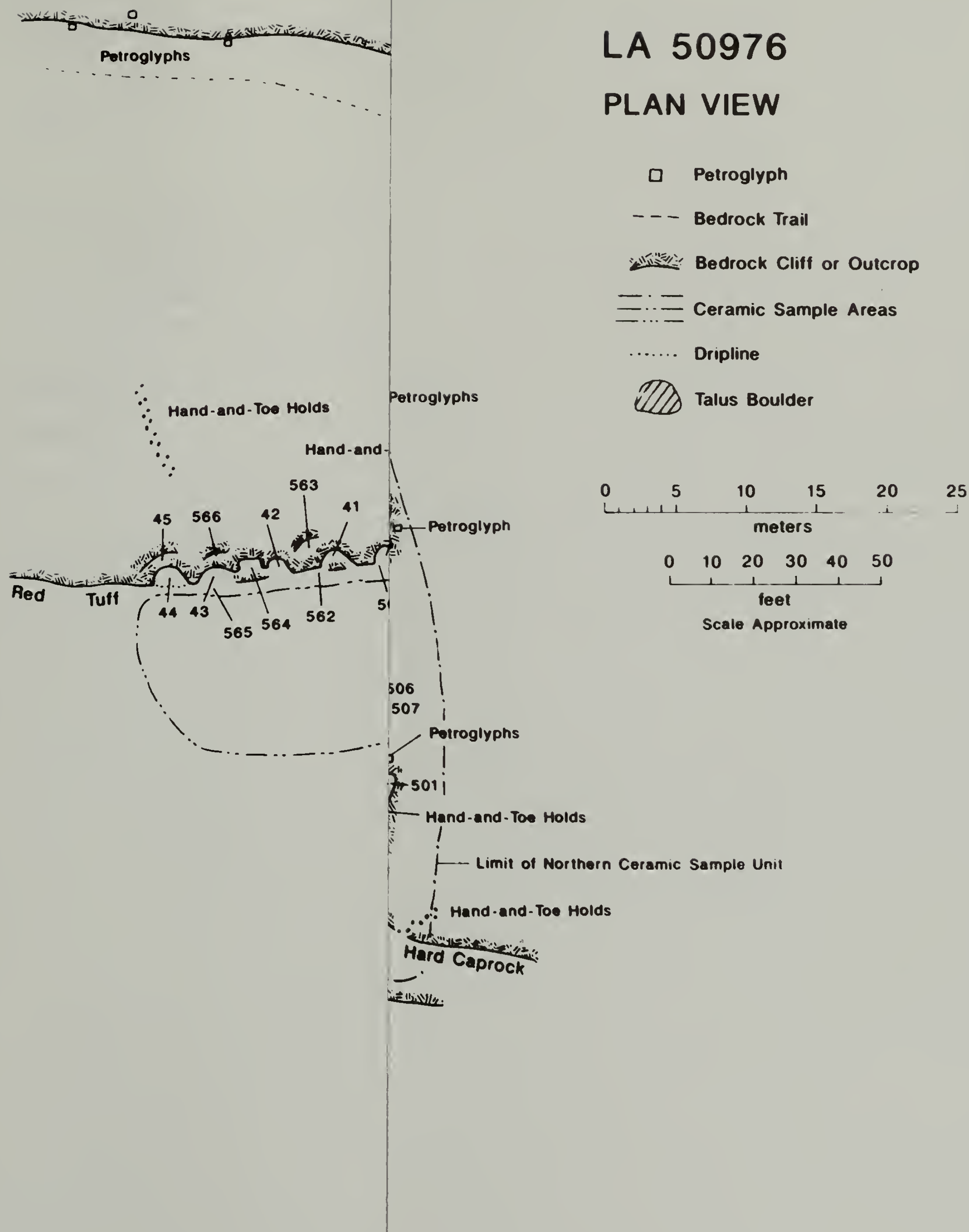
Cavates are abundant on the south and east slopes of the mesa and can be separated into reasonably discrete groups on the basis of distribution, as was done long ago for the Frijoles cavates. Such groups include the rooms located at the end of the western lobe of Tsankawi Mesa (not recorded by Lister), the lower rooms in the red tuff (Lister's C-123-C-165 and C-170-C-174), the rooms in the south-facing rincon below the pueblo to the southwest (Lister's C-69-C-120), and the east-facing rincon below the pueblo to the southeast (Lister's C-15-C-45 and C-50-C-67). Such subdivision may impose some breaks that do not correspond to prehistoric groupings, and other methods could be used to distinguish other groups. Still, this division has the advantage of creating more manageable analytical units for archaeologists.

The east-facing rincon group was chosen for recording because it contains many rooms (even more than we anticipated) in both the red and gray tuff units. Also, the rooms in the red unit looked to be in good condition relative to most of the other rooms in that stratum. The "site," as we defined it, is delimited by two points in the mesa side. The point on the north and east extreme is small, and there are scattered cavates quite close to the LA 50976 group in the next rincon to the east. The point on the south is a more distinct break formed by a relatively high, sheer cliff and an absence of cavates for a considerable distance.

Lister mapped and mentioned 49 rooms in this area. With a few exceptions, he included only relatively complete chambers and did not assign separate numbers to back chambers. Our count for the whole area is 119 rooms, reached by counting exterior rooms indicated by cliff features and by giving back chambers separate numbers. We retained Lister's numbers but replaced his C prefix with a TS (C indicated only "cave" and was used at all the other groups Lister worked in as well). New TS numbers, beginning with 501, were assigned to the rooms he had not numbered. TS-501 was chosen as a starting point because Lister's numbers for the whole Tsankawi area go up to 180, and it was thought desirable to flag the added numbers and keep them separate (TS-501-TS-570 were used). Lister's map clearly shows the relative locations of structures, and we adopted it as a location map to which we added our new numbers. The map included here (Figure 2.19) is based on the modified Lister map and a detailed sketch map drawn by the Bandelier Survey crew. The only other recorded work in this group is the removal of a secondary burial by Johnson (1960; see chapter 1 of this study).

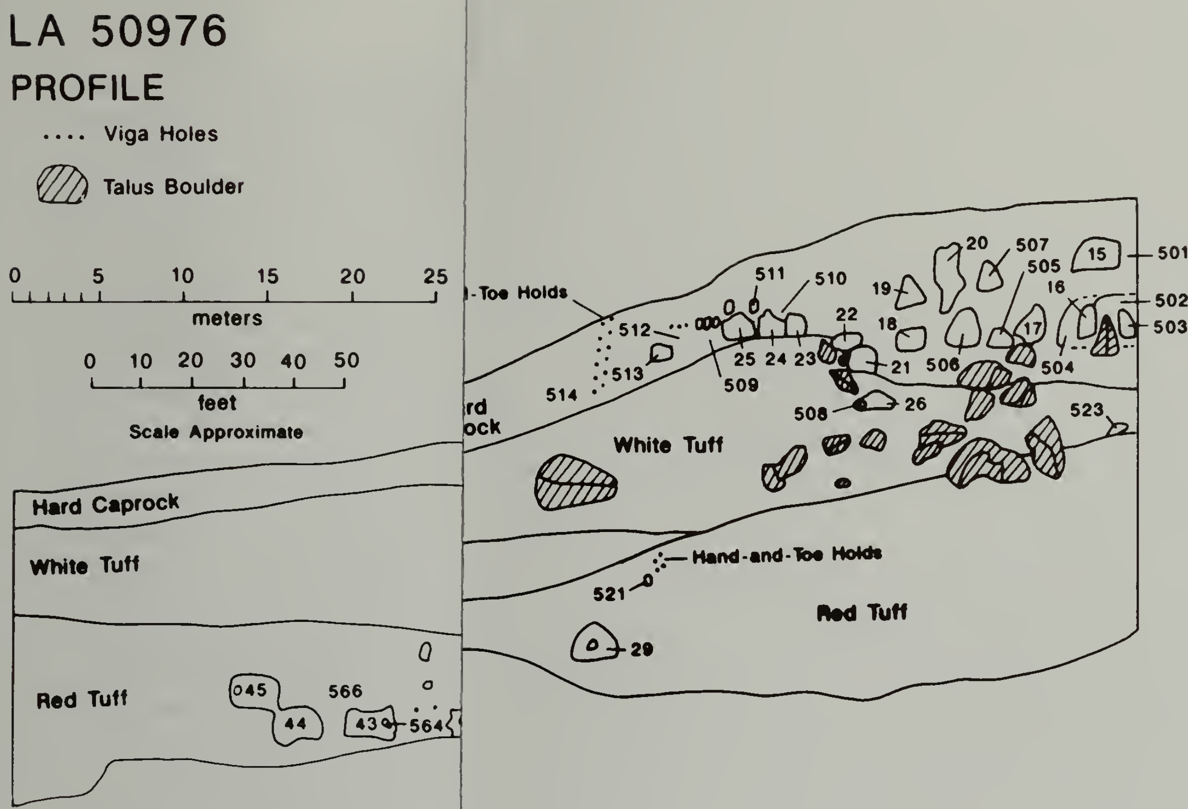
The rooms in the LA 50976 rincon are located on about four different levels, three in the thick gray-and-white tuff layer, and another in the underlying red tuff layer (Figure 2.20). Within the rincon several subgroups can be defined; these could be considered as the equivalent of room blocks in a masonry site or as separate sites. At the north end of the rincon, on the highest bench, is a group of about 25 rooms (TS-15-TS-26 and TS-501-TS-513) located in a porous, frothy tuff layer, overlain by the homogeneous, obviously indurated layer that forms the mesa caprock. They are closely spaced, and most front on a flat shelf 4-5 m wide that may have had structures on it: there are several sets of viga holes for rooms near rooms TS-21-TS-25, even though masonry rubble is scarce. Above most of this stretch of rooms on the rimrock is an elaborate, varied, and well-preserved rock art panel; the good condition of this panel results from the hardness of the top stratum. Among the petroglyphs there are three large rectilinear depressions ground into the cliff face. These features seem to occur only here and with a second cavate group recorded by Lister in a rincon to the west of LA 50976. After some discussion, we decided to call these features cliff niches, though their bases slope somewhat (Figure 4.23). There is also a cleavage in the rimrock with paired beam seats reminiscent of scaffold supports, like those at Scaffold House in Navajo National Monument. The densest cluster of rooms is on the next level down, on the east-facing slope and about in the center of LA 50976. Rooms TS-54-TS-61 and TS-530-TS-533 are packed onto several levels, and rooms TS-62-TS-65 are close by. Down yet another level is a smaller group of rooms, the last cluster in the white and gray tuff: TS-51-TS-53 and TS-540-TS-546.

The top of the red tuff layer forms a distinct ledge for most of the length of the rincon. This coarse, very soft tuff, possibly the Tsankawi Pumice Bed (Bailey et al. 1969:14-15), is exposed for thicknesses of 3 m or less for most of the middle of the rincon, with thicker exposures at each end. The rooms in the red tuff form a subgroup because of their elevation;



le. First mapped by Lister (1940b), locations for this py of Lister's 1940 map; remapped by R. Powers and

Figure 2.19. *Plan view for the Tsankawi sample. First mapped by Lister (1940b), locations for this study originally recorded on a copy of Lister's 1940 map; remapped by R. Powers and T. Chadderdon in 1988.*



wi sample. Given the curvature and stepped nature of necessarily somewhat schematic; relative positions and proximate. This drawing is based on field sketches and R. Powers in 1994.

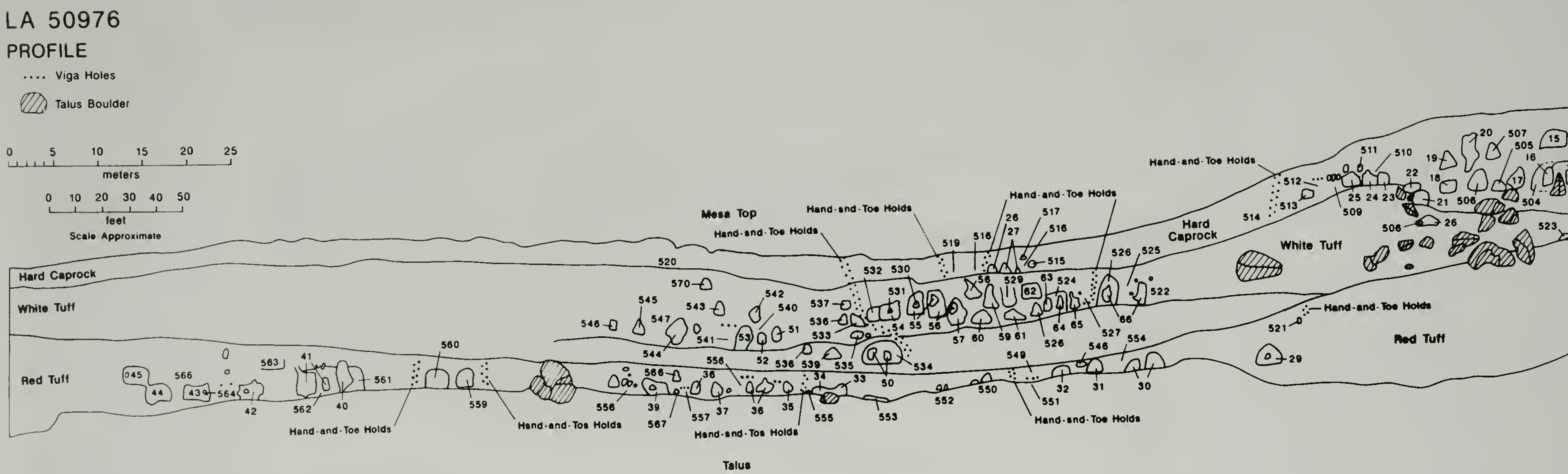


Figure 2.20. *Elevation sketch for the Tsankawi sample. Given the curvature and stepped nature of these cavates, this drawing is necessarily somewhat schematic; relative positions and shapes are shown, but scale is approximate. This drawing is based on field sketches and photos; redrawn by S. Herr and R. Powers in 1994.*

from TS-29 to TS-39 the rooms are fairly continuous, including TS-548-TS-558, TS-567, and TS-568. The southernmost rooms form a final red tuff subgroup: TS-40-TS-45 and TS-559-TS-566. The cliff exposure here is greater, and these rooms are built on several levels. Some isolated rooms are interspersed among these groups, and some pockets are also found, which may have been modified for storage cists but were not recorded. The pockets are especially abundant in the white tuff at the south end of the rincon where no rooms are present. Elevations were assigned to the various levels beginning at 6600 ft (2012 m) for the uppermost level and dropping by 20 foot contours to 6500 ft (1981 m) for the red tuff rooms. To judge from Lister's photos, there has been little change in the condition of cavates at Tsankawi over the last several decades (Figure 2.21).

Because of the multilevel, dispersed nature of LA 50976, trails and staircases are abundant. Lister shows six stairways, and worn trails connect most of the groups. Some of these may be the result of the heavy visitation this area has had and continues to receive--at the very least, modern visitors surely enhance prehistoric trails. Other paths, however, now terminate where there would once have been a roof (e.g., in front of TS-507). None of these routes was separately recorded.

A primary reason for recording some structures at Tsankawi was to look for degrees of difference that might speak (however subtly) to the question of differences in ethnicity between the inhabitants of Frijoles and Tsankawi. Anthropological tradition holds that Frijoles Canyon is the northern limit of prehistoric Keres speakers, with the Tewa extending to the north (see, for example, Hewett 1938; Steen 1977). Accordingly, about a third of the 1986 field time was spent at Tsankawi, and about the same proportion of records was compiled there (8 full field days and 119 records). Differences are present among all the groups in which we worked, but the differences are greatest in the case of Tsankawi. This site decidedly stands apart from the Frijoles groups.

Some of the differences between Frijoles and Tsankawi relate directly to topography. In contrast to the sheer cliffs of Frijoles Canyon, the sides of Sandia Canyon below Tsankawi Ruin consist of short cliffs separated by benches and talus slopes. This affects both the distribution of rooms and construction possibilities: the dispersed, many-tiered distribution of rooms at LA 50976 is just not possible in Frijoles, and the absence of high cliffs at LA 50976 means that multiple stories would have been far more difficult to construct. Where cliffs are higher at Tsankawi, such as around TS-35-TS-39, there is evidence for multistory structures. Another noticeable difference between Frijoles groups and LA 50976 is in exposure. While the Frijoles groups were pleasantly cool and shady (the unappreciative said cold) until late morning in July and August, the LA 50976 rooms received early-morning sun, with some late afternoon shade.

More likely to have cultural (or temporal?) significance are several differences in the presence and absence of features, and in their characteristics. Rooms at Tsankawi are notably larger than those in Frijoles, both in height and floor area. While at least two examples of two chambers being joined into a single larger chamber were found at LA 50976, none was identified in the larger Frijoles Canyon sample. Remains of masonry structures, masonry plugs, and small walls are scarce at Tsankawi. It is possible that the cavate rooms at LA 50976 were more often primary rooms while those in Frijoles were more often back chambers of secondary importance, though the features in many of the Frijoles chambers are not in accord with this interpretation. Room outlines, particularly at Frijoles Group A, suggest that large chambers were in use in Frijoles as well. The scant evidence for masonry at LA 50976 may be related to the presence of postholes both inside and outside the rooms there, while none

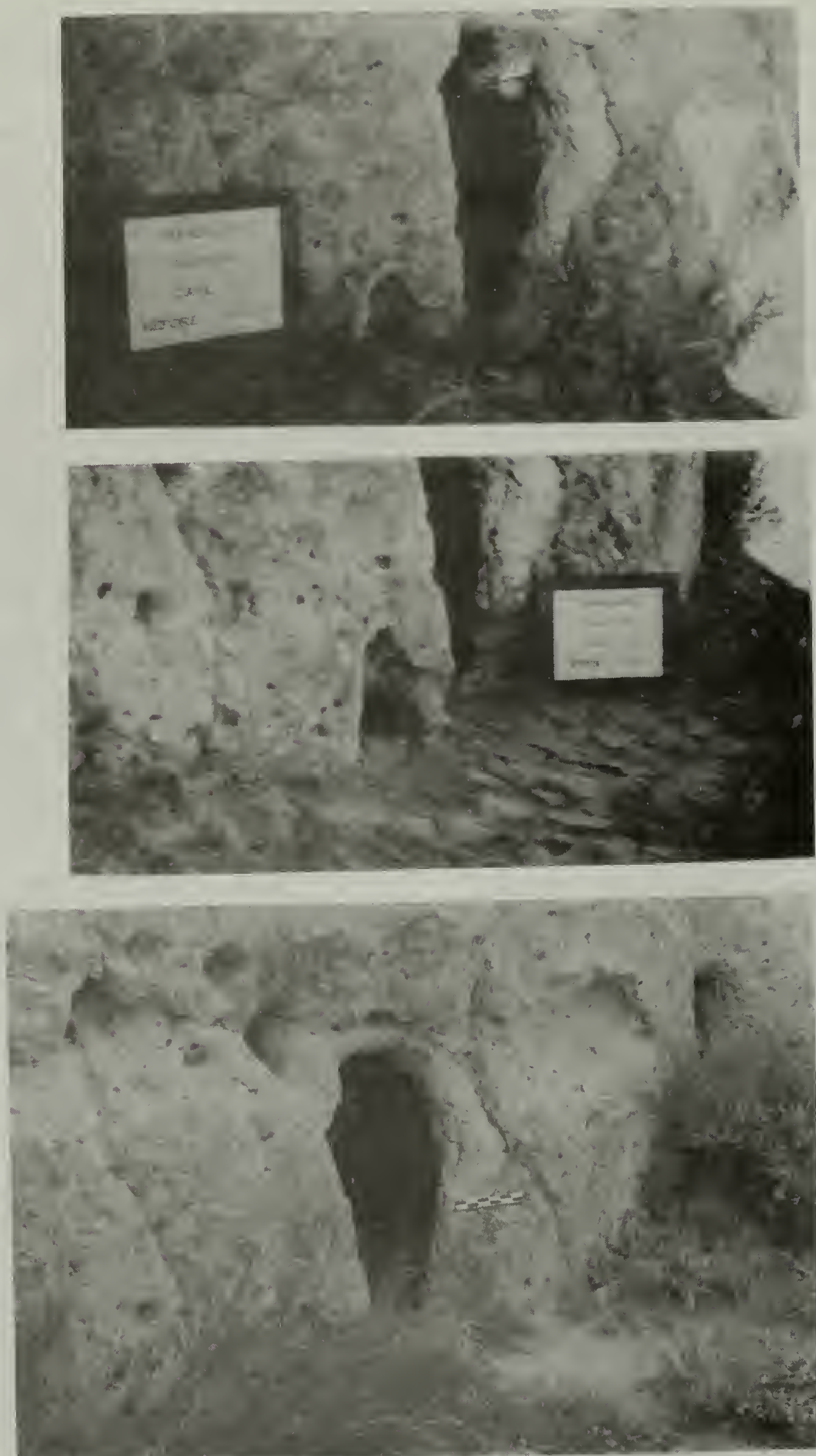


Figure 2.21. *Comparison photographs for TS-53. a, b. Before- and after-stabilization photographs taken by Lister in 1939. c. TS-53 as it appeared in August 1986. Other than in vegetation, little change is apparent.*

was identified in Frijoles; however, Frijoles has few of the expanses of clear horizontal tuff that are common at Tsankawi. The proportion of nearly complete chambers is much higher at Tsankawi than at the Frijoles sites. Excavated small back chambers are also relatively more abundant at LA 50976.

The extramural rock art at Tsankawi is in a different class from what is now visible in Frijoles, in terms of quantity, variety, and preservation. It is, of course, difficult to determine how far preservation is responsible for the other differences. We observed several features only at Tsankawi: the cliff niches mentioned above, vertical holes in ceilings (named Panowski Holes in honor of one of our crew), groups of floor pits, and series of deep incisions in room walls. We observed other features in Frijoles that seem to be lacking at LA 50976: slots, metate rests, and floor ridges. Loom support-and-anchor complexes seem to be especially common at both Group M and Tsankawi/LA 50976.

"Cuevitas Arribas" (no LA number)

In addition to the formal recording of the sites described above, our crew also conducted a preliminary reconnaissance of a group in Frijoles Canyon not recorded on the Hewett-Chapman map. This group is located upstream from Ceremonial Cave and at approximately the same level on the canyon wall (Figure 2.1). Unlike those farther down the canyon, it is located on a bench above the first cliff above the creek. Although the canyon is narrower here, the placement of this group is probably related to the presence of a low bench by the Rito and a wider floodplain, which could have provided an opportunity for irrigated farming similar to that at Group A. There are three subgroups separated by drainages. The rooms closest to Ceremonial Cave are in very poor condition. There are no complete chambers, and the degree of exposure and the coarseness of the tuff here has left few recognizable features. The upper two parts, located just past the wilderness boundary, are closer together, larger, and better preserved. We named this site Cuevitas Arribas (loosely, "the cavates above"), to indicate its location up-canyon from Group A. Separate room counts came to 72 and 74 rooms in the two upper subgroups; including the 10-15 less well-preserved rooms down-canyon, this settlement contained well over 80 rooms. There are several examples of well-preserved masonry, including a retaining wall inside a chamber, a dividing wall, some very clear room outlines in front of the cliff, and some partial closures of openings. One of the rooms has the reddest plaster of any observed during this study. In spite of its exclusion by Hewett and Chapman, the Cuevitas Arribas group is equivalent to Groups A-M and definitely merits further study.

Cavate Chronology

Attempts to decipher relationships among cavate groups, between cavates and large masonry structures, and between purported Tewa and Keres areas all hinge on tight chronological control. Sadly, few dates are available from cavates, and this project adds little to the broad outlines already known. P. J. McKenna and R. P. Powers conducted a field analysis of the surface pottery at the groups we studied, but the sherds are generally not abundant and all are found on the talus slopes below the cavates. The location of the ceramics means that their association with structures is vague and there is high potential for mixing. With a very few exceptions, dates can be assigned only to groups of cavates and not to individual features. McKenna's report on the surface ceramics is given in full at the end of this chapter.

Incorporation of Ceramic Dates and Further Dating Potential

Based on McKenna's analysis we assigned the following date spans (all dates are A.D.) to the groups we studied:

Group A	1225-1550	
Group F	1100-1175	1315-1550
Group I	1275-1525	
Group M	1250-1550	1695-1725
Tsankawi	1300-1650	

Archaeomagnetic sampling of two exposed hearths in lower Group M (behind Hendron's excavations and between there and M-60, the lowermost cavate we recorded in the group) provided dates of A.D.1425-1550 (±26) and 1275-1550 (±41) (Table 2.1). Together with the Group M tree-ring dates of 1493 and 1494 (if the dates given by Smiley et al. [1953] and Robinson et al. [1972] are in fact different specimens), occupation of Group M seems quite firmly placed in the 1400s. The archaeomagnetic dates suggest that the extent of the eighteenth-century reoccupation was small, since the hearths are very near where the late materials were excavated. The small quantity of late ceramics further corroborates that suggestion.

Justin Hyland's (1986:50-54) ceramic analysis indicates that the Garcia Canyon cavates he studied fall toward the early end of the dates derived for the Frijoles and Tsankawi cavates. He suggests a range of 1275-1350 and a mean of 1275, though his analyses were not complete when he wrote his thesis. None of the tree-ring samples submitted yielded dates (Hyland 1986:86). The decorated type dominating cavate assemblages analyzed by Hyland is Santa Fe Black-on-white, to which he assigns a date of 1275 in calculating his ceramic dates (Hyland 1986:61, appendix).

The high frequency of Santa Fe Black-on-white on these sites is in accord with Gauthier's assessment that many cavates, especially more dispersed ones, were constructed and used before the establishment of large aggregated sites (R. Gauthier, personal communication, 1989). There is also some indication (again based nearly entirely on ceramics) that cavates may have been in use earlier in the northern part of the plateau than in the south; in addition to Hyland's ceramic counts at Garcia Canyon, Stuart and Gauthier (1981:105) place the beginning of Puye at ca. 1250. Major differences in the period of use of cavates are unlikely, however, given the relatively small area of the Pajarito Plateau. All the areas included in the present study are near large, aggregated pueblos that postdate the manufacture of Santa Fe Black-on-white, and both the ceramics and the few chronometric dates suggest primary use during the fourteenth and especially fifteenth centuries. Santa Fe Black-on-white, however, is present in all the counts in small quantities. Given intensive use of existing cavates and the probable construction of more rooms during aggregation, it is easy to understand how Santa Fe Black-on-white would become a minority type, especially in surface collections.[2]

A plausible sequence is that cavate structures came into use relatively early in the intensive occupation of the Pajarito Plateau, around 1200. As the population aggregated, they continued in use and were a part of the aggregation phenomenon. Given their permanence relative to masonry structures, some cavates were periodically reused into the historic period. Like other forms of habitation on the Pajarito, then, cavates were constructed in the Coalition Period and continued in use in the Classic Period, though the settlement pattern changed rather dramatically. Because many cavates remain intact and unfilled, the total use span of a cavate that survives intact is potentially very long--much longer than for almost any masonry room not continuously maintained.

The long potential use spans of unfilled cavate rooms complicate precise dating of construction and period of greatest use. As always, the best hope for precise dates lies with tree-ring samples. Though William Robinson and others (1972:73) indicate that more samples from cavates may be in collections, including some from Group F, the only two dates now in the record as having come from cavates are those from Group M (Table 2.1), and there is a

Table 2.1. Chronometric Dates and Ceramic Associations from Bandelier.

A. Adapted from Smiley et al. 1953:21-39

Site	Samples	Dates	Ceramics Associated
Group M	1 dendro 2 archeomagnetic	1493c 1275-1550±41 1425-1550±26	Biscuit A and B Sankawi B/c Rio Grande Glazes I-V
Tyuonyi	16 dendro	1383+-1466c 1417-1505 best	Kwahe'e B/w, Santa Fe B/w Wiyo B/w, Biscuit A & B, Sankawi B/c Rio Grande Glaze I-V
Rainbow House	20 dendro	1421-1453 1448-1451 best	Biscuit A & B, Sankawi B/c, Santa Fe B/w, Rio Grande Glaze I-V
Frijolito	3 dendro	1431-1447	Kwahe'e B/w, Santa Fe B/w, Wiyo B/w, Biscuit A & B, Rio Grande Glazes I-III, White Mountain Redware

B. From Robinson et al. 1972

Site	Samples	Dates	Comments
Puye	41 dendro	1413-1562vv 1536-1577r	miscellaneous and unknown proveniences; no cavates specified
Tschirege	33 dendro	1411-1581v, vv 1559r, 1572+	miscellaneous proveniences; no cavates specified
Tyuonyi	55 dendro	1386-1467r 1309-1527v, vv	construction 14th-16th centuries; Group F nearby
Group M	1 dendro	1494vG	Hendron excavation; see part A above
Saltbush Pueblo	3 dendro	1194-1241vv	see Snow 1974; near Group M
Big Kiva	15 dendro	1505-1525r 1383-1525v, vv	below Group I

Note: All dendro dates are ranges for terminal dates only (outside rings only, pith not given).

chance that they come from the same specimen. Although some original structural wood probably exists in unfilled cavates, we observed none during this project. Datable wood from cavates is more likely to come from excavation of at least partially filled rooms and possibly hearths.

Other sources of date ranges include further archaeomagnetic sampling, obsidian hydration analysis of artifacts from firm contexts (no suitable artifacts were recovered during this nonexcavation project), and C-14 dating. The heavy carbon deposits on the ceilings of many cavates open the possibility that C-14 samples may be available without excavation. Hyland (1986) submitted some such samples, though he reports no results. These samples pose even greater problems than most C-14 samples: the source of the carbon may be material that died long before it was burned, the carbon present is likely to have come from numerous different burning events, and there is no control over what the original substance was. Given the inherent imprecision and ambiguity of C-14 dates, their high processing cost, the relatively fine ceramic dates possible, and the additional problems with these samples, they are of little potential utility, though still tantalizing.

Analysis of Surface Ceramics from the Study Areas

Peter J. McKenna

In recording surface ceramics at the five recorded cavate groups, we followed procedures adopted in the 1985 pilot survey at Bandelier (McKenna and Powers 1986). Given the absence of other means of dating the cavates, ceramic dating was the focus of the data collection, but we also recorded vessel form. Here we present the cavate chronology indicated by the surface ceramics and point out some differences among ceramic assemblages of the cavate groups as suggested by surface materials.

Sampling Areas

Cavate refuse scatters are diffuse. In covering approximately 32,400 m^2 of sample area in two days, we located and identified only 2553 sherds. This gives an average of 0.08 sherds per square meter, in stark contrast to the extremely high-density scatters around Tsankawi and Yapashi Pueblos proper, where surface sherd scatters were as high as 254 sherds per square meter and no lower than 87. In the sample survey, of the 21 fully recorded sites only a trail and a small structure showed ceramic densities lower than those recorded at the cavates (McKenna and Powers 1986: Table 8). We noted no dense ceramic trash in cavates or along the flat rubble/talus margins immediately fronting cavates, but we did see some variability in the relative frequency of ceramics among cavate scatters. To locate ceramics we scoured extensive areas of rubble mound or talus slope in front of recorded cavate groups. We collected, identified, and tabulated the ceramics, and replaced them by scattering them in the same general area from which they were collected. We found no ceramics in any Frijoles cavates during ceramic sampling and observed only four Biscuit B sherds in separate cavates at Tsankawi. We observed a few sherds in two inaccessible Frijoles cavates (F-56 and M-15) during cavate recording, but none was included in this analysis. We sampled Groups A, F, I, and M in Frijoles Canyon; we did not sample the "Cuevitas Arribas" site. We subdivided the cavates at Tsankawi into three sampling units and those at Frijoles Group F into two.

All sherds observed in the following areas were included in the counts:

Group A: the talus/rubble fronting the west half of the group, from the central kiva to cavate A-1 (108 m E-W x 20 m N-S, ceramic n=253). In addition two 2 x 1 m grids were sampled at 16 m and 34 m east of the central kiva in the soil-fan bordering the talus/house rubble.

Group F: the talus/rubble mound fronting the entire group of architecturally sampled cavates. Two cavate groups were apparent: those constructed on the south side of some detached tent rocks and those along the main cliff at the top of the talus. The lower group was sampled in an area (24 m N-S by 23 m E-W, ceramic n=263) directly downslope, while the remaining area was associated with the upper cavates (ca. 41 m E-W x 30 m N-S, ceramic n=282; total ceramics n=545).

Group I: rubble mound and talus fronting the architecturally sampled cavates (60 m N-S x 30 m E-W, ceramic n=174), to near the base of the talus slope.

Group M: rubble mound and talus fronting cavates, primarily between drainages flanking the central portion of the architecturally sampled cavates, erosion having denuded slopes along the east and west margins of this cavate group (55 m E-W x 40 m N-S, ceramic n=672).

Tsankawi Group (LA 50976): three sample areas, a northern and central group located in gray and white tuff just below the mesa top, and a lower or southern group in the red tuff (see Tsankawi description above). The northern group consisted of cavates below the east-west trending section of hard caprock (an irregular 58 m E-W x 30 m N-S, ceramic n=362). The central group consisted of a scatter focussing on the middle group of cavates in the white tuff (50 m NE-SW x 45 m NW-SE, ceramic n=141), with the lower margin of collection ending at the top of the lower red tuff layer. The southern, or lower, sample area fronted cavates below this red layer of tuff (91 m NE-SW x 17 m NW-SE, ceramic n=406). The south cavate sample was taken in halves for comparison because the northeast half of this sample area lay below the cavates in the upper gray and white tuff and undoubtedly contained some ceramics from this upper scatter. The ceramic sample from the Tsankawi LA 50976 cavates is 906 items.

Chronology and the Rio Grande Series

Ceramic chronologies and type descriptions are based on information presented in the sample survey report for Bandelier (McKenna and Powers 1986) and summarized in Table 2.2. Unidentifiable or chronologically nonsensitive categories are often composites of technically separate classes. An example is "whiteware," which is undecorated portions of bichrome service wares, whether those specimens are technically black-on-white or black-on-cream. Cavate sites at Bandelier have seen heavy visitation, and for decades collectors have relentlessly gathered their ceramics. This has resulted both in selective disappearance, particularly of decorated sherds, and in sherds of a generally smaller, nondescript character--important points in the evaluation of cavate ceramics.

Ceramics and the chronological data base in the Rio Grande region have, at best, a working relationship between two independent data sets that requires constant scrutiny and evaluation. The default time spans assumed (Table 2.2) in dating the present samples are, naturally, only as accurate as the patchy information on which they are based. A healthy degree of skepticism and periodic reevaluation of ceramic chronologies are necessary because such constructs rest on the broad extension of limited chronometrics, with some inherent imprecision, and on the necessity of accepting uniformity across space as a characteristic of the "type" ceramics. The extremely short time spans assigned to types such as San Lazaro Glaze-on-polychrome are suspect and should be used only tentatively (F. H. Ellis, personal communication, 1985). While there is no particular reason to suspect that ceramic chronology on the Pajarito Plateau is totally out of step with the Rio Grande chronological sequence, some differences are likely (see Lang 1982). The chronological data

Table 2.2. Date Ranges Used by Various Analysts for Rio Grande Ceramic Types.

Ceramic Type	McKenna & Powers 1986	Hubbell & Traylor 1982:242	Snow 1982† Warren 1979	Breternitz 1966[a]
Kwahe'e B/w	1000-1225	950-1225	950-1225	1125-1200
Socorro B/w	1100-1250	1050-1275		1050-1275
Santa Fe B/w	1175-1300+	1175-1300+	1175-1300	1200-1350
Wiyo B/w	1250-1400	1250-1400	1300-1400	1300-1400
Biscuit A	1350-1450	1350-1450	1350-1450	1375-1450
Biscuit B	1425-1550	1425-1550	1425-1550	1400-1550
Galisteo B/w	1300-1400	1250-1400	1250-1350	1300-1400
Sankawi B/c	1500-1675	1500-1675	1550-1625†	1500-1600
Tewa Polychrome	1675-1720	1675-1720	1675-1720	post 1500
Kapo Black	1650+	1650+	1650+	
Posugue Red	1675+		1675+	
Potsuwi'i Incised	1450-1550	1450-1550	1450-1550	1425-1525+
Glaze A	1315-1425		1300-1450†	
Agua Fria G/r		1315-1425	1315-1425	
Cieneguilla G/y		1325-1425	1325-1425	
San Clemente G/Poly		1315-1425	1315-1425	
Cieneguilla G/Poly		1325-1425	1315-1425	
Glaze B	1400-1450	1400-1450	1400-1450†	
Largo G/y-r			1400-1450	
Largo G/Poly				
Glaze C			1450-1490†	
Espinosa G/Poly	1425-1490	1425-1490	1425-1490	
Glaze D			1490-1515†	
San Lazaro G/Poly	1490-1515	1490-1515	1490-1515	
Glaze E			1515-1625†	
Puaray G/Poly	1515-1650	1515-1600	1515-1650	
Pecos G/Poly	1515-1700	1515-1700		

Table 2.2. (continued)

Ceramic Type	McKenna & Powers 1986	Hubbell & Traylor 1982:242	Snow 1982† Warren 1979	Breternitz 1966[a]
Escondido G/Poly	1515+	1515+		
Encierro G/Poly				
Glaze F			1625-1700†	
Kotyiti G/y-r			1650-1700+	
Kotyiti G/Poly				

[a]Base reference Smiley et al. 1953.

in use at present are unstructured and inadequate beyond a very crude "regional" level.

The chronology of the sequence itself rests on widely scattered, poorly provenienced data (Smiley 1951; Robinson et al. 1972), summarized and ceramically correlated by Smiley and others (1953), and taken verbatim in the most "recent" gospel on ceramic dating for Rio Grande types (Breternitz 1966). Dates available from Bandelier sites poorly reflect the temporal range of ceramics actually present (Table 2.1). Certainly more recent work, with better provenience/ceramic associations, is available for a reappraisal of the general Rio Grande sequence and perhaps for a more rigorous scrutiny of areas within the region (Orcutt 1994).

Variation from accepted temporal sequences by subregional ceramic assemblages has been noted by Mills (1986) along the lower Rio Grande and is just as likely on the Pajarito Plateau. Differences in date assignments to the same pottery types by projects in the Rio Grande region are another indicator of subregional ceramic temporal variation (see Table 2.2). Both more extensive dating of Pajaritan contexts and a complete summary of more recent work are needed before a Pajaritan chronology can be redefined and compared to the general Rio Grande sequence. Ceramic chronologists traditionally track "trade" items on a separate time line than indigenous wares because nonlocal types tend to occur longer in regions removed from the production center. Use of the default time spans for these trade types, which are assumed to be a substantial component in Bandelier ceramic assemblages, further muddles the assignment of site chronology.

Cavate Group Ceramic Dates

The ceramic samples from the Bandelier cavate groups suggest variation in initial occupation and periodicity in reuse. All cavates show occupation during the Coalition and Classic Periods in the fourteenth, fifteenth, and early sixteenth centuries; only one, Frijoles Group M, shows early eighteenth-century ceramics (Table 2.3). In general, based on relative frequencies of ceramics, early occupations are most evident in the upper Frijoles groups, while later occupations are more evident in cavates farther down-canyon. Tsankawi cavates are largely contemporaneous with the mesa-top pueblo A.D. 1250-1650), but differences in the relative abundance of Sankawi

Table 2.3. Ceramic Samples for Bandelier Cavates.

	Tsankawi Cavates							Frijoles Cavates							
Ceramic Type	N	C	S	Total N	%	Tsankawi Pueblo	%	A	F	I	M	Total N	%	Yapashi Pueblo	%
Rio Grande series															
Kana'a Gray											1	1	0.1		
Corrugated			2	2	0.2	1	0.2		3	2	2	7	0.4	6	0.7
Smeared corrugated	5	3	5	13	1.4	25	2.6	19	4	3	18	44	2.6		
Indented corrugated	8	4	3	15	1.6	7	0.7	1	7	4	3	15	8.9	14	1.7
Smeared-indented	15	13	13	41	4.5	13	1.4	23	3	2	25	53	3.1	107	13.0
Tesuque series															
Plain											3	3	0.2		
Indented									3			3	0.2		
Smeared indented		2		2	0.2			12	3		4	19	1.1	12	1.5
Sapawe washboard	186	38	205	429	47.2	299	31.6		2	1	6	9	0.5		
Plainware															
Plain gray	37	24	36	97	10.7	149	15.8	158	318	98	404	978	57.9	308	37.3
Striated plain								7	2		3	12	0.7	1	0.1
Culinary total	251	84	264	599		495		220	345	110	469	1144		448	
Percent culinary	69.3	59.6	65.0		65.9		52.3	72.1	64.0	63.2	69.8		67.7		54.3
Kwahe'e B/w									6			6	0.6		
Santa Fe B/w	3	1	5	9	1.0	2	0.2	8		4	5	16	6.8	16	1.9
Wiyo B/w			1	1	0.1	4	0.4	1	1		1	3	0.2	3	0.4
Biscuit A	20	11	28	59	6.5	15	1.6	2			2	4	0.2	12	1.5
Biscuit B	12	11	35	58	6.4	53	5.6	7	22	7	26	62	3.7	16	1.9
Sankawi B/c	5	5	7	17	1.9	93	9.8							1	0.1
PII-III M/w									1			1	0.1		
PIII-IV C/w	15	6	13	24	3.7	74	7.8		1	1	3	5	0.3		
Whiteware	44	15	44	103	11.3	187	19.8	10	18	1	11	40	2.4	21	2.5

Table 2.3. (continued)

	Tsankawi Cavates							Frijoles Cavates							
Ceramic Type	N	C	S	Total N	%	Tsankawi Pueblo	%	A	F	I	M	Total N	%	Yapashi Pueblo	%
Tewa plain buff		3		3	0.3	2	0.2		2	6	6	14	0.8		
Historic polychrome											1	1	0.1		
Matte-decorated total	99	52	133	284		434		28	51	19	54	152		69	
Percent matte-decorated	27.3	35.9	32.8		31.2		45.9	9.2	9.5	10.9	8.0		9.0		8.4
Kapo Black											1	1	0.1		
Plain Red	3			3	0.3	6	0.6		1		3	4	0.2		
Potsuwi'i Incised		1		1	0.1	3	0.3		2		3	5	0.3		
Plain total	3	1		4		9			3		7	10			
Percent plain	1.7	0.7			0.4		1.0		0.6		1.0		0.6		
Glaze A															
Agua Fria G/r	1			1	0.1	1	0.1		3	2	4	9	0.5	13	1.6
Cieneguilla G/y											1	1	0.1	2	0.2
Cieneguilla G/poly								1				1	0.1		
San Clemente G/poly								1	1	1		3	0.2		
Glaze B															
Largo G/r									2			2	0.1	3	0.4
Largo G/y										1	1	2	0.1	5	0.6
Largo G/poly														5	0.6
Glaze C															
Espinosa G/poly										4	1	5	0.3	4	0.5
Glaze D															
San Lazaro G/poly						1	0.1	9	14	4	7	34	2.0		

Table 2.3. (continued)

Ceramic Type	Tsankawi Cavates N	C	S	Total N	%	Tsankawi Pueblo	%	Frijoles Cavates A	F	I	M	Total N	%	Yapashi Pueblo	%
Glaze E															
Puaray G/poly						1	0.1				3	3	0.2		
Escondido G/poly									4			4	0.2		
Pecos G/poly						1	0.1								
G/r bodies	6	3	4	14	1.5	1	0.1	34	79	17	72	202	9.9	151	18.3
G/y bodies	1			1	0.1				1	1	4	6	0.4	51	6.2
G/poly bodies	1	2	4	6	0.7	2	0.2	12	35	15	49	111	6.6	74	9.0
Unidentified glaze									1			1	0.1		
Glaze total	9	4	9	22		7		57	140	45	142	384		308	
Percent glaze	2.5	2.8	2.2		2.4		0.7	18.7	26.0	25.9	21.1		22.7		37.3
Grand total	362	141	406	909		945		305	539	174	672	1690		825	
Percent	39.8	15.5	44.7		100.0		100.0	18.0	31.9	10.3	39.8		100.0		100
Ceramic dates	1300-1650	1300-1650	1300-1650			1250-1650- or 1675		1225-1550	1100-1175/ 1315-1550	1275-1525	1250-1550/ 1695-1725			1250-1675	

Black-on-cream suggest either that cavates were not occupied as long or that the use of Sankawi Black-on-cream differs at the cavates.

In the Frijoles groups, Group A (1225-1550) is estimated to have been first occupied at 1225 because of the amount of Santa Fe Black-on-white relative to Wiyo and later black-on-whites. Group F (1100-1175 and 1315-1550) seems to have seen two separate occupations, one during the late Developmental Period and another during the Classic Period; the absence of Santa Fe Black-on-white suggests that Group F was not in use during the Coalition Period. This pattern is consistent in both cliff cavate and tent rock ceramic subgroups at Group F. With only two Santa Fe Black-on-white vessels represented, Group I (A.D. 1275-1525) shows little evidence of a late Coalition Period occupation; at the terminus of its ceramic sequence, Glaze D polychromes are more similar in rim form to earlier Glaze C forms than to the Glaze D examples encountered in other cavate groups. These facts suggest that Group I may have had the shortest period of occupation of all the sampled cavate groups, with a late beginning date and an earlier ending date. Group I also has the fewest ceramics tallied, though the sample area is comparable to those covered at other cavate groups. This low frequency of sherds may also be a reflection of a shorter occupation span; whatever the cause, a sample size problem is evident which is critical in assessing the validity of the temporal placement of the group. Group M (1250-1550 and post-1695 [to 1725]) shows the only clear evidence of early historic ceramics. A single Kapo Black and historic polychrome jar base were the only representatives of this late assemblage in the 1986 sample. Turney's 1948 work (see Table 1.1) presents other evidence for Pueblo Revolt-early eighteenth-century occupation at Group M. The mid-1200s-mid-1500s occupation at Group M is indicated by the continuum of decorated types from Santa Fe through Biscuit B and Glaze E ceramics. Glaze D seems to have lasted longer than the traditional 20-year span, ending in 1515, while the Glaze E sample is largely finished in muted fawn and tan tones, a style of coloration likely coeval with late Glaze D and predating what may be the later use of light cream slips in Glaze E. This is the basis for the terminal date assignment of 1550 for the initial occupation of Group M. No Glaze F was identified at any of the cavate groups sampled.

Ceramic samples from the Tsankawi Pueblo proper suggested a date of 1250-1675 based on conventional time spans for the production of Sankawi Black-on-cream in conjunction with minor but consistent amounts of Santa Fe and Wiyo Black-on-white. Beginning dates nearer 1300 and ending dates nearer 1650, however, may be more appropriate. Cavate samples suggest a similar time span for those features. No confidently identifiable glaze types were found in the cavate samples, but the impression from partial rims and surface attributes of glaze sherds is that glaze import became more common during and after Glaze D; a similar situation was noted in the mesa-top pueblo samples as well.

Two other cavate groups in Frijoles Canyon, sampled during the 1985 test survey, also had ceramics indicative of late occupation. Cavates B-70 and B-71 (portions of Groups C and B respectively as defined in the 1985 pilot survey [McKenna and Powers 1986]) had even fewer sherds than the present sample of cavates, but they had early historic types of Kapo Black, Tewa Polychrome, and Glaze E. These cavate groups were dated 1450-1700 and 1500-1700 respectively. Here again, sample size problems undoubtedly affect the assessment of occupation span. Cavate pueblos sampled away from the main clusters in Frijoles Canyon and around Tsankawi show earlier, more discrete occupation spans. LA 50909, south of Frijoles Canyon in the Corral Hill area of Bandelier National Monument, was primarily a Coalition Period site dating to 1200-1425 (McKenna and Powers 1986: Table 9). Coalition Period occupation was also the main period for cavates surveyed north of Bandelier by the Pajarito Archaeological

Research Project (Hill and Trierweiler 1986). Especially when viewing sherds on the surface, the long-term aggregation associated with communal pueblos and cavates is a major factor in making occupational episodes at cavate groups indistinct. The trend to aggregation is stronger at lower elevations (such as Tsankawi) than at higher ones (such as at Yapashi).

Ceramic Patterns

The chi-square statistic was used to test for differences in the ceramic samples from the cavates. Vessel forms, reduced to open ("bowls") or closed ("jars"), ware, and provenience, were the dimensions of the tests. Data and test results are presented in Table 2.4. The 0.05 level was accepted as significant.

In the tests of intrasite sample areas for Group F and at Tsankawi, we found no differences in the general vessel populations. Clearly, surface ceramic evidence cannot be used to support special use of cavates at the intrasite level as presently measured. However, considering only decorated ware in the Tsankawi red tuff cavates (south sample area), there is a significant difference in vessel form between the cavates in the western and eastern halves of that subgroup (Test 1): a greater than expected number of whiteware jars is found in ceramics associated with the western red tuff cavates.

In the comparisons between areas at Tsankawi (Test 2) we found a significant difference between the northern area and the central and southern areas. The number of jars is higher than expected in the northern area, while bowls are more common in the central and southern areas; northern and southern area distributions are the strongest contributors to this pattern. Distributions of service ware only (Test 3) reinforce this observation, with bowls being more common in the southern and central areas and jars more common in the northern cavates. A test of ware distributions (Test 4) shows culinary (exclusively jars) more than expected in the north area, which again contributes to the value of the chi-square in determining a significant difference in form distribution between these cavate subdivisions at Tsankawi. In comparing cavate ceramic distributions with those of the pueblo, we found general agreement in form ratios (bowls:jars--Tsankawi=1:2.9; cavates=1:2.9), but the number of decorated bowls (Test 5) is higher than expected at the cavates, as compared to the main pueblo midden sample, where jars are more common.

We found no significant difference in form distributions among the Frijoles cavates. Form distribution, however, does seem to differ between cavate sites and some communal pueblos. A test (Test 6) of distributions of culinary versus service ware shows that culinary ware is significantly more abundant at cavate sites, while service wares are relatively more common at communal pueblos. Since culinary ware consists almost entirely of closed forms, it follows that closed forms will be relatively more common on cavate sites in later tests. Comparison of all forms among the Frijoles cavates, Yapashi, and Tsankawi Pueblo plus cavates (Test 7) shows the Yapashi and Tsankawi samples to be higher than expected in bowls while the Frijoles cavates are higher in jars. A test of the Tsankawi Pueblo and cavate ceramic forms showed no significant difference, permitting us to treat them as a unit in Test 7. A test considering only service wares (Test 8), however, shows that the Tsankawi sample is higher than expected in bowls and the Frijoles cavates are higher in jars, while forms at Yapashi occur as expected. Some differences may be related to trends in ware forms: glazed ware production is more often associated with closed forms and Tsankawi's matte-paint bichrome tradition with bowls. Some differences may also be related to differing emphasis in site functions involving ceramic use. However, the consistently low value for the coefficient of contingency (Table 2.4) indicates a weak association between site types and the ceramic dimensions of form and ware in the present data.

Table 2.4. Ceramic Form and Ware Data and Significance Tests.

	All Ceramic Forms[a]			Decorated Only		
Site	Bowls	Jars	Test No.	Bowls	Jars	Test No.
Frijoles cavates						
A	47	206		47	26	
F	119	424		119	80	
I	38	136		38	26	
M	110	553		110	70	
B-70 (C)	14	56		14	15	
B-71 (B)	21	54		21	14	
Tsankawi cavates North	69	280	2	69	29	3
Central	40	101	2	40	17	3
South	120	285	2	120	21	3
Frijoles cavates A-M	314	1319	7	314	202	8
Tsankawi cavates	229	666		229	67	5
Tsankawi Pueblo	255	645		255	150	5
Tsankawi all	484	1311	7	484	217	5, 8
Yapashi Pueblo	234	572	7	234	124	8
Intra-site						
Group F Lower	53	210		52	43	
Remainder	66	214		66	37	
Tsankawi (south sample) East half	83	196		83	9	1
West half	37	89		37	12	1

	All Ceramic Wares		
Site	Culinary	Decorated	Test No.
Tsankawi North	251	98	4
Central	84	57	4
South	264	141	4
Tsankawi cavates	599	296	6
Frijoles cavates	1104	540	6
Yapashi Pueblo	448	377	6
Tsankawi Pueblo	495	450	6

Table 2.4. (continued)

Test No.	N	χ^2	degrees of freedom	probability	Contingency Coefficient	Cells <5
1	141	5.456	1	0.020		
2	895	10.250	2	0.006	0.106	0
3	296	9.216	2	0.010	0.174	0
4	895	7.929	2	0.019	0.019	0
5	701	16.596	1	0.000		
6	4309	84.469	3	0.000	0.139	0
7	4234	39.476	2	0.000	0.096	0
8	1575	8.834	2	0.012	0.075	0

[a]Unknown forms excluded.

The distinction in ware varieties between Tsankawi and Frijoles needs no test to illuminate it. All samples show culinary ware as the majority of the ceramic assemblage. The culinary wares are distinct between the two areas. The micaceous paste Tesuque series dominates the Tsankawi assemblage, and the sand-tempered utility wares of the Rio Grande series are most abundant in the Frijoles cavate sites. The pattern in decorated or nonculinary ceramics is even more apparent: glaze-paint ware is clearly associated with the Frijoles cavates (23 percent of the assemblage), while nonglaze service wares are associated with Tsankawi (31 percent). Although the ordering of the ware representations is clear, there is relatively more matte-paint material in the Frijoles sample (9 percent) than there is glaze-paint material in the Tsankawi sample (2 percent); see Table 2.3.

Summary

As might be expected, the surface sherds inventoried at the Bandelier cavates provide date groups too broad to be useful for fine temporal comparison or structuring in analyses of architectural variability. All architecturally sampled cavate groups overlap for some undeterminable period(s) during their occupation; it is not possible to isolate "earlier" from "later" groups of cavates either within or between sites based on the ceramic sample. Temporal differences are present, but the nature of the ceramic samples does not permit their correlation to groups of cavates within sites or the meaningful temporal placement of cavate sites relative to one another.

Temporal holes exist which may relate to some cavate variation, but confidence in assessing those "holes" depends on the willingness to accept chronological evidence from very sparse, widely scattered, and heavily picked-over ceramic assemblages. The present sample suggests the following major temporal distinctions: (1) the early, apparently noncontinuous, occupation of cavate Group F; (2) the post-Pueblo Revolt historic reoccupation of Group M; (3) the apparently relatively short, possibly less intense, occupation at Group I. These distinctions generally suggest that occupation of cavates was discontinuous, at least in the Frijoles groups. The spotty evidence of historic reoccupation is clear at Groups M, B, and C. Prehistoric periodicity in occupation is also suggested by stylistic trends in some cavate groups, such as the similarity of Glaze D to C rims in Group I, and by the apparent discontinuity in some type sequences (though this may be reading more into the sample/type tabulations than is warranted). At Tsankawi no temporal distinctions are evident among the cavates or between the cavates and the main pueblo.

Some functional differences are suggested between cavates and between cavates and nearby communal pueblos. A difference in functional emphasis at cavate sites is implied by the greater-than-expected number of culinary vessels. The association of closed forms with the Frijoles cavates is particularly strong, since both culinary and service-ware jars occur more often than expected. Such a difference might indicate use of cavate sites for living and cooking, or it might result from an emphasis on storage in cavates. Better samples and more detailed analysis of excavated samples are needed to refine this interpretation. While culinary ware forms the majority at all sites examined here, we suspect that this may be at least in part a function of long collection of decorated sherds. Some differences in the proportion of service ware in sections of the red tuff cavates and in vessel forms between the cavate subgroups at Tsankawi also suggest some functional variation within cavate groups.

Economic and possibly ethnic differences are certainly reflected in the relative proportions and types of wares in the Tsankawi and Frijoles samples. The relative proportions of micaceous to sand-tempered culinary, and matte-bichromes to glaze-paint ware, are reversed in the two areas. This clearly indicates differing patterns in ceramic circulation and, by extension, in spheres of production and exchange. Nevertheless, functional patterns of ceramic use, when compared with a limited sample of community pueblos, tend to crosscut these differences in both the Tsankawi and Frijoles cavate samples. This indicates a measurable difference in site types, which may be more clearly expressed in architecture than in ceramics.

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1. This count includes all traces of former rooms. Figure 2.10 shows at least 32 excavated rooms.

2. Santa Fe Black-on-white is also a minority type at Tyuonyi and, as at the cavates, its presence appears to reflect early occupation. Although Tyuonyi was probably constructed between the late 1300's and early 1500's, tests conducted by Onstott (1948) below the earliest surface in Tyuonyi's plaza revealed Santa Fe Black-on-white and contemporary utility wares suggestive of a late Coalition occupation. A higher plaza surface with Santa Fe Black-on-white and early glazes is either associated with the remains of an early structure or the early building stages of the present pueblo (Onstott 1948; Van Zandt 1994).

3

Recording Procedures, Group Attributes, and Cavate Condition

Recording cavates presents an interesting archaeological problem. On the positive side, many features not normally visible without excavation are exposed without the time and effort required for digging. On the negative side, cavates are difficult to survey because they are numerous, because they are exposed to various types of degradation, and because recording all the data available would consume much field time. To take advantage of these data-rich, well-preserved features, a survey on the Pajarito Plateau must compromise between recording a few cavates in extreme detail and recording many of them in insufficient detail. A major goal of the 1986 fieldwork was to develop a procedure for efficiently recording enough cavate data to understand variability in their construction and features. Although it was not so used, the recording method was intended for dealing with cavates encountered by the survey. The sample of cavates and associated features recorded by this pilot study provides baseline information on cavate variability, as well as on the condition of this particular set of features.

Recording Procedures

Cavate and Noncavate Forms

The prehistoric Pueblo people had many techniques for using the tuff cliffs of the Pajarito Plateau. In some cases they hollowed entire chambers out of the cliff, leaving a small door. In others they seem to have excavated a large chamber and then built the front wall of the room entirely of masonry. The proportion of room excavated into the cliff ranges continuously from a fully excavated chamber with a tuff front wall, to a masonry-fronted completely excavated chamber, to masonry-tuff combination rooms, to mostly masonry rooms with back walls somewhat indented, to rooms that used the otherwise unmodified cliff with some viga holes bored in it. Edgar Hewett recognized and described this range at Puye:

> We note here three classes of dwellings. 1. Excavated, cavelike rooms, serving as domiciles without any construction in front. 2. Excavated rooms with open rooms or porches built on in front . . . 3. Houses of stone, one to three stories high, with corresponding terraces, built upon the talus against the cliff. In these groups the excavated chambers now seen in the cliff wall were simply back rooms of the terraced buildings. . . . An examination of the talus discloses remains of several villages of considerable extent that were built against the cliff. (Hewett 1908:19)

This variability adds another dimension to the problem of recording sites with cavates. The situation is further complicated by processes of erosion and falling blocks of cliff, and by the fact that masonry is more susceptible to disintegration than are cavate rooms. To attempt to address the problem, we used two types of forms in the field, one for cavates and the other for noncavates. The noncavate form was designed for rapid recording of rooms showing little cliff excavation. Such rooms clearly lack many of the features that more completely excavated rooms may have (Figure 3.1). The difficulty comes when deciding which form to use for borderline features. Copies of the forms as they were used in the field, the coding conventions, and the dates of added categories are given in appendix 1.

Our use of these forms was influenced to some extent by the evolution in our perception of the project's goal. Initially the focus was on cavate structures as unusual architectural features in need of better recording, with a nod to other associated features. Early in the field season we adopted a somewhat different and, we believe, better approach: the recording of whole sites. In two respects, we did not attain the goal of full-site recording. First, we noted but did not record in detail architecture that had no manifestation on the cliff, such as rubble mounds and walls. Second, we did not record artifact samples. The latter shortcoming was partially remedied by a later field inventory of surface ceramics (see chapter 2).

The use of two forms allowed us to separate features into analytical classes and also shortened the time spent recording partial features. Reduced recording of partial features is acceptable because they contain less aggregate information and waste many form entries. As our working definition of a cavate in this study, we specified that a feature must be enclosed on at least three sides and have some remaining sheltering qualities. Some judgment is required to gauge the completeness of a cavate room, and the decision is complicated in some cases by erosion of the exterior edge. We recorded cavates we considered reasonably complete and made an ordinal estimate of the completeness of all cavates. The noncavate category includes badly collapsed former cavate rooms, excavations in the tuff for rooms that were largely built rather than excavated, and other prehistoric, artificial cliff features. Completely natural pockets or overhangs showing prehistoric use should be recorded with their natural origin noted, but during our recording we found no examples of cavates we regarded as completely natural.

In the field the distinction between a cavate and a noncavate usually centered on whether the feature was judged to be sufficiently intact and to contain sufficient information to merit detailed recording. Early in the recording (especially at Group M) there was greater variability in application of differentiation criteria. On the whole, as the season progressed we tended to make greater use of the noncavate form in the case of partial rooms. Group M has a relatively low number of noncavates, which is partly an artifact of this adjustment period and partly the result of the occupants of Groups F and A having made greater use of the cliff as a back wall with no excavation than did the builders of the other three groups. A standardized list of noncavate feature types did not exist during the field recording. The categories we used, however, fell into a fairly restricted range and were placed into the following groups during the data correction phase: back wall, partial cavate, filled cavate, chamber, hand-and-toe hold route, cliff niche (see also Table 3.1). The cavate form includes an estimation of room completeness, which thus becomes an important screen for chamber analyses, since it allows sorting of observations into reliability categories.

Another carryover from the initial inclination to treat the two categories differently is that features within noncavate rooms were

Figure 3.1. *Schematic drawing of three cavates and two noncavates, showing feature types. At upper left is a row of viga holes defining a noncavate backwall; at lower left is a mostly filled cavate that would have been recorded on a noncavate form in 1986. At mid-left and upper right are the most common form of cavate, which would have been closed by masonry, and at lower right is a fully enclosed cavate with an exterior door. Note the truncated pyramid shape, and how wall plaster extends only partway up the wall. Ceilings are smoke-blackened and show digging stick marks. The features shown, with code numbers, are as follows:*

2 Exterior door	*10 Slot*	*19 Interior door*
4 Firepit	*11 Viga holes*	*26 Exterior opening*
6 Floor ridge	*13 Loom anchors*	*27 Ceiling*
7 Floor pit	*14 Upper loom supports*	*28 Indeterminate holes*
8 Large floor-level niche	*15 Smokehole*	*37 Wall depression*
9 Wall niche	*16 Vent*	*40 Metate rest*

sometimes measured by ranges (which was our initial intent) and sometimes individually (which we concluded was preferable). Features recorded only within a range obviously cannot be used the same way as individually recorded ones (though ranges *are* decidedly faster to measure and record). In the spirit of full-site recording and monitoring of the full range of variability, the two-form approach had its uses, but the forms should have been fully congruent in terms of codes and feature recording. It is probably preferable to have a single form with a rigorous set of room types, along the lines enumerated by Hewett (1908; see above).

Although we had both computer and paper forms for recording data, only the paper form is presented here and in appendix 1. The computer form was slightly different, but all the same information was recorded in both formats, and all data are, of course, now equivalent in the various data bases. Certain classes of information do not apply to certain sets of features (firepits do not lead to other rooms, and a wall does not need a precise location). These classes of features are separated on the paper form, with only the variables relevant to each included. We stressed the avoidance of redundancy in recording, so that notes relative to specific features, such as condition of walls, were entered with the features rather than with general room notes.

Discussion of Codes

Although all the "variable states" are presented in appendix 1 with the forms, several variables require further explication, and some need reconsideration after field use.

Chamber Location

Locations of features within cavates were recorded with a two-part system: by chamber portion, such as right or left wall or floor, and by means of azimuths from a point as near as possible to the center of the room. The chamber portion was usually a straightforward assessment, though partitioning walls in curved chambers sometimes required subjective judgments. Azimuth location of features and measurement of height above floor give a relative location of all features relative to all others. The compass was usually located by establishing the intersection of the diagonals across the room. Taking an azimuth to a feature requires reducing it to a point; we shot to the center of features. Long Awanyu petroglyphs and whole walls are not amenable to this treatment, so we did not take azimuths to them. Ideally, every feature would also have a distance measured to the "Brunton station" (the compass location), but this procedure would greatly increase the recording time. As a compromise and a means of better locating walls, we adopted the practice of taking angle and distance to distinct chamber features. Chamber corners were given preference, but other features occasionally had to be used. Given these basic measurements it would be possible either to relocate the measurement point with considerable accuracy or to create a rough plan of a room from measurements. The measurements would be especially useful for reconstructing feature layout to record station-to-feature distances to all floor features, though we did not do so in 1986. Rooms that did not have enough space or floor for setting up the compass lack azimuth locations for features.

Shapes

Given the variety of chamber and feature shapes present in the cavates, it is clear that measurements are far more meaningful if associated with a shape. This requires visualizing features as regular geometric figures, which is often not easy. The effort is worthwhile, however, because it makes the measurements more accurate and appropriate while also serving to describe the features. The use of fractions further refines the information collected.

Geometric Fraction

The two fraction codes--geometric and feature--probably caused more discussion and confusion than any other part of the recording process. Geometric fraction is intended to be a descriptive code and to complement the assignment of a shape to a feature. Because features often do not conform well to purely geometric shapes, geometric fraction is an estimate of how much of the shape assigned and measured is actually present. For example, if a chamber most nearly approximates a rectangular solid, but a portion of the whole solid is missing because of curvature of the cliff at the opening of the room, estimating the amount of the solid that is present tells the analyst that the volume of the room is perhaps only 80 percent as large as the measurements suggest. It is often possible to refine the estimate of how much of a shape is present by measuring the "missing" portion. Portions of circles were used to record semicircular shapes. By multiplying the figure derived for the shape measured by the geometric fraction, actual volumes and areas can be more closely approximated.

Feature Fraction

In contrast to the descriptive nature of geometric fractions, feature fraction is interpretive. The recorder assesses the feature as it now exists and estimates how much is missing. There is a subjective element here, of course, but--particularly in the case of fairly complete features--it does not require wild guessing. These estimates can be used as confidence limits in analysis of feature measurements. That is, measurements for whole or nearly whole features can be used with confidence; the more of the feature that is missing, the more suspect the measurements become. In cases where it is very difficult to estimate how much of the feature is present, usually because so much of it is missing, assignment of a very low feature fraction flags the measurements as probably unreliable for inclusion in size assessments. Feature fraction values of greater than 0.7 were usually required for inclusion in feature dimension analysis.

As an example of how the two fractions interact, consider a viga hole that is basically cylindrical but has a portion of the cylinder missing because of its location in a slanted wall. It might be recorded as having a geometric fraction (GF) of 0.8. Inspection of the edges of the viga hole show that the feature is still intact as it was used, so the feature fraction (FF) is 1.0. The GF and the FF will be the same if it is apparent that the feature was originally a regular shape, none of which has been removed through deterioration.

One cause of confusion is the tendency of some features (openings, especially doors) to become larger rather than smaller when they deteriorate. Whenever possible we measured what we considered to be the original feature. This was possible when, for example, two sides of a door remained but the other two were broken away; in such a case, the FF would be entered as 1.0. Where we measured an opening that was clearly larger than the prehistoric fact, we could assign FF greater than 1.0. Again, as values approach 1.0, they are more reliable. To reiterate, geometric fractions describe what is present and help correct area and volume calculations; feature fractions are interpretive judgments of how much of the original feature is present and place a rating on the reliability of measurements. FF values close to 1.0 could be used to estimate full measurements of original features.

Evidence for Construction

This variable involves the straightforward observation of various construction features. It does, however, result in some mixture of phenomena. That is, digging stick marks (Figure 3.2) are clearly evidence of part of the construction of a cavate. The other code values deal more with features that were made,

Figure 3.2. Example of digging stick marks in the ceiling of A-10. These are especially visible because they cut through the smoking of the ceiling. Presumably they are evidence of cavate construction and/or expansion.

such as shaping of corners or doorways. Although these are somewhat inconsistent, I do not see this as a major problem, especially in view of the scarcity of evidence of construction other than digging stick marks. Some chambers contain fairly clear evidence of having been enlarged after having been used for a while (Figure 3.3). Although we had no code for this (it was mentioned in the verbal notes), one might be useful in future recording.

Unusual Tuff Characteristics

A more fruitful approach to this variable would have been to call it something like tuff type. The tuff in given areas tends to be similar, though it can vary considerably within a site area, notably at Tsankawi and Group A. Slightly redefining this variable would have permitted a meaningful entry for each cavate, rather than lumping many cavates into an ill-defined "normal" group. Somewhat by default, "normal" in our observations means basically the fine-grained, white to very light gray tuff seen particularly in locations such as Frijoles Groups F and I.

Rooms Up/Rooms Down

This observation places a room within its group by specifying how many rooms are up-canyon and how many are down-canyon to the

Figure 3.3. Evidence for chamber expansion in M-10. The plaster and smoking of the back wall stop at the juncture with the right wall. A single coat of plaster is present on the right wall, while the back wall has several coats.

ends of the group. It turned out to be a difficult blank to fill in the field, so the values were all entered after the field season when complete recording and maps were available. Counting rooms is far from exact in these sites because cliff features are subject to several interpretations. We made a careful count as we began to record each group in order to assign room numbers, but we invariably found that we had to add rooms as we studied features carefully during recording. Thus, counts from parts of groups not recorded (as at Groups A, F, and M) are likely to be somewhat low. In determining the entries for this variable, we treated columnar sections of cliff, so that multistory rooms above one another and rooms that opened off the back of other chambers all had the same number of rooms up- and down-canyon. This means that the counts are not a steady progression as one moves through the group unless rooms are single-level without back chambers. In addition to the potential for seeing whether location in group seems to relate to size and function, this observation is helpful in locating rooms.

Level

An observation that could better and more easily have been made in the field was added after we returned from the field. Each room was placed according to its level (or story). We also noted how many levels were present at that location. Thus each room now has an observation of the type "second level of three." In some instances intervening or underlying levels may have been present but not visible, so we assumed some other means of access to the upper levels. Such an assumption is more plausible for fully excavated cavates than for rooms evident only as back walls. Recording this attribute has the added practical advantage of helping to locate rooms, as does the rooms up/rooms down variable. This variable is also relevant to the possibility of assessing the distribution of functions and room sizes.

Noncavate Data Sets

As noted, the separate form for recording noncavates was a good idea that would have produced more useful results if it had been more completely compatible with the fuller cavate forms. Anyone using noncavate records individually should be aware that the first feature notes (rather than the base notes) often contain most of the observations on the noncavate; this is because the first feature is often most of what remains to be recorded. Several of these compatibility problems could be fixed by examination of the records. Here again, we made some later modifications to the data set.

Feature Type

On the field form this was a verbal entry, which gave rise to a variety of classes. The variability was reduced and the responses were made to follow a more consistent set of criteria. I would recommend that future cavate recording use a coded list, such as this, rather than verbal entries. Possible responses now include:

1. Back wall. The category for which the noncavate form is most appropriate is the common instance where a masonry room was clearly placed against the cliff. Evidence for this feature includes rows of viga holes, wall features (niches, other holes), and plaster. In most cases these features involve little or no excavation into the cliff.

2. Partial cavate. Features included in this category have at least portions of one or more walls in addition to the back wall. As a result of this definition and the nature of the archaeological remains, this category contains a wide variety of features. The use of the noncavate form was intended in part to cover remains that, for whatever reason, had little visible information. Thus features that might literally be "partial cavates" were in many cases recorded as cavates. Partial cavates probably result in about equal measure from the loss of fronting masonry structures from only partially excavated rooms and from the loss of natural exterior walls. Although we cannot know with certainty, I believe the former is probably the more common cause.

3. Filled cavate. Certain areas, particularly at Tsankawi and Group M, have a great deal of architectural and natural fill against the cliff base. In these areas only the top of an opening to a chamber is sometimes visible. There is no doubt that cavate rooms are present, but they are largely unmeasurable.

4. Chamber. In a few cases the noncavate form was used for more or less intact chambers. These should probably have been recorded on cavate forms. They were placed on these forms because there was some question as to their prehistoric use and artificial origin. Because of the absence of features, however, loss of data and comparability was minimal.

5. Cliff niches. These features are peculiar to Tsankawi (see chapter 4). They appear to have been outside rooms so that assignment of room numbers to them is inappropriate. They are recorded on forms both individually and in groups; they have all had their room-number values set to zero.

6. Trails and hand-and-toe hold routes. There are two instances of extramural routes on noncavate forms from Group A. Other examples are present at Group I and Tsankawi, but they were not recorded on forms. Although recording these is difficult, perhaps it should have been done. These features also have room number values of zero.

Table 3.1 shows the distribution of these noncavate features at the groups studied.

Connected with Cavate

This is filled in only when a noncavate and a cavate are physically linked by a feature. The most common example occurs where a door to a cavate goes through a back wall or partial cavate. In a few cases, a vent passes through a wall between a noncavate and a cavate, and these have been coded as connected.

Condition/Damage

The first version of the noncavate form had only a single code for condition. During the recording of Group M (M-53 and after) this was

Table 3.1. Distribution of Noncavate Feature Types.

Feature Type	Group A	Group F	Group I	Group M	Tsankawi	Total
Back wall	37	38	14	9	27	125
Partial cavate	10	7	0	7	21	45
Filled cavate	0	0	2	3	2	7
Chamber	1	0	0	0	2	3
Hand & toe routes	2	0	0	0	0	2
Cliff niches	0	0	0	0	4	4
Total	50	45	16	19	56	186

split into human and natural damage; we reconstructed the damage codes for the early forms from the information on the forms.

Cavate Type

This variable was added after the fieldwork to link the cavate and noncavate records. All cavate records received the code "cavate," while noncavate records were coded as one of the noncavate feature types listed above. In retrospect, it would have been useful to classify both "fully enclosed cavate" and "excavated portion of partially masonry room" as types of cavate, since many of the current noncavate "partial cavate" features are excavated portions of masonry rooms. The two cavate subtypes would have somewhat different information recorded, particularly for doors: enclosed cavates have true "exterior doors," while the back portions of partly masonry rooms would be "exterior openings."

Collections

Materials collected were limited to perishable items that seemed likely to carry information and to be possibly at risk of disintegration (see appendix 1). Two possible coprolites and a fused clump of corn were collected from Group M. A possible squash rind was collected from Group A. Most important, several bones from a very small infant were collected at Tsankawi. These remains were exposed in the disturbed fill of a room. Given the heavy visitation at Tsankawi, we decided to collect the exposed elements pending decisions on how best to deal with the vandalism of the deposits and how to most properly treat the burial.

Rock Art

Recording rock art is a time-consuming and specialized process. In recognition of this fact, we initially planned only to note the general size, location, and subject matter of rock art as features during recording. We were extremely fortunate in having June and Bill Crowder to do supplemental recording of the rock art. They took photographs, recorded locations, and compiled a summary of the rock art that was present in the sections where we worked, providing a much more detailed record of rock art than would have otherwise been available (see chapter 4).

Mapping

We made a plan map for each of the Frijoles groups. The procedure was to establish Brunton compass stations, run a long tape along a recorded azimuth, and take right-angle measurements (right angles verified by Brunton) to edges of rooms along the line. Later Brunton stations were established on the line as made necessary by cliff curvature and topography. The first group we mapped was Group M, and we attempted to place all rooms at all levels, which proved time-consuming and resulted in a confusing map. The remaining maps measured only the rooms at cliff base, with higher rooms recorded in their relative locations, with level (or story) keyed. The maps locate only the edges of openings of rooms and do not reproduce floor plans. As discussed in chapter 2, this volume includes plane table maps made by the Bandelier Survey crew when they are available. The map for Group A (Figure 2.5) was made by the technique described here; the maps for Groups F, I, and M (Figures 2.10, 2.14, and 2.17) were made using a plane table and alidade by crews from the park survey. The plane table maps do render chamber shape, but not floor plan. We did not draw a plan for the Tsankawi group (LA 50976) because of the availability of Lister's map (1940b). The map included here is based on Lister's enlarged and updated map and a park survey detailed sketch map to show rooms added by this project (Figure 2.19).

Frontal elevation or profile maps were drawn to compensate for the lack of measured plan locations (Figures 2.6, 2.11, 2.15, 2.18, 2.20). Initially, we hoped that the NPS Branch of Remote Sensing would produce metrically correct elevations for each group; this plan was not followed, however. We therefore had to produce frontal elevations using field sketches and combinations of distant and close-up photographs. Because they attempt to render very irregular surfaces flat, and because of the perspective problems inherent in transferring from uncorrected photos, scales are approximate. Although not metrically correct, these elevations do show relative locations and shapes of rooms. The survey field crews also made more detailed elevation maps of Groups F, I, and M. The Group F survey map and elevation have been modified to reflect cavate project room numbers; the survey crews used cavate project numbers for the Group I and Group M maps.

Individual maps were drawn for only a few rooms, all at Tsankawi. One of these rooms had a complex floor plan due to chamber expansion, one had many floor features revealed by extensive brushing and is heavily visited, and one contained the infant remains and some disturbance, as noted above. Although it would be desirable to have plans and profiles for each feature, angle and size measurements and complete video coverage help compensate for that lack.

Photography and Video Recording

Photographic recording fell into four categories. First, Bill Crowder made photographs (mostly 4 x 5) of the fronts of all the Frijoles cavates that we recorded. Detailed photography of cavate fronts is complicated by the steep slopes in front of many of the rooms, as well as by the high vegetation in some areas. Second, as noted above, the Crowders took photographs of each rock art panel in the areas recorded. Rock art photography can also be difficult, but through experimentation and darkroom techniques, most figures are visible in the photographs. Third, the archaeologists photographed specific examples of features and room groups. Such record photographs were kept to a minimum because of the complete videotape coverage. Lister (1940a,b) had taken some pictures of groups in which we worked. In Groups A, F, and I and at Tsankawi we took pictures from the same angle to show change after 46 years (Figures 2.7, 2.8, 2.12, 2.13, 2.16, 2.21). Fourth, we made videotape recordings of each room recorded. Videotape has proven extremely useful in mapping of underwater archaeological sites, and it seemed likely to be useful in cavates as well. After the completion of standard recording in each group, two people (one handling camera and color, and one serving as coach and carrying props) proceeded back through each room filming each feature inside and out and attempting to point out features in each. The videotapes form a complete, economical, readily archived, and easily referenced record of the current condition of the cavates included in this preliminary project. Videotape has other advantages, as well. It allows detailed mapping of plaster, features, and rock art if such drawings become necessary, without the great expenditure of field time required to draw such maps on site. Since the completion of the cavate fieldwork, videotape technology has advanced to allow direct digitizing for computer mapping and recording of features like cavates, although this process is expensive. It is also possible with the proper equipment to produce slides from videotape (C. Schaafsma, personal communication, 1988).

Videotape redefines the position of traditional still photography. If the video recording is of good quality, the videotape will hold more information than still photographs. But photographs still have their uses. In taking photographs for this project we emphasized their use for illustrating reports with examples of features and giving an idea of setting, and the Crowders made extensive use of them for recording rock art. As Bill Crowder's work demonstrates, photographs *can* be used to bring up detail not visible in videos and *can* be of far higher quality. Video technology is evolving rapidly and has advanced since 1986, but still photography retains its important place in recording, especially given the levels of expertise and types of equipment available to most archaeological projects. Photographs are more accessible than videotapes, since they do not require special equipment for viewing; however, they are also an archival headache. Since we were fairly satisfied with the results of videotaping, we took fewer still photographs than we would have done otherwise.

Assessment of "High Tech" Techniques

During the cavate fieldwork we used two tools that could, in 1986, be considered high-tech: direct entry of data into a laptop computer, and use of a video camera for recording features. (As noted above, the possibility of using remote sensing for producing elevations was eliminated before we even went into the field.) Both laptops and video cameras have great potential for fieldwork, and this is an evaluation of their usefulness as applied in Bandelier in 1986.

Direct Data Entry

Computer technology and capability are advancing even faster than video recording, and many of our experiences in 1986 could be avoided in 1994. Only the portions of what we learned that remain relevant are presented here. Data entry in the field has some well-known advantages: it circumvents a lengthy phase of data entry after leaving the field (time was projected to be short at the end of the cavate project field season and key-punching personnel scarce); it reduces keystroke errors because there are fewer generations of input; it creates legible and easily searched records; and it makes summary information and preliminary analysis available in the field. If the field workers are competent with the hardware and software, data recording can be faster than conventional methods.

Our experience with field data entry was less than a resounding success. File transfers to the mainframe computer were far more difficult than we had been led to expect, and field conditions were harsher than the computer could easily withstand. File transfer problems result from the use of several unrelated software packages (WordPerfect, CEO Write, Oracle) and staff inexperience in file translation. Use of compatible software and participation in field form creation by someone familiar with the program to be used in analysis will prevent these problems. The computer we had was a fancy, expensive piece of equipment--for 1986. It was an 8088-based machine with a single floppy drive, no hard drive, and 512 K of RAM. On the whole it worked well, although we had to be extremely cautious with it. The dusty and gritty nature of cavates would never have been so evident to us if we had not had the computer with us: the keyboard collected grit at an alarming rate, and in spite of careful cleaning after every day in the field, it was always noticeable. The single disk drive necessitated continual insertion and removal of disks, unavoidably introducing more dirt into the machine. Disks went bad at an alarming rate. Even today's smaller, far more capable laptop computers will require means of dust and grit protection if they are to survive and be useful in archaeological fieldwork.

The actual process of data entry went fairly well. There was often considerable difficulty in reading the screen, but an adequate angle could usually be found. Speed of entry was about comparable to pencil and paper form; if anything, I found a tendency to take more complete verbal notes. We found one drawback, at least with the entry format we used: it was more difficult to check an earlier part of the form for previous entries and measurements than it was with a paper form.

Videotape Recording

The advantages of video recording are listed above. Overall, we were pleased with the quality of the picture. The cameras did a remarkable job of recording in the low light of many of the cavates. They also seemed to be less susceptible to the ubiquitous dust and grit than the computer, though that was again a concern. Of course, not every last detail of every wall is visible and well recorded on our tapes. It would probably be preferable to make the videotaping process part of the recording procedure for each room, so that all details could be remarked. This would considerably increase the recording time, however, and would also increase the risk of damage to the equipment, as it would have to be in the field every day instead of on selected videotaping days.

As recording becomes more complex, there is a greater possibility that something will go wrong, and that is what happened here. The microphone of the first camera stopped working partway through the season, leaving large stretches of tape without sound. We remedied this by dubbing in the sound later, but the detail of the commentary undoubtedly suffered. This sort of event can considerably increase the time involved. On the whole, however, the video recording offers the advantages of completeness of coverage available in no other way. Archiving videotapes presents several problems. As of 1994 the NPS still did not have a systematic method for storing and retrieving tapes, although they are used by several units. More troubling, the technology is still new enough that no one knows how long images survive, although there is no doubt that they do degrade and that their storage life is probably quite short (less than 10 years?). To be useful as archival material, tapes of mid-1980s vintage must either be rerecorded onto longer lasting metal-based tape or, ideally, digitized. Digitization does ensure a virtually permanent, archival-quality record.

Work Schedule and Field Time Spent

The approximate distribution of time expenditure for this project is shown in Table 3.2. Adjustments have been made for the varying hourly schedules among the people who worked on the project, but all days have been rounded down to standard work days (that is, some "overtime" does not show). It is quite

Table 3.2. Time Spent and Forms Completed by Cavate Group, 1986.

Frijoles		
Group M	July 8-part of July 17	
LA 50972	fieldwork man-hours: 236	
	cavate records: 46	
	noncavate records: 19	
	total rooms: 140	% recorded: 46.4
	personnel:	B. J. Mills and B. P. Panowski, 7½ days
		H. W. Toll, 6½ days; B. Fuller, 3 (recording)
		Bill and June Crowder, 3 days each (photos & rock art)
Group A	part of July 17-part of July 23, August 14-15	
LA 50973	fieldwork man hours: 170	
	cavate records: 25	
	noncavate records: 50 (48 rooms)	
	total rooms: 130	% recorded: 56.2
	personnel:	BJM, 4 days; BPP, 3; HWT, 5
		BF, 3 days (recording)
		JC, 3 days; BC, 2 (photos and rock art)
		E. R. Bayer, 2 days (recording)
Group I	part of July 23-part of July 25	
LA 50974	fieldwork man hours: 106	
	cavate records: 21	
	noncavate records: 16	
	total rooms: 38	% recorded: 97.4
	personnel:	ERB, BJM, HWT, 2½ days; BPP, 2
		BF, 1 day (recording)
		Crowders, 1 day each (photos and rock art)
Group F	part of July 25-July 30	
LA 50975	fieldwork man hours: 126	
	cavate records: 15	
	noncavate records: 45	
	total rooms: 106	% recorded: 56.6
	personnel:	ERB, BJM, BPP, HWT, 3 days
		BF, 1 day (recording)
		Crowders, 1 day each (photos and rock art)

Table 3.2. (continued)

Tsankawi			
LA 50976	late July 30-most of August 13		
	fieldwork man hours: 268		
	cavate records: 63		
	noncavate records: 56 (54 rooms)		
	total rooms: 117	% recorded: 100.0	
	personnel:	BJM, BPP, HWT, 8 days	
		ERB, 1½ days	
		BF, 3 days (recording)	
		Crowders, 2½ days each (photos and rock art)	

clear that the groups that have more cavates than noncavates take considerably more time to record. The break-in period at Group M is also evident, though some of that extra time resulted from a more detailed mapping, and some from revisitation of rooms to record variables added after the rooms had been recorded.

Data Manipulation

After we returned from the field, Bruce Panowski coordinated a group of five people (including himself) who entered first the paper forms and then the personal computer records into the version of the Oracle database form that he had devised for the mainframe. None of those who entered data worked full time, and the process spanned a month (from August 18 to September 18, 1986). During this time and later considerable further effort was invested by Toll and especially Panowski in doing initial tabulations and locating various errors and omissions. After entry and checking, the files were transferred among several systems for further processing and for analysis. These included the University of New Mexico and NPS mainframe computers and personal computers. This section discusses various ways in which the data were used. Appendix 2 contains information on actual data set transformations and storage.

Data Set Modifications and Formats

We made some modifications to the data set during data correction and analysis. We outline these changes here for future users of the data and as part of the description of the data.

Laboratory of Anthropology Numbers

As discussed in the description of cavate groups, LA numbers that had been assigned to another project were given to the field crew. Replacement "official" numbers are given in chapter 2. In the computer data sets, the numbers used in the field and on all records are retained under the name FIELDLA, while the numbers on record with the Laboratory of Anthropology Survey Room ARMS File, are under the variable NEWLANO.

Locations

Universal Transverse Mercator (UTM) grid locations were assigned to all the study groups. It is not possible to locate every cavate on 1:24,000 USGS maps, or to realistically specify UTM coordinates at an accuracy greater than 10 m. UTMs, therefore, were assigned to upper and lower halves of Groups A, F, and M; Group I was assigned a single UTM value; and the Tsankawi (LA 50976) group was divided into northern, middle, and southern groups for UTM assignment. Assignment of Section, Township, and Range location for the Tsankawi group was straightforward, since that entire location falls within a single quarter-quarter section. Township 18N, Range 6E, however, has never been platted. Moreover, the platted sections on the northern part of the Frijoles Quadrangle are somewhat irregular. Projections were made from the existing platted areas on the Frijoles Quad to the cavate locations, and quarter-quarter-section locations have been provided in the computer files for the groups studied. The section locations and probably the quarter sections are likely to be correct, but the locations must be recognized as projections and estimates only.

Calculation of Volumes and Areas

The measurements we took were designed to allow us to calculate volumes of chambers and areas of plane surfaces. Assumptions and compromises are necessary in calculating and using such values both because of the nongeometric shapes of cavates and because they are often only partially present. The procedures and formulas we used to obtain volume and area measurements are given below. An annotated version of the SAS program (SAS Institute 1985) is presented in appendix 2.

Plane Shapes

Formulas for all the plane shapes except the two varieties of ovals are well known and straightforward:

Rectangle: Area equals width times length. Same formula used for bowed rectangle.

Oval (and "natural oval"): As a compromise approximation, the area of oval features was calculated as the mean of the axes divided by two (giving the equivalent of a circle's radius), which was then squared and multiplied by pi.

Trapezoid: A trapezoid may be thought of as a rectangle with either one or two triangles appended. The heights of the triangles are equal to the rectangle. The formula for finding the area is half the height times the sum of the bases (see, e.g., Kern and Bland 1934:vii).

Circle: The area is the square of the radius times pi. Since we measured diameters rather than radii, the measurements were halved to find the radius.

Triangle: The area is the product of the base and one-half the height.

Areas were not calculated for linear or irregular shapes. The areas found using the above formulas were all multiplied by the geometric fraction to correct for partial and irregular forms. This correction is especially important in "round" shapes, which were often semicircular. We took all measurements in meters (generally measuring to the nearest centimeter) and rounded the areas only to four decimal places, since this allows expression of a square centimeter. Zeros were used for missing values when the data were originally entered. All areas of zero have been changed to missing values, as have all zero values for measurements, except for height above floor where zero is a valid measurement.

Solid Shapes

Solids are more complex to measure and thus involve more assumptions. Nonetheless, the resulting volume estimates are unquestionably closer to the actual volume than they would be if based on purely rectilinear measurements. The formulae used are taken from Kern and Bland (1934:14-34).

Rectangular solid: The volume is the product of the length and width of a base and the height.

Cylinder: The volume is the area of the base times the area of the height. This shape was used most often for holes in the walls, so that the "base" is the aperture of the hole. Because the area of the base requires a radius, the aperture diameter had to be halved.

Hemisphere: Measuring the volume of a hemisphere (or a spherical segment of one base) requires knowing the diameter of the whole sphere. We assumed that the diameter taken in the field is the diameter of the whole sphere, which is unlikely to have been the case. For the height of the segment the depth measurement was used, which is the best approximation of the segment height. The formula for the volume is one-third pi times height squared times the quantity three times the sphere's radius minus the segment's height. In contrast to our practice with other area and volume measurements, we did not use the GF on hemispheres, since the two measurements should approximate the fraction of a sphere present. This method of estimating hemispherical volume may give values somewhat greater than the actual values because of inflation of the radius value. Using this approach, we found that some volumes result in negative values, which shows the approximate nature of this calculation and indicates that hemispherical volumes should be treated with extra caution. We set volume values to missing for features whose measurements resulted in negative values (about 12 in all).

Truncated cone: This shape was used mostly for wall holes. The upper diameter was often difficult to measure; the cones are assumed to be right cones (that is, the altitude from the apex to the center of the base is a right angle). The volume formula is one-third pi times the height times the sum of the square of the basal radii and the product of the radii.

Truncated pyramid: Several assumptions are active here: that the figure is the frustum of a right pyramid, and that the bases are rectilinear (and thus proportional). We measured two sides of the lower base of the figure, the height of the figure, and the length of the upper base. The volume formula requires that the area of both bases be known, which in turn requires that both sides of the upper base be known. To arrive at the width of the upper base, the lower base width was divided by the lower length, and the result was multiplied by the upper base length, generating the upper base width. The volume is then found by multiplying the sum of the areas of the two bases and the mean proportional of the two bases (the square root of the product of the two areas) by the height divided by three.

Cone: Like the truncated cone, cones are assumed to be right. The volume is calculated as one-third pi times the basal radius squared times the height (basal radius found by halving the diameter taken in the field).

Sphere: The volume formula is pi times the cube of the diameter, all divided by six.

Pyramid: Pyramids were measured as four-sided right figures. The volume of such figures is calculated as one-third the area of the base times the altitude.

In some cases we were best able to describe a feature as a plane figure with depth (usually triangular or oval). In these cases the area of the plane figure was multiplied by the depth to give a feature volume. For hemispheres and the "plane figures with depth," the GF was applied only to the area value. For all other shapes the volume values were also multiplied by the GF to correct for nonconformance to the geometric shape used.

After the calculation of volumes, rectangles with depth were converted to rectangular solids for purposes of mean volume calculations. "Plane figures with depth" presumably do not conform easily to the selection of geometric solids because of such things as irregular depth and rounded corners, and this treatment of volume may somewhat inflate the volume derived. The change to solid figures was done only for calculation, not as a permanent change to the data sets. Volume values were rounded to seven decimal places (of a cubic meter), which allows expression to the nearest 10 cc. Again, field measurements are generally to the nearest centimeter, but given the difficulties and imprecisions in measuring volumes, the nearest 10 cc is the closest realistic estimate, and in many cases even that level is probably false precision.

Photographic Entries

Four sets of photographs exist from the 1986 cavate recording: 4 x 5 frontal photographs of individual cavates (or groups of a few closely spaced rooms) taken by Bill Crowder, 35 mm black-and-white negatives of rock art taken by Bill and June Crowder, color slides of rock art taken by the Crowders, and 35 mm black-and-white shots of features and cavates taken by the archaeologists both during the field season and in April 1987. Some of the photographs in each of these groups are of activities or are overviews of large portions of cavate groups. The more specific photographs have been entered on the appropriate data lines, using the numbering conventions listed in appendix 2. Computer listings of photographs sorted by feature type and photograph and, for base information, by group and cavate number are on file with the National Park Service. Although not every feature or cavate that shows in every photograph has been entered, the coverage should be good enough to permit users to locate photographs of examples and specific instances. Users can also find specific instances by referring either to general features, such as the wall on which a feature is located, or to nearby cavates as indexed by the frontal drawings.

Location and Processing of Computer Data Sets

The field forms for the cavate data were entered by various NPS personnel using the Oracle data base at the regional office in Santa Fe. After several attempts, the data were transported via tape to the University of New Mexico mainframe IBM system. Once there, Statistical Analysis System (SAS) formats (SAS Institute 1985) were generated, and the data sets were checked line by line and corrected as necessary. Much of the data analysis for this study was done in SAS on the university system, though many analyses were conducted on a personal computer using the Number Cruncher Statistical System (NCSS) and SAS-PC. During the project, NPS acquired SAS for its Santa Fe system, so we returned the data sets in SAS format for use in Santa Fe and did much of our analysis on that system. Appendix 2 lists the data sets and the various outputs saved and now in the care of NPS.

Group Attributes

As discussed above, we recorded two sets of information for each cavate and noncavate feature: first, general or "base" information, followed by recording of specific features. Examination of the base information shows the distribution of construction, condition, and other attributes in the various groups.

The distribution of room types among groups as reflected by form types is quite different. Groups A and F both show strong predilection for rooms built against the cliff, while the other three groups show more frequent use of rooms at least partially excavated into the cliff (Tables 3.1, 3.3).

Table 3.3. Room Type and Mode of Recording by Site.

Recording Format	Group A	Group F	Group I	Group M	Tsankawi	Total
Cavate	25	15	21	47	66	174
Noncavate	48	45	16	19	52	180
Total	73	60	37	66	118	354

Construction and Use

Based on our observations, we can only speculate about how the cavates were actually made, and about whether the builders converted the tuff removed into building material. In Turkey people excavate rooms with picks, splitting off blocks for use in construction elsewhere; one man expected to spend a year working part-time by himself to complete a dwelling of five rooms and a cellar (Blair 1970:142-145). The most common evidence of construction in our sample--observable in more than half of the cavates--is the presence of grooves, which are especially visible in the ceilings (Table 3.4, Figure 3.2). These are modally 2-3 cm wide, around 1 cm deep, and perhaps 30-40 cm long; they look very like the digging stick marks sometimes seen in the hard earth walls of pits revealed by excavation. They are at numerous different angles, though they tend to have some patterning. They look more like a means of final shaping of the chamber than a means of removal of large chunks.

At least partly because of different tuff types, digging stick marks are less common at Tsankawi, but at both Tsankawi and Frijoles it was common practice to smooth the walls of a cavate as high as the plaster was to go (often around 1 m) and leave the upper wall and the ceiling rough. Remodeling and housekeeping seem not to have included removing the smoked layer of tuff from the ceiling; replastering the walls seems to have sufficed. In contrast, recent Turkish occupants of cavate rooms cut into tuff similar in appearance to that in Frijoles, remove smoke-blackened rock from the ceilings with hammers, and replaster on an annual basis (Riboud 1958:138-139). Some form of grinding or polishing similar to that used to smooth lower walls probably also finished the shaped openings and doors, but we noted no evidence other than smooth, regular surfaces. As far as we could determine, 95 percent of the cavates we examined resulted more from artificial excavation of the cliff than from use of natural pockets (Table 3.5). The use of masonry was the least at Tsankawi (Table 3.6). Among the Frijoles groups, there was less use of masonry in upper Group M than in the other groups, though M-60 contains one of the most substantial remaining walls recorded. Masonry remains in about 20 percent of the cavate features of Groups A, F, and I; if the upper part of Group F had also been recorded, Group F would have been likely to stand out as containing more masonry than the other groups, because of the number of masonry features and dividing walls present there.

The greatest use of multilevel rooms occurs at Group M, where a large central cluster of cavate rooms is located above a substantial house mound. Group F has a similar high central cluster, but it forms a smaller percentage of the rooms recorded. There are also many multilevel rooms at Group A, though upper Group A contained no areas with four levels.The part of A we did not record contains further

Table 3.4. Evidence for Construction.

Type of Evidence	Group A	Group F	Group I	Group M	Tsankawi	Total
Cavates						
Evidence lacking	4	1	3	15	24	47
2: Digging stick marks	3	6	3	4	13	29
3: Shaped opening	0	0	0	2	5	7
4: 2 + 3	2	1	1	6	8	18
5: Shaped corners	4	1	3	13	3	24
6: 2 + 5	7	1	6	6	6	26
7: 2 + 3 + 5	4	5	5	1	7	22
8: Floor leveling	1	0	0	0	0	1
Total	25	15	21	47	66	174
Total digging stick marks	16	13	15	17	30	91
Noncavates						
Evidence lacking	43	36	14	18	51	162
Digging stick marks	2	9	1	0	4	16
Shaped opening	0	0	0	1	0	1
Shaped corners	4	0	1	0	0	6
Total	49	45	16	19	55	185
Combined total	74	60	37	66	121	359

Table 3.5. Estimate of Excavated versus Natural Space (Cavates Only).

Portion Excavated	Group A	Group F	Group I	Group M	Tsankawi	Total
Completely excavated	12	9	13	20	41	95
>Half excavated	10	6	7	26	22	71
>Half natural	2	0	1	0	2	5
Completely natural	1	0	0	1	1	3
Total	25	15	21	47	66	174

multilevel areas, and it is likely that of the five groups, Group A has the highest frequency of stacked rooms. Although the percentage of upper-level rooms is somewhat less at Group I, it still far outstrips that at Tsankawi (Table 3.7). The stepped nature of the tuff outcrops at Tsankawi made it more difficult for us to assign levels, and in most areas it precluded construction of more than one or two levels. Tsankawi has a markedly lower frequency of rooms built at least partly above other rooms.

Fill

The paucity of fill in a great majority of the cavates is evident in Tables 3.8 and 3.9: one-fifth were found to have no fill at all. Most of those containing fill in the Frijoles groups contain a mixture of disintegrated tuff and a very fine, floury dust, presumably mostly aeolian in origin. There is frequently some mixture of organic materials, such as grass and leaves, which often look as though they may also have blown in or may have been brought in by rodents. Animal dung was sometimes present in Frijoles, but never in quantity. In the lowermost tier of rooms at Tsankawi, several rooms had a thick, hard layer of dung. This tier of structures also had many of the most deeply filled rooms because of its location at the base of a low cliff. The few deeply filled rooms in Frijoles are next to the rockfall in Group I or have openings below the level of the exterior ground surface so that fill runs into the structure. A few chambers of which only the top few centimeters were visible were recorded on noncavate forms at Tsankawi and Group M, so that the deeply filled chamber count in Table 3.9 is somewhat depressed. The consistency with which cavate rooms with raised entries have very little fill leads me to suspect that they may never have had much. Alternatively, earlier visitors may have been very thorough in their "investigations" of these features.

Small fill amounts make it difficult to detect whether there has been disturbance of the fill, because every entry into a room with a few centimeters of fill is a substantial disturbance. Our forms did not have a specific entry for noting the presence of pothunting activity, and generally we saw little evidence of it. Two of the deeply filled, red tuff rooms at Tsankawi do have major "potholes" in them (one exposing the bones of an infant). One or two Group F rooms have dirt and roots clinging to the walls, suggesting that fill has been removed, and another has had its floor cut through with metal tools.

The few rooms we examined that were especially difficult to get into did have more cultural material in them. Four smaller, higher rooms had quantities of chunks of tuff in them

Table 3.6. Masonry Presence and Type.

Masonry Type	Group A	Group F	Group I	Group M	Tsankawi	Total
Cavates						
Masonry absent	20	12	17	43	63	155
Large blocks, simple	4	0	4	4	1	13
Small rock, much mortar	1	2	0	0	0	3
Coursing absent	0	1	0	0	2	3
Total	25	15	21	47	66	174
Percent with masonry	20.0	20.0	19.0	8.5	4.5	10.9
Non-cavates						
Masonry absent	47	44	15	19	56	181
Large blocks, simple	1	0	1	0	0	2
Small rock, much mortar	0	1	0	0	0	1
Coursing absent	1	0	0	0	0	1
Total	49	45	16	19	56	185
Combined total	74	60	37	66	122	359
Percent of group with masonry	9.5	6.7	13.5	6.1	2.5	6.4

along with relatively high artifact frequencies (rooms A-4, A-57, F-56, and M-15). The likeliest explanations for the unusual rock fill are either the collapse of portions of walls or "basketball" practice after abandonment, probably during the last hundred years.

Natural Features

The greater variability in tuff found at Group A and Tsankawi is shown in Table 3.10. These assessments of tuff are somewhat impressionistic. Still, the tuff at Group M

Table 3.7. Room Level, Cavates and Noncavates Combined.

Level	Group A	Group F	Group I	Group M	Tsankawi	Total
First	38	34	27	29	107	235
Second	29	20	9	22	11	91
Third	6	4	1	12	0	23
Fourth	0	2	0	2	0	4
Total	73	60	37	65	118	353

Table 3.8. Fill Type, Cavates Only.

Fill Type	Group A	Group F	Group I	Group M	Tsankawi	Total
Clear floors	7	2	2	16	8	35
Disintegrated tuff	7	3	4	18	5	37
Dung and tuff	0	1	0	0	1	2
Aeolian/alluvial	7	3	10	7	20	47
High organic content	0	0	1	1	0	2
Tuff, dung, organic	0	3	3	3	11	20
Aeolian/alluvial, tuff, organic	4	2	0	0	21	27
Total	25	14	20	45	66	170

Table 3.9. Fill Depth, Cavates Only.

Fill Depth	Group A	Group F	Group I	Group M	Tsankawi	Total
< 10 cm	22	6	11	38	28	105
10-25 cm	1	4	6	4	17	32
25.1-50 cm	0	0	2	0	12	14
> 50 cm	0	1	1	0	6	8
Total	23	11	20	42	63	159

Table 3.10. Tuff Characteristics, Cavates Only.

Tuff Type	Group A	Group F	Group I	Group M	Tsankawi	Total
Ordinary white	12	15	19	23	18	87
Softer than usual	0	0	0	1	0	1
Stratified, variable	9	0	1	0	1	11
Large fibrous chunks	4	0	1	23	1	29
Highly porous	0	0	0	0	24	24
Soft red	0	0	0	0	22	22
Total	25	15	21	47	66	174

contains abundant soft, fibrous chunks of tephra, which probably leads to an increased rate of deterioration.

The most common nonhuman users of the cavates are insects (Table 3.11). Wasp nests are probably the most common evidence of insects, and larval casings are also found. A bee swarm was noted at Group A, but it was happily in a natural hole well above where we were working. A single room in Group M was almost completely plastered with some form of larval casing that we did not see in any other place. We saw no rodent nests, but tracks and scat were commonplace. Pack rats seemed to be frequenting only two features at Tsankawi and one at Group A. The absence of bats was surprising, but the shallowness of many cavates, and the rounded, perchless nature of most of the ceilings may account for the bats seeking the higher cracks rather than the cavates. Birds seem to be primarily casual, though not infrequent, visitors to the cavates, except for the vultures that use the low, dark, dank, mostly filled rooms at one end of Group I. We watched with bemused indignation as a rock wren brazenly removed our room tags from Group M very shortly after we had put them in place. Cattle and sheep have made the greatest impact on cavates, but fortunately their use is fairly limited. Livestock (and perhaps wild burros or even deer) has entered many cavates, especially at Tsankawi. Where livestock has been abundant, a thick layer of dung is present, which may well protect room fill; heavy use by large animals has apparently worn grooves 20-30 cm wide ("incised dados") into cavate walls just above the top of the fill. We recorded four instances of these grooves at Tsankawi and one at Group M. "Combination" use, as noted on our forms, generally meant use by several of the common categories of nonhuman users, especially insects, rodents, and ungulates. We noticed no visitation or use by carnivores, though we found some tracks in Group I that we could not identify. Perhaps incorrectly, we did not include pothunters as nonhuman users.

Cavate Condition

On the whole, extremely fragile cavates are likely to have fallen apart long ago, becoming, for our purposes, noncavates or nonexistent. In comparing the estimated stability of cavates and noncavates, we see that relatively more cavates seemed to be stable and more that seemed to be facing major problems, while a higher percentage of the noncavates fall in the middle ranges (Table 3.12). Noncavates tend to be more exposed and either have fewer features

Table 3.11. Nonhuman Use of Cavates.

Animal Use	Group A	Group F	Group I	Group M	Tsankawi	Total
None visible	10	3	4	21	30	68
Ungulates	0	2	2	0	10	14
Pack rats	1	0	0	0	2	3
Insects	7	4	6	15	9	41
Combinations	5	3	3	6	8	25
Raptors and vultures	0	0	4	0	0	4
Other birds	1	1	0	5	1	8
Other rodents	1	2	2	0	6	11
Total	25	15	21	47	66	174

Table 3.12. Overall Stability of Cavates and Noncavates.

Degree of Threat	Group A	Group F	Group I	Group M	Tsankawi	Total
Cavates						
Apparently stable	4	1	5	8	13	31
Lesser threat	8	9	6	9	35	67
Greater threat	7	4	6	17	13	47
Major problem	5	1	3	7	4	20
Total	24	15	20	41	65	165
Noncavates						
Apparently stable	3	0	1	1	7	12
Lesser threat	13	22	7	1	41	84
Greater threat	25	22	8	10	7	72
Major problem	7	1	0	7	1	16
Total	48	45	16	19	56	184
Combined total	72	60	36	60	121	349

at risk (as with back walls) or have already experienced most of what loss was possible. The majority of both types falls into the middle ranges. Appendix 3 lists all cavates and noncavates by their apparent stability and includes the notes for each room considered to have an imminent possibility of collapse. In spite of its greater visitation, Tsankawi seemed to have the highest percentage of stable and "lesser threat" cavates, while Group M seemed to have the greatest deterioration problem. Of course, Group M has a large number of partial rooms, which accounts in part for its lower stability (see Table 3.12). Tsankawi and Group F have the highest relative frequencies of complete or mostly complete cavate chambers, with the absolute number being by far the greatest at Tsankawi.

The amount of graffiti in noncavates is really quite small (Table 3.13), but complete cavates attract far more attention than do back walls. Of the areas in which we worked, Group A is the most seriously affected by graffiti, which is reflected in both the cavate and the noncavate data. Signs of serious wear are most evident at Tsankawi. The exposed nature of noncavates is reiterated in the assessment of natural impacts presented in Table 3.14, where severe weathering combined with severe cliff deterioration is the most common category.

The presence of natural and human damage was assessed on two levels. First, we estimated the overall stability of each cavate and noncavate; for each cavate structural feature (wall, floor, ceiling), we recorded human and natural damage, and we used the same codes for an overall assessment of each noncavate. Tables 3.13 and 3.14 summarize this information by group and by chamber location.

Of the groups we studied in 1986, Tsankawi has the most complex situation regarding the condition of the rooms. The chambers at Tsankawi are visited daily, sometimes by rather large numbers of people, while access to Groups A, F, I, and M is limited to varying degrees. In the two weeks when we worked at LA 50976 on a regular basis, one substantial portion of shaped tuff was broken off in the area of TS-57 and TS-60, campers were present in TS-57, and numerous rocks were thrown and dislodged in the midst of the room concentration (some too close for our comfort). In rooms where we swept away shallow fill, a very clear wear pattern was present: the plaster floors are missing completely around the door and into the middle of the room, while aboriginal floor, sometimes in remarkably good condition, is present around the edges. Even more remarkable is the presence of intact loom anchors in some of the rooms in spite of their being covered by only a few centimeters of fine fill. The loom anchors seem to be on the margin of the worn area, probably because the looms were placed at the edge of the prehistoric traffic flow, as well.

On days of high traffic and bad behavior, complete closure of the site seemed the best course. On the other hand, many of the visitors to this area genuinely appreciated the opportunity to see these structures up close. Powers favors importing fill for shallowly filled rooms, but while this would help protect remaining floor features, it would be difficult to do and would have its own impacts. Finding fill that is not part of an archaeological deposit will require going to the canyon bottom, and transporting it will be laborious and potentially damaging to the structures. Closure of especially fragile areas, such as the TS-54-TS-66 area, has some appeal, but closure would only keep out law-abiding people. The best alternative may be to carefully, systematically, and completely clear ("excavate," if you will) shallowly filled rooms, collect samples, fully record the floors, and then refill them to the extent possible. This should not be a hurried, under recorded, and under reported salvage job. Rather, it should receive the full excavation status warranted by its location in a national monument. Such a project would not be cheap,

Table 3.13. Human Damage by Group and Chamber Location.

A. Human Damage to Cavate Walls, Floors, Ceilings

Type of Damage	Group A	Group F	Group I	Group M	Tsankawi	Total
No damage	74	48	74	144	197	537
Minor graffiti	13	15	12	17	19	76
Major graffiti	19	2	6	0	4	31
Graffiti & other	1	0	0	1	1	3
Obvious wear	6	4	2	2	17	31
Tourist blasting	0	0	0	0	2	2
Minor vandalism	4	1	0	3	3	11
Major vandalism	0	0	0	0	3	3
Total	117	70	94	167	246	694

B. Human Damage to Noncavates

Type of Damage	Group A	Group F	Group I	Group M	Tsankawi	Total
No damage[a]	42	12	16	11	2	83
Minor graffiti	3	1	0	1	0	5
Major graffiti	1	0	0	0	0	1
Obvious wear	0	0	0	0	1	1
Tourist blasting	0	0	0	0	3	3
Minor vandalism	1	0	0	0	0	1
Major vandalism	1	0	0	0	0	1
Total	48	13	16	12	6	95

Table 3.13. (continued)

C. Human Damage by Chamber Location, Cavates Only[b]

Type of Damage	Right Wall	Back Wall	Left Wall	Exterior Wall	Floor	Ceiling	Total
No damage	112	96	109	60	50	109	537
Minor graffiti	23	18	22	8	0	5	76
Major graffiti	9	13	5	3	0	1	31
Graffiti & other	0	1	1	1	0	0	3
Obvious wear	2	2	5	11	10	1	31
Tourist blasting	0	2	0	0	0	0	2
Minor vandalism	1	7	2	0	0	1	11
Major vandalism	1	1	1	0	0	0	3
Total	148	140	145	83	60	117	694

[a]In 91 cases there was no entry; probably no damage.
[b]Cavate structural features only; 14 features with damage not recorded are not shown.

but it would likely be no more expensive than some of the other alternatives. It is also a sensible plan in archaeological terms, given the current visitation regime.

Another impact that is more severe at Tsankawi than at the other sites is the effect of livestock. The lower, red tuff rooms were heavily used by sheep and/or cattle; combined with the friable nature of this geological unit, the livestock use has ensured that few wall features remain in the majority of the red tuff rooms. On the whole these low rooms have more fill than most cavates, which may have preserved features closer to the floors.

The rate at which cavates deteriorate can only be discussed generally, given the lack of any precise baselines. Lister's photographs from the late 1930s allow us to make some comparisons (Figures 2.7, 2.8, 2.12, 2.13, 2.16, 2.21). They show clearly that the elements most at risk are masonry: all the major changes visible involved masonry collapse, in spite of the attempts to slow that process through stabilization. On the whole, it seems that there is very slow (on a human scale) erosion of natural features, punctuated by occasional, much larger but relatively infrequent events, such as the rockfall at Group I, the dislodged blocks at Group A and Tsankawi (A-72 and TS-22), and

Table 3.14. Natural Damage by Group and Chamber Location.

A. Natural Damage to Cavate Walls, Floors, Ceilings

Type of Damage	Group A	Group F	Group I	Group M	Tsankawi	Total
No damage	19	10	17	28	37	111
Moderate erosion	21	16	7	31	35	110
Severe erosion	4	2	3	10	9	28
Moderate cliff deterioration	15	4	2	16	18	55
Severe cliff deterioration	7	5	3	18	9	42
Moderate erosion & deterioration	8	16	17	12	66	119
Severe erosion & deterioration	43	17	45	52	74	231
Total	117	70	94	167	248	696

B. Natural Damage to Noncavates, Including Nonrooms

Type of Damage	Group A	Group F	Group I	Group M	Tsankawi	Total
Absent	1	0	0	1	0	2
Moderate weathering	1	1	0	0	4	6
Severe weathering	2	5	2	6	8	23
Severe deterioration	2	0	0	1	0	3
Moderate weathering & deterioration	5	1	1	0	13	20
Severe weathering & deterioration	37	38	13	10	31	129
Total	48	45	16	18	56	183

Table 3.14. (continued)

C . Natural Damage by Chamber Location, Cavates Only

Type of Damage	Right Wall	Back Wall	Left Wall	Exterior Wall	Floor	Ceiling	Total
No damage	25	34	22	8	3	19	111
Moderate erosion	25	29	27	10	4	15	110
Severe erosion	5	6	4	4	5	4	28
Moderate cliff deterioration	15	12	12	4	2	10	55
Severe cliff deterioration	7	6	7	6	7	9	42
Moderate erosion & deterioration	26	27	22	17	7	19	118
Severe erosion & deterioration	45	27	51	34	32	42	231
Total	148	141	145	83	60	118	695

fallen boulders at Tsankawi with evidence of former rooms. Robert Preucel, formerly of the PARP team, reports that between 1980 and 1985 three cavates collapsed in the Garcia Canyon area, presumably due to natural processes such as freezing and thawing (R. Preucel, personal communication, 1988).

Human visitation compounds natural erosion and, worse, causes disturbance of deposits and features that are subject to little natural damage. The human threat is more focused and destructive to archaeological information than other types of damage. At least in theory, however, it is also more easily averted.

4

Cavate and Noncavate Features: Definitions, Distributions, and Dimensions

This chapter defines each feature type recorded in 1986, as well as presenting occurrence and metric data for each. This information forms the basis for the analyses, which use selected features and attributes to look for patterning within and among the various cavate groups. All measurements are in meters, though in the discussions we sometimes refer to centimeters or other smaller units. Volume measurements are given to five decimal places, which might appear to be a pretension to extraordinary precision. The field measurements were taken to the nearest centimeter, however, and 1 cc is 0.000001 m^3, so that technically the data as presented drop one decimal point of precision. In interpreting all the measurements, and especially the volumes, one must remember that measuring cavate features usually requires fitting complex, curvilinear shapes into simplified geometric shapes. Thus, most of the measurements are only best approximations. In some cases, measurements only from features thought to be reasonably (more than 70-75 percent) complete, or feature heights only in chambers where fill is minimal (15-20 cm is the usual cutoff) are used. In other cases, combining similar shapes gives larger samples and better overall characterization of feature size. Wherever these screens and combinations have been applied, the tables are annotated accordingly.

In examining distributions of features across cavate groups and locations within chambers, the varying numbers of observable cases from which the sample is drawn are obviously crucial to understanding what is normal and what is unusual. As discussed in chapter 2, different groups have different compositions, and this can be seen in Table 4.1. Although the gross number of features recorded can generally be ranked in descending order as Tsankawi, Group A, Group M, Group F, and Group I, the pattern certainly does not hold for all categories. The standard of comparison cannot always be number of cavates, partly because of the variability in cavates. Further, while some features can occur only in fairly complete cavates, other features are found in both cavates and noncavates, and still others, such as viga holes, are more likely to occur in noncavates than cavates. As discussed in chapter 3, the noncavate form allowed us to record groups of features and size ranges for those groups. The metric data presented here are only for individually recorded features. For each feature type containing examples recorded as groups, the distribution table includes an entry for "noncavate, grouped" showing the numbers of features so recorded at each cavate group. A total of 362 features were group-recorded, and 83 percent of these fall into three feature types: 234 viga holes (65 percent), 37

Table 4.1. Overall Occurrence of Cavates, Noncavates, and Features by Group.

	Group A	Group F	Group I	Group M	Tsankawi	Total
Total rooms recorded	73	60	37	65	118	353
Row percentage	20.7	17.0	10.5	18.4	33.4	
Cavates recorded	25	15	21	46	65	172
Row percentage	14.5	8.7	12.2	26.7	37.8	
Noncavates recorded	48	45	16	19	53	181
Row percentage	26.5	24.9	8.8	10.5	29.3	
Total features	667	402	318	616	1394	3397
Row percentage	19.6	11.8	9.4	18.1	41.0	
Total walls recorded	137	104	89	123	265	718
Row percentage	19.1	14.5	12.4	17.1	36.9	

indeterminate holes (10 percent), and 29 hand-and-toe holds (8 percent).

The 53 feature types recorded are discussed individually in the following pages (Table 4.2). They are grouped into the following categories: structural features, such as chambers, doors, and walls; floor features; wall features; and rock art. Except for feature types of which only a few examples were found, the occurrence across groups, the shape distributions, and appropriate metric data are tabulated for each type. Particularly where classifications were difficult or subjective--as in the case of holes in walls, for example--comparisons across types have also been made. This chapter includes some discussion of co-occurrence of functionally related feature types, and chapter 5 further explores feature associations.

Structural Features

Chamber (Code 1)

This feature type was used to give the best approximation of the entire space enclosed by a cavate. The components enclosing the space (walls, floor, ceiling) were also recorded, but this feature type is best suited to describing the room as a whole.

The shape-by-group frequencies show whole chambers that were recorded either as single shapes (most cases) or as combined shapes (Table 4.3). The combined shapes are shown as the base shape plus the top shape; one chamber at Tsankawi resulted from removing the wall between two truncated-pyramid chambers. The single cylindrical "chamber" is a partial cavate at Tsankawi, of which only the base was recordable. A clear trend toward rounded shapes is seen at Tsankawi, though the most common shape overall, the truncated pyramid, is also abundant there. Of the 182 cases shown, 166 were recorded as cavate features and 17 as noncavates (11 partial cavates, 4 filled cavates, and 2 chambers).

The mean volume of chambers is also larger at Tsankawi, but variability in chamber size is also much greater there. Thirteen chambers at Tsankawi have volumes greater than 8 m^3, which is larger than the largest for any

Table 4.2. Occurrence of All Individually Recorded Features in Cavates and Noncavates, by Cavate Group (Number and Percentage).

Feature	Group A (n) (%)	Group F (n) (%)	Group I (n) (%)	Group M (n) (%)	Tsankawi (n) (%)	Total (n) (%)
Structural features						
Chamber	26 13.5	18 9.3	22 11.4	48 24.9	79 40.9	193 5.7
Exterior door	10 15.4	11 16.9	6 9.2	6 9.2	32 49.2	65 1.9
Exterior opening	16 22.2	5 6.9	2 2.8	10 13.9	39 54.2	72 2.1
Interior door	4 10.3	0	8 20.5	8 20.5	19 48.7	39 1.1
Passage	1 33.3	0	0	1 33.3	1 33.3	3 0.1
Natural wall	137 19.0	104 14.4	89 12.4	124 17.2	266 36.9	720 21.2
Masonry wall	1 16.7	0	3 50.0	2 33.3	0	6 0.2
Ceiling	20 16.4	12 9.8	14 11.5	28 23.0	48 39.3	122 3.6
Masonry and tuff wall	3 100.0	0	0	0	0	3 0.1
Chamber corner	33 22.0	18 12.0	22 14.7	14 9.3	63 42.0	150 4.4
Compass location point	0	0	0	0	14 100.0	14 0.4
Floor features						
Floor	18 27.7	3 4.6	5 7.7	31 47.7	8 12.3	65 1.9
Firepit	12 42.9	1 3.6	3 10.7	7 25.0	5 17.9	28 0.8
Floor burn	1 16.7	0	0	4 66.7	1 16.7	6 0.2
Subfloor pit	4 19.0	0	2 9.5	6 28.6	9 42.9	21 0.6
Floor depression	18 27.7	3 4.6	5 7.7	31 47.7	8 12.3	65 1.9

Table 4.2. (continued)

Feature	Group A (n) (%)	Group F (n) (%)	Group I (n) (%)	Group M (n) (%)	Tsankawi (n) (%)	Total (n) (%)
Floor pit complex	0	1	0	0	3	4
		25.0			75.0	0.1
Posthole	0	0	0	0	9	9
					100.0	0.3
Floor ridge	3	0	0	7	1	11
	27.3			63.6	9.1	0.3
Metate rest	0	1	1	4	0	6
		16.7	16.7	66.7		0.2
Loom anchor	0	0	1	12	16	29
			3.4	41.4	55.2	0.9
Step	0	0	1	2	0	3
			33.3	66.7		0.1
Axe groove	0	0	0	0	5	5
					100.0	0.1
Adobe collar	0	1	0	0	0	1
		100.0				0.0
Deflector	0	0	1	0	2	3
			33.3		66.7	0.3
<u>Wall features</u>						
Large floor-level niche	23	25	8	24	48	128
	18.0	19.5	6.3	18.8	37.5	3.8
Wall niche	29	28	9	26	64	156
	18.6	17.9	5.8	16.7	41.0	4.6
Slot	3	1	1	5	0	10
	30.0	10.0	10.0	50.0		0.3
Viga hole	97	37	19	55	74	282
	34.4	13.1	6.7	19.5	26.2	8.3
Possible latilla hole	21	5	0	6	16	48
	43.8	10.4		12.5	33.3	1.4
Beam seat	39	7	9	45	76	176
	22.2	4.0	5.1	25.6	43.2	5.2
Indeterminate hole	91	78	51	74	277	571
	15.9	13.7	8.9	13.0	48.5	16.8
Possible loom support	1	0	3	3	21	28
	3.6		10.7	10.7	75.0	0.8

Table 4.2. (continued)

Feature	Group A (n) (%)	Group F (n) (%)	Group I (n) (%)	Group M (n) (%)	Tsankawi (n) (%)	Total (n) (%)
Smokehole	12 20.7	11 19.0	8 13.8	2 3.4	25 43.1	58 1.7
Vent	5 15.6	8 25.0	4 12.5	3 9.4	12 37.5	32 0.9
Groove	2 25.0	0	1 12.5	1 12.5	4 50.0	8 0.2
Wall depression	24 35.3	12 17.6	6 8.8	7 10.3	19 27.9	68 2.0
Wall ledge	4 36.4	1 9.1	2 18.2	1 9.1	3 27.3	11 0.3
Vertical ceiling hole	1 1.8	0	0	0	55 98.2	56 1.6
Narrow wall incisions	1 4.0	0	0	0	24 96.0	25 0.7
Hand-and-toe hold	0	0	0	4 100.0	0	4 0.1
Incised dado	0	0	0	1 20.0	4 80.0	5 0.1
Cliff niche	0	0	0	0	5 100.0	5 0.1
<u>Rock art</u>						
Geometric petroglyph	2 12.5	4 25.0	0	4 25.0	6 37.5	16 0.5
Geometric pictograph	2 28.6	0	4 57.1	1 14.3	0	7 0.2
Zoomorphic petroglyph	1 3.1	4 12.5	6 18.8	9 28.1	12 37.5	32 0.9
Zoomorphic pictograph	0	0	0	2 40.0	3 60.0	5 0.1
Indeterminate petroglyph	3 9.7	4 12.9	4 12.9	8 25.8	12 38.7	31 0.9
Indeterminate pictograph	8 36.4	1 4.5	1 4.5	7 31.8	5 22.7	22 0.6
Handprint	0	0	0	3 100.0	0	3 0.1

Table 4.2. (continued)

Feature	Group A (n) (%)	Group F (n) (%)	Group I (n) (%)	Group M (n) (%)	Tsankawi (n) (%)	Total (n) (%)
Anthropomorphic petroglyph	0	1 7.1	2 14.3	4 28.6	7 50.0	14 0.4
Total	665	401	318	616	1395	3395
Percent	19.6	11.8	9.4	18.1	41.1	100.0

Note: Row percentages are shown for each feature, and percentages of the total count are shown in the "Total" column and row.

Frijoles group (see Figures 4.1-4.3b). At least two very large chambers at Tsankawi (TS-36 and TS-66) resulted from the prehistoric removal of walls dividing what once were two separate chambers. Six of the rooms greater than 8 m^3, and three of the five largest (larger than 13 m^3), are located in the top tuff stratum, which suggests that that location was favorable to large chamber construction (TS-25, TS-26, TS-15, TS-27, TS-24, TS-20 in ascending order of size; see Figures 2.19, 2.20). The vesicular nature of the tuff there may have provided natural beginnings for rooms. In addition, the tuff in the top stratum seems to be indurated, perhaps making the chambers more stable. Three of the large chambers are located in the soft, red, lowermost tuff layer (TS-44, TS-29, and TS-36), and all are less than 10 m^3. TS-36, an expanded chamber, contains much fill and its volume may have been underestimated. The remaining four large chambers are in and adjacent to the concentration of structures in the middle levels of the group (TS-50, TS-66, TS-64, and TS-59). Both TS-50 and TS-66 have two doors, and TS-59, TS-64, and TS-66 contain diverse features and rock art. The largest chamber (TS-59) is remarkable for the number of features, elaborate rock art, and unusual height (nearly 2 m). Among the rooms larger than 8 m^3, there is a clear mode (and median) of 9-10 m^3: 5 of the 13 fall into that size range, and 8 fall between 9 m and 15 m^3 (see Figure 4.1).

Using a t-test to compare the 29 relatively complete Tsankawi chambers designated as habitation rooms with the 44 from Frijoles, the two groups are significantly different (means of 6.28 and 4.26 m^3, $t= -2.59$, $p=0.014$). A similar comparison of rooms designated as storage rooms, however, finds no significant difference between groups of 19 and 23 rooms (means of Tsankawi [1.42 m^3] and Frijoles [1.34 m^3], $t= -0.24$, $p=0.811$).

When the chambers greater than 8 m^3 are removed from the calculation, the Tsankawi mean becomes 2.7095 m^3, which is smaller than the mean for all other groups but Group I. Perhaps large chambers were used for most functions, so that fewer activities were carried out in the remaining rooms, and they could be smaller. Alternatively, with access to larger rooms for habitation, the residents could devote more of the smaller rooms to storage.

Assigning functions to chambers is a matter of speculation, but we based the

Table 4.3. Chamber Occurrence and Dimensions.

A. Chamber Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Oval	0	0	2	0	2	4
with hemispherical top	0	1	0	0	0	1
Rectangular	3	1	4	8	8	24
with hemispherical top	0	0	0	1	0	1
Cylindrical	0	0	0	0	1	1
Hemispherical	0	4	2	19	33	58
with rectangular top	0	0	0	0	1	1
with pyramidal top	1	0	0	0	0	1
Truncated cone	0	0	0	2	2	4
Truncated pyramid	17	11	11	17	21	77
with hemispherical top	0	0	0	0	2	2
with conical top	1	0	0	0	0	1
with 2nd truncated pyramid	0	0	0	0	1	1
Spherical	1	0	0	0	3	4
Irregular	0	0	2	0	0	2
Total	23	17	21	47	74	182

Table 4.3. (continued)

B. Mean Chamber Volumes in Cubic Meters

Grouping	n	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation (CV)
By shape						
Rectangular	12	3.86317	2.34067	0.7358	9.1728	60.6
Hemispherical	37	3.72179	3.99955	0.3445	15.4956	107.5
Truncated Pyramid	69	4.24722	3.22900	0.3512	18.6326	76.0
By assigned function						
Habitation	73	5.04244	2.69408	0.5906	15.1495	53.4
Storage	42	1.37660	1.04885	0.3445	5.5545	76.2
Kiva	7	8.98803	6.74858	2.7211	18.6326	75.1
By group						
Group A	18	3.60704	2.45064	0.5576	7.5840	67.9
Group F	13	3.32241	1.87310	0.3512	6.2586	56.4
Group I	14	2.85180	1.35703	0.7358	5.5313	47.6
Group M	29	3.14225	2.19974	0.3445	7.3764	70.0
Tsankawi	57	4.78904	4.41563	0.4523	18.6326	91.0
By group and function						
Group A						
Habitation	12	4.92763	1.83442	2.2717	7.5840	37.3
Storage	5	0.69419	0.14392	0.5576	0.9307	20.7
Group F						
Habitation	10	4.11853	1.25625	2.2362	6.2586	30.5
Storage	3	0.66867		0.3512	1.2032	

Table 4.3. (continued)

Grouping	n	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation (CV)
Group I						
Habitation	7	3.18887	1.34459	1.5239	5.5313	42.2
Storage	5	1.96018	0.99595	0.7358	3.0620	50.8
Kiva	1	2.86365				
Group M						
Habitation	15	4.31373	2.03163	0.5906	7.3764	47.1
Storage	10	1.55611	1.57855	0.3445	5.5545	101.4
Kiva	2	2.88122		2.7212	3.0413	
Tsankawi Group						
Habitation	29	6.27539	3.40041	1.3315	15.1495	54.2
Storage	21	1.41990	0.82667	0.5422	3.2121	58.2
Kiva	4	13.05380	6.22100	4.8256	18.6326	47.7

C. Mean Heights in Meters

Grouping	n	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation (CV)
By assigned function						
Habitation	70	1.58	0.441	0.95	3.93	28.0
Storage	38	1.11	0.242	0.75	2.05	21.7
Kiva	7	1.62	0.232	1.25	1.94	14.3

Table 4.3. (continued)

Grouping	n	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation (CV)
By group						
Group A	16	1.42	0.271	0.85	1.81	19.1
Group F	12	1.39	0.241	0.97	1.74	17.3
Group I	14	1.48	0.411	0.82	2.05	27.8
Group M	28	1.32	0.351	0.69	2.12	26.6
Tsankawi	51	1.47	0.539	0.75	3.93	36.6

Note: Chambers with indeterminate function assigned are not shown. Table includes only chambers judged to be more than 70% complete. Heights have been corrected by adding fill depths. Volumes have been given for all shapes, heights for simple regular shapes.

assignments on criteria including numbers and types of features, plastering, and size (Figure 4.2). Although the "kiva" features are present in larger chambers at Tsankawi, those at the Frijoles groups are within the range of habitation room sizes recorded here (Figures 4.2, 4.3a). Rooms called storage rooms tend to be smaller, but there are some large examples as well (Figure 4.3b). Clearly, the distribution for "habitation" rooms shows a great deal of overlap with the other two categories. Most of the rooms to which no function was assigned are smaller (less than 3 m^2), though there are three larger ones as well (Figure 4.2).

Hyland's (1986:101) results from Garcia Canyon show chamber volumes and heights considerably greater than those we found. He gives a mean volume of 9.62 m^3 with a range of 0.99-24.42 m^3, and of 25 measured cases his data contain 9 chambers greater than 12 m^3. This disparity is partly a result of his having calculated volumes from the product of the maximum dimensions of the cavates involved, without taking into account how cavate rooms constrict toward the ceiling or how rarely they approximate rectilinear solids. If we calculated the volume for the largest chamber at Tsankawi following Hyland's procedure, the result would be more than 25 m^3, larger than any of the volumes Hyland found. Still, the apparent tendency to build larger chambers at both Tsankawi and Hyland's more northern cavates may have some cultural significance.

Exterior Door (Code 2)

This feature type was used for all intentionally shaped openings to what is currently outside. Many such doors probably opened into masonry rooms when the sites were in use, but we assigned them to this type anyway (Table 4.4).

Measurable doors are clearly mostly rectangular with some oval and trapezoidal variants (Figure 4.25); of the "circular" doors, three were considered full circles and one a half circle. Not surprisingly, 60 of the 65 recorded doors are found in the exterior wall of their rooms, with the other 5 occurring in exterior corners (2), the right wall (1), the top of the chamber (1), and inside another feature (1).

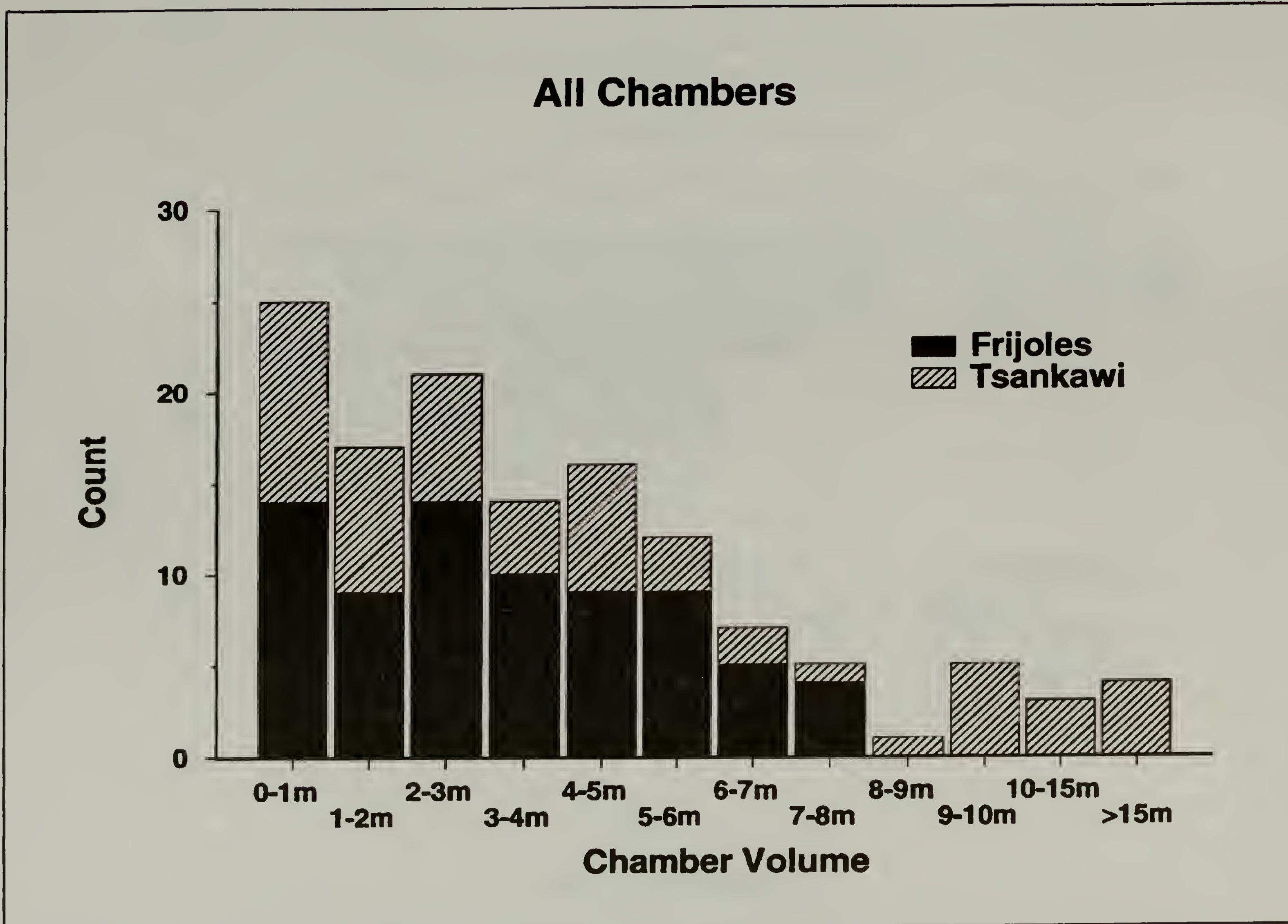

Figure 4.1. *Histogram for Frijoles (n=74) and Tsankawi (n=56) chamber volumes in* m^3*, showing rooms judged be more than 70 percent present.*

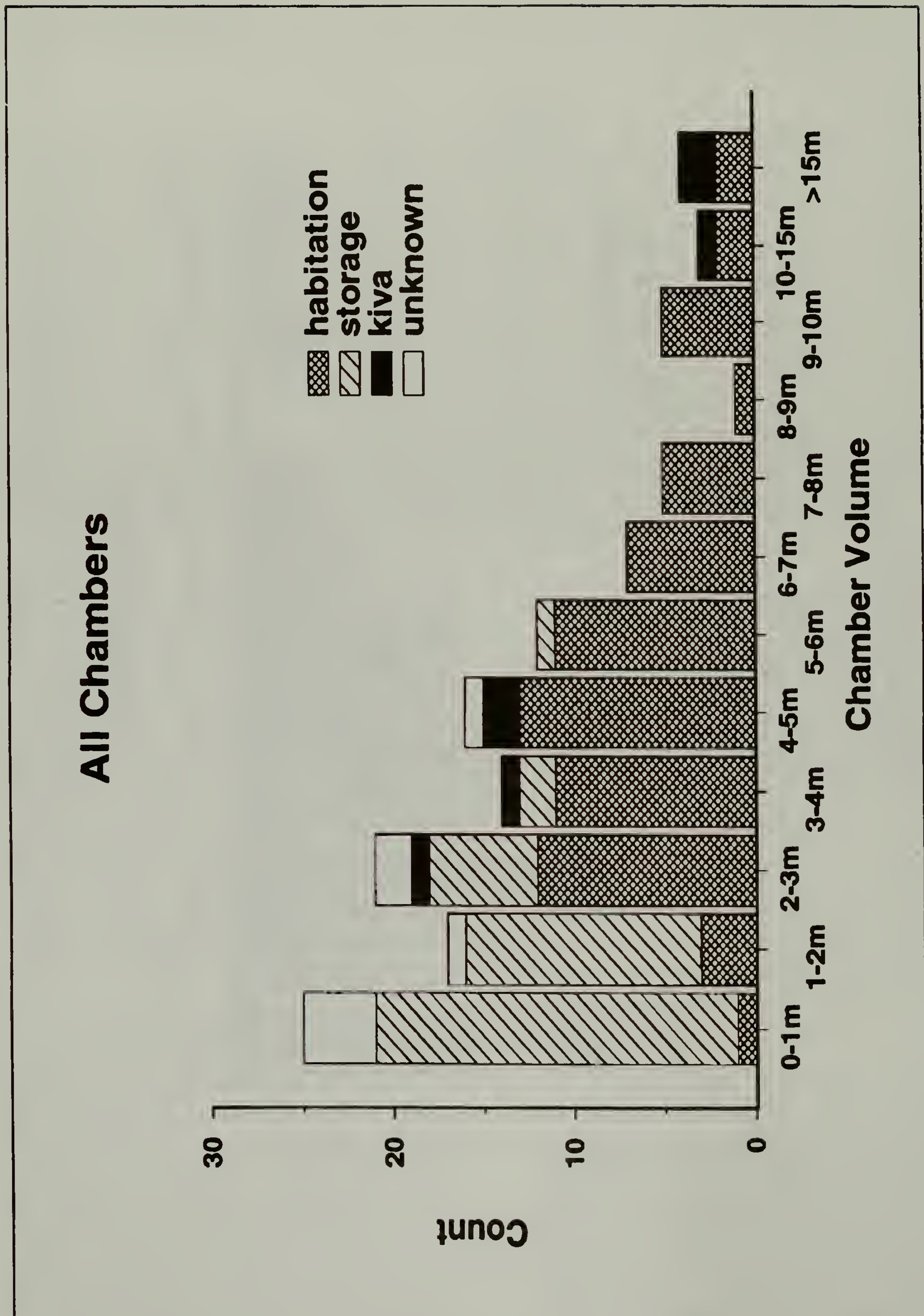

Figure 4.2. *Histogram of cavate chamber volumes in* m^3*, showing function assignments. One hundred and thirty chambers are shown. Only those 70 percent or more present are included. Eighty-one percent of the chambers are less than 6* m^3*, and 56 percent of the chambers were labeled habitation structures.*

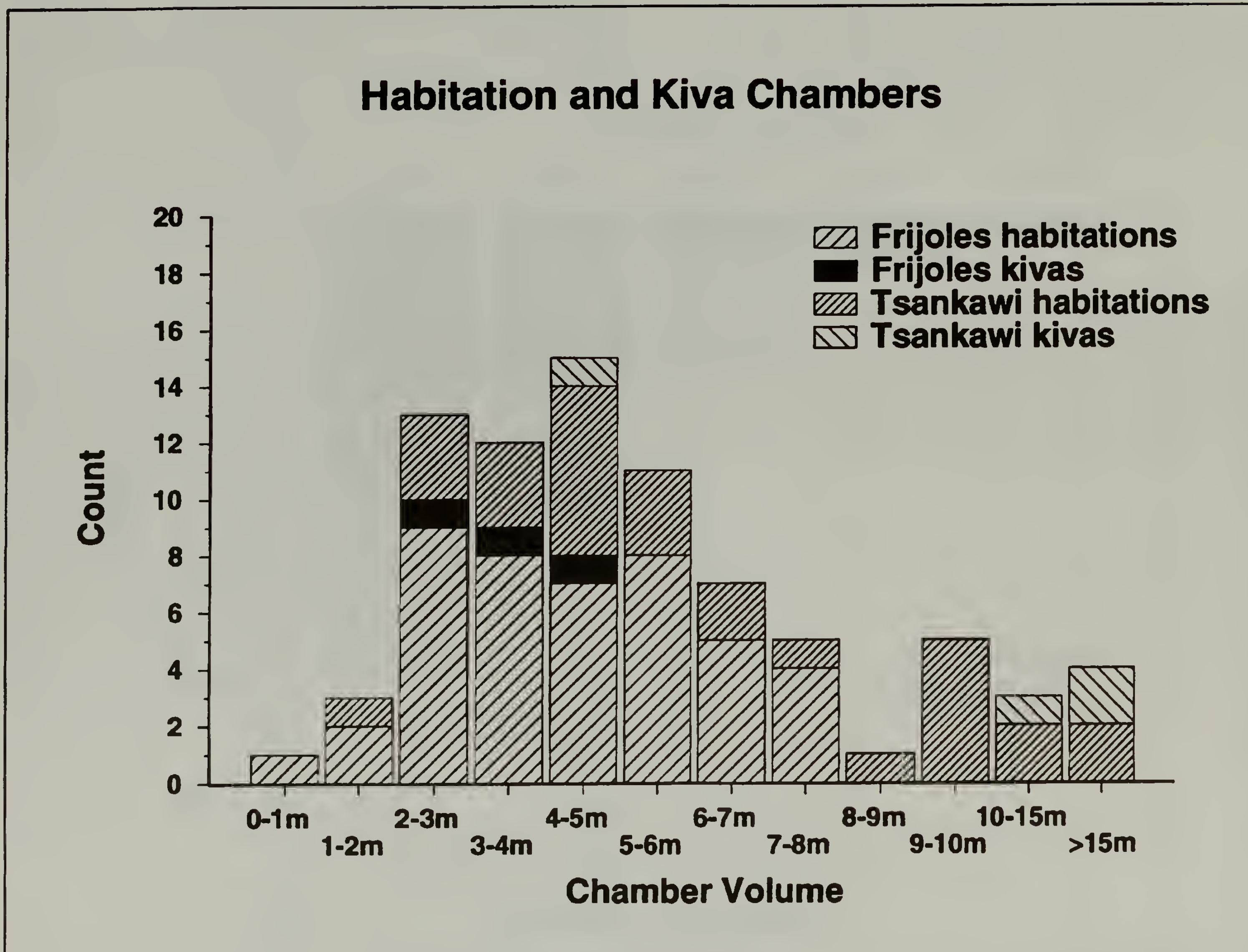

Figure 4.3a. *Comparison of Frijoles and Tsankawi habitation and kiva chamber volumes. Only chambers more than 70 percent present are included (n=80, 47 in Frijoles, 33 at Tsankawi).*

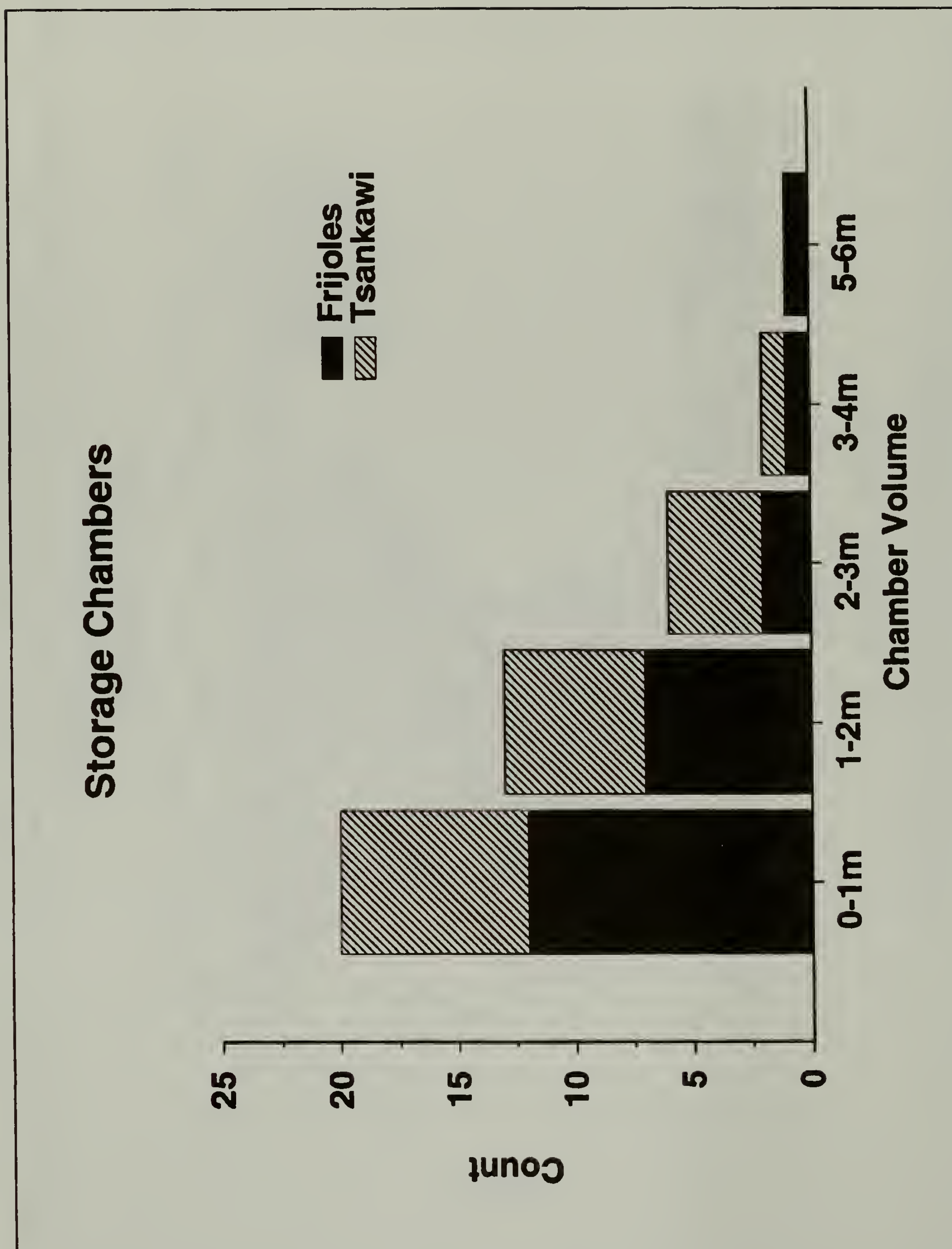

Figure 4.3b. *Storage chamber volumes at Frijoles and Tsankawi. Only chambers more than 70 percent present are included (n=42, 23 at Frijoles, 19 at Tsankawi).*

Table 4.4. Exterior Door Occurrence and Dimensions.

A. Exterior Door Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	6	1	2	1	12	22
Bowed rectangular	2	1	2	2	5	12
Oval	0	3	0	2	7	12
Trapezoidal	1	4	1	0	3	9
Circular portion	1	0	0	0	3	4
Triangular	0	1	1	1	2	5
Irregular	0	1	0	0	0	1
Total	10	11	6	6	32	65

B. Mean Dimensions of Oblong[a] Doors in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Width	48	0.68	0.275	0.30	1.35	40.4
Height	49	1.00	0.312	0.48	2.10	31.1
Wall Thickness	44	0.34	0.157	0.05	0.88	46.5
Area	48	0.61	0.334	0.15	1.98	54.5

Note: Only features considered to be 70% or more complete are included.

B, coefficients of variation (CV) in all tables are calculated with unrounded means and standard deviations. These CV's will be different from those obtained using the rounded values in the tables, particularly when the values are very small.

[a]Oblong includes rectilinear, oval, trapezoidal, and triangular shapes.

Also predictably, all but one are located in cavate features.

Even though some extreme cases are included, the most consistent dimension is the height, with a mean of exactly 1 m. The mean door width is two-thirds of the height, giving an indication of the basic shape of relatively complete doors. Some doors show evidence of having had lintels, which were probably stone (Figures 2.12 and 2.16 show doors with lintel grooves). In some cases the opening for the door may have been divided into a door and a smoke vent by a lintel.

Exterior Opening (Code 26)

This code was designed to record cavate openings that could not be called doors. The absence of a formal door has two main causes: loss of sections of cliff, which would have been weakened by the placement of both room and door, and, especially in Frijoles, loss of masonry chamber closings. The exterior opening, then, is a cross-section of the room at the cliff and as such is a potentially useful source of information about the room. Since completely enclosed cavates are the exception rather than the rule, this should be a very commonly used code. It seems, however, that its intent was somewhat misunderstood by the recorders, who probably did not record it in all cases. Once again, deciding whether a shallow feature has an "exterior opening" or is merely a "back wall" requires the exercise of judgment.

All but three of these features are recorded as being in the exterior wall (the three exceptions are in the left and right walls). The majority are semicircular, and the seven trapezoidal cases corroborate the tendency of cavates to constrict toward the ceiling (Table 4.5). Since a large number of noncavates are back walls, noncavates are unlikely to have either doors or exterior openings. In order to examine the variable occurrence of openings at the various groups, Table 4.6 compares numbers of cavates, doors, exterior openings and noncavates. Since only cavates are likely to have doors or exterior openings, the total number of openings should be roughly equal to the number of cavates present. At Groups A and F the large number of non-cavates accounts for the relatively small number of openings recorded. Over half of the exterior openings recorded are at Tsankawi, though Tsankawi accounts for around a third of the total numbers of rooms recorded. The number of doors and openings recorded at Tsankawi accounts well for the cavates recorded there, though several Tsankawi rooms do have more than one opening. The under-representations, then, are at Groups M and I; this results in part from a lack of full understanding of the use (and usefulness) of this category in the early recording at Group M. Group M, in fact, probably has more openings that would have been profitably recorded in this category than the other groups. I am unable to account for the low count at Group I.

Interior Door (Code 19)

Doors leading from one cavate chamber into another, usually providing access to a smaller inner chamber.

As is true for the exterior doors, the most consistent dimension for interior doors is the height. On average, interior doors are considerably lower than exterior doors (0.7 m versus 1 m) and somewhat narrower (0.56 m versus 0.68 m). As can be seen from the dimensions, some interior doors are so small that a modern adult finds it difficult to pass through them (Table 4.7).

Natural Wall (Code 17)

The great majority of remaining walls in the cavates recorded are entirely of "living" rock, without exception tuff. Even though they are carved from the cliff, distinct walls are usually definable, though this attribute varies

Table 4.5. Exterior Opening Occurrence and Dimensions.

A. Exterior Opening Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	2	0	0	1	6	9
Bowed rectangular	0	0	0	1	4	5
Oval	4	0	0	0	11	15
Trapezoidal	1	1	0	3	2	7
Circular portions	8	3	1	2	14	28
Triangular	0	1	1	0	2	4
Irregular	1	0	0	3	0	4
Total	16	5	2	10	39	72

B. Mean Dimensions by Shape in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Oval						
Width	12	1.98	0.958	0.80	3.00	48.4
Height	12	1.01	0.367	0.96	1.85	25.5
Area	12	0.849	0.584	0.204	2.227	68.8
Rectangular						
Width	14	1.13	0.706	0.20	2.60	62.6
Height	14	1.00	0.250	0.55	1.49	25.0
Area	14	1.125	0.862	0.088	3.013	76.6
Round						
Diameter	8	0.89	0.40	0.30	1.60	44.7
Area	8	0.651	0.503	0.071	1.609	77.4
Semicircular						
Width	9	1.86	0.756	0.85	3.00	40.6
Height	6	1.02	0.302	0.70	1.55	29.5
Area	9	1.657	1.156	0.425	3.535	69.7

Table 4.6. Occurrence of Doors and Openings by Group and Cavate Type.

	Group A	Group F	Group I	Group M	Tsankawi	Total
Openings						
a) Exterior Doors	10	11	6	6	32	65
b) Exterior Openings	16	5	2	10	39	72
c) Total Openings (a+b)	26	16	8	16	71	137
Rooms						
d) Cavates + Noncavates	73	60	37	65	118	353
e) Noncavates	48	45	16	19	56	184
Co-occurrence						
f) Openings + Noncavates (c+e)	74	61	24	35	127	321
Difference (f-d)	+1	+1	-13	-30	+9	-32

Table 4.7. Interior Door Occurrence and Dimensions.

A. Interior Door Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	0	0	3	2	1	6
Oval	3	0	2	5	9	19
Trapezoidal	1	0	2	0	0	3
Round	0	0	0	0	8	8
Triangular	0	0	1	1	1	3
Total	4	0	8	8	19	39

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall & Corners	Back Corners	Other	Total
Rectangular	1	1	2	2	0	0	6
Oval	5	3	4	4	2	1	19
Trapezoidal	1	0	0	2	0	0	3
Round	1	1	3	2	1	0	8
Triangular	1	0	0	0	0	2	3
Total	9	5	9	10	3	3	39

C. Mean Dimensions of Nonround Doors in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Width	22	0.56	0.227	0.30	1.35	40.1
Height	22	0.70	0.176	0.41	1.10	25.0
Wall Thickness	10	0.28	0.136	0.08	0.50	49.1
Area	22	0.338	0.1814	0.105	0.672	53.7

Note: C, only doors thought to be 70 percent or more complete are included. Nonround includes rectangular, oval, trapezoidal, and triangular shapes.

from rooms with four squared corners to nearly spherical small chambers. In the latter cases, definition of discrete walls is of course more subjective.

The recorded shapes of natural walls do show some patterning (Table 4.8). About three-quarters of the walls at each group are trapezoidal, reflecting the preference for chambers in the shape of truncated, four-sided pyramids. The Group A cavate sample contains the lowest percentage of trapezoidal walls, the difference being made up by higher percentages of rectangular, semicircular, and triangular walls. The common shapes (rectangles and trapezoids) occur in very similar proportions, while the odd shapes, such as triangles, semicircles, and lines, occur much more often in walls other than the back wall. This is because walls other than the back wall are much more likely to be partial than are back walls.

Wall heights are clearly less variable than widths. The right, back, and left walls all fall into similar ranges, with each having some extreme values less than 50 cm. The means are strikingly close to 1.2 m for exterior, left, and right walls, while the back walls average closer to 1.5 m. This difference doubtless results from the fact that full heights for back walls of noncavate rooms are generally larger than for rooms excavated from the tuff. Predictably, the areas vary the most, as the variability of both linear dimensions is compounded.

Plastering

As can be seen in the series of plaster color, coat, and height tables, the average height of plaster on all types of reasonably intact walls (those with FF greater than 0.7) that show some plastering and have suffered moderate or no natural damage is 0.86 m, with a range of 0.13-1.77 m (Tables 4.9-4.11). This value is quite consistent from wall to wall and from group to group, though the mean given is subject to at least two complicating factors. On one hand the minimum value of 13 cm probably does not represent a full plaster height, and plaster loss is likely to have reduced measurements in some cavates. On the other hand some chambers have a single coat of plaster extending to the ceiling, while other coats stop short of it; in such cases, the plaster height was measured to the height of the coat that goes farthest up the wall, which has probably caused some inflation in the height values. This single coat, like the single coats often seen in storage rooms, seems to be a rough, scratch coat. Heavily or long used habitation rooms can have numerous coats of smooth plaster. Counting visible coats, and without dissecting the plaster, the largest number of coats we observed was 10. Carlson and Kohler (1989:53) report 12 coats in Group M, but some of those may relate to the construction of a niche.

Although some walls are plastered to the ceiling, the majority are plastered only to a level well below the ceiling (Figures 3.3, 4.12). Small wall holes are more abundant near the top of the plaster. The largest mean is for back walls, perhaps due to preservation and to the presence of some higher values from masonry-fronted rooms. In reading the plaster tables one must recall that the counts are taken from walls rather than chambers. Chambers with multiple coats of plaster show both smoked and unsmoked coats, suggesting variation or changes in chamber function, or differences in the periodicity of plastering. The low frequency of walls with preserved plaster at Tsankawi is clearly evident.

Of 524 natural and masonry walls recorded in cavates, 339 (65 percent) had enough plaster remaining to be recorded. Plaster colors are listed in Table 4.11, which shows that by far the most common color was tan. The second most common category, walls with multiple colors of plaster, results from the number of walls with more than one coat of plaster visible and from variation in color across the wall.

Table 4.8. Natural Wall Occurrence and Dimensions.

A. Natural Wall Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	34	12	18	23	35	122
Bowed rectangular	0	5	0	2	2	9
Oval	0	0	1	1	0	2
Trapezoidal	88	75	66	92	218	539
Circular portions	1	7	0	2	2	12
Triangular	13	5	4	2	8	32
Hemispherical	1	0	0	0	0	1
Linear	0	0	0	1	0	1
Total	137	104	89	123	265	718

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall	Total
Rectangular	19	77	19	7	122
Bowed rectangular	2	5	2	0	9
Oval	0	2	0	0	2
Trapezoidal	137	205	131	65	538
Circular portions	2	7	2	1	12
Triangular	12	5	9	6	32
Hemispherical	0	1	0	0	1
Linear	0	0	1	0	1
Total	172	302	164	79	718

Table 4.8. (continued)

C. Mean Dimensions by Location in Meters

Wall	n	Mean	Standard Deviation	Minimum	Maximum	CV
Width						
Right	102	1.61	0.981	0.40	7.45	60.9
Back	236	2.18	0.858	0.44	5.00	39.3
Left	100	1.51	0.708	0.37	5.30	47.0
Exterior	44	2.03	1.265	0.30	8.30	62.4
Height						
Right	102	1.21	0.374	0.38	2.25	30.9
Back	234	1.51	0.467	0.35	3.05	31.0
Left	100	1.22	0.365	0.55	2.40	30.0
Exterior	44	1.23	0.382	0.37	2.10	31.1
Area						
Right	101	1.77	1.275	0.14	7.25	72.2
Back	235	3.08	1.885	0.22	10.23	61.2
Left	100	1.67	1.078	0.17	7.58	64.5
Exterior	44	2.32	1.943	0.16	11.57	83.9

Table 4.9. Plaster Coats by Group, Wall, and Function.

A. Plaster Coats by Group

Coats	Group A	Group F	Group I	Group M	Tsankawi	Total
0	8	2	2	1	28	41
1	5	5	12	33	16	71
2	5	4	3	10	14	36
3	8	7	1	6	6	28
4	7	1	0	4	4	16
5	4	3	2	2	1	12
6	0	2	1	1	0	5
7	3	1	0	1	0	5
8	1	0	0	0	0	1
9	0	1	0	0	0	1
10	2	0	0	0	0	2
Total	43	26	21	58	69	218

B. Plaster Coats by Chamber Wall

Coats	Right Wall	Back Wall	Left Wall	Exterior Wall	Total
0	14	11	12	4	41
1	19	20	21	11	71
2	14	12	9	1	36
3	7	12	7	2	28
4	3	5	5	3	16
5	4	4	4	0	12
6	1	4	0	0	5
7	0	4	1	0	5
8	0	1	0	0	1
9	0	1	0	0	1
10	1	0	0	1	2
Total	63	74	59	22	218

Table 4.9. (continued)

C. Wall Plaster Coats by Assigned Function

Coats	Habitation	Storage	Kiva	Total
0	16	25	0	41
1	23	40	3	66
2	25	6	5	36
3	23	0	5	28
4	11	0	5	16
5	7	0	5	12
6	5	0	0	5
7	4	0	1	5
8	1	0	0	1
9	1	0	0	1
10	2	0	0	2
Total	118	71	24	213

Note: A-C, only walls considered to be more than 70 percent present and to have had slight or no natural damage are included. C, five cases with unassigned function are not shown.

Table 4.10. Mean Plaster Height and Number of Coats by Group and Wall.

Height and Coats	n	Mean	Standard Deviation	Minimum	Maximum	CV
All walls height (m)	151	0.86	0.304	0.13	1.77	35.3
All walls coat (n)	151	2.7	1.90	1	10	70.6
Group						
A height	35	0.90	0.210	0.24	1.34	23.2
A coats	35	3.9	2.37	1	10	61.1
F height	21	0.85	0.279	0.55	1.77	32.6
F coats	21	3.0	1.91	1	9	64.7
I height	15	0.68	0.323	0.13	1.21	47.7
I coats	15	2.2	1.74	1	6	79.1
M height	52	0.93	0.332	0.27	1.68	35.7
M coats	52	2.1	1.55	1	7	73.5
Tsankawi height	28	0.78	0.319	0.23	1.52	40.63
Tsankawi coats	28	2.3	1.12	1	5	48.4
Wall						
Right wall height	41	0.86	0.333	0.24	1.52	38.8
Right wall coats	41	2.5	1.76	1	10	71.5
Back wall height	54	0.93	0.263	0.27	1.68	28.3
Back wall coats	54	3.2	2.12	1	9	66.6
Left wall height	41	0.78	0.257	0.23	1.26	32.7
Left wall coats	41	2.3	1.37	1	9	59.0
Exterior wall height	15	0.84	0.435	0.13	1.77	52.1
Exterior wall coats	15	2.5	1.28	1	10	66.2

Note: Only plastered walls considered to be more than 70 percent present and to have had slight or no natural damage are included. Only walls with plaster height greater than 0.10 m included.

Table 4.11. Plaster Color by Group.

Color	Group A	Group F	Group I	Group M	Tsankawi	Total
Tan	38	17	34	60	38	187
Brownish	2	6	0	3	14	25
Reddish	1	0	0	0	0	1
Black	0	1	0	4	0	5
White to gray	0	0	0	0	3	3
Several colors	22	18	22	40	16	118
Total	63	42	56	107	71	339

Note: Shows all cavate walls with plaster recorded.

Masonry Wall (Code 18)

We found few walls constructed entirely of masonry in the sample recorded in 1986. We observed some such walls in unrecorded groups, including upper Group F and Group B. Although there can be little doubt that they were once common at these various sites, preserved portions are not visible without excavation.

The very low frequency of remaining masonry walls is quite apparent (Table 4.12). Those recorded are mostly small remnants. The use of masonry for closing and separating rooms is visible in the chamber locations of masonry walls. We found no masonry walls in the section of Group F we recorded, but observed several in the upper part of the group. The presence of masonry walls at Group I is quite out of proportion to the size of that group, as is the absence of masonry at Tsankawi. Tsankawi is both the most heavily visited group as well as the group with the greatest relative use of wholly excavated chambers. Masonry was surely present in the Tsankawi group but is now missing. Exterior masonry is also absent at Group M; the "walls" in that group are two sides of the very well-preserved interior divider between M-59 and M-60.

Masonry and Tuff Wall (Code 43)

We recorded three examples of these walls, all at Group A. They are located at the exterior, the right, and the left of their respective rooms. The low count of this type of feature is unquestionably due to the low preservation rate of masonry at all five study groups. Tsankawi has several examples of what appear to be low tuff wall bases, which almost certainly had masonry upper walls. On the whole, however, walls were probably either all natural or all masonry.

Chamber Corner (Code 39)

Corners were recorded primarily as means of triangulating the location of the compass used to take azimuths for the features so measured. Although we recorded direction for each feature that could be located as a point, we took distances from the compass to the feature only for triangulation points.

Table 4.12. Masonry Wall Occurrence and Dimensions.

A. Masonry Wall Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	0	0	3	2	0	5
Trapezoidal	1	0	0	0	0	1
Total	1	0	3	2	0	6

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall	Total
Rectangular	2	0	1	2	5
Trapezoidal	0	0	0	1	1
Total	2	0	1	3	6

C. Mean Area by Shape in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
Rectangular	5	1.375	1.146	0.141	11.567	71.7
Trapezoidal	1	4.410				

Floor (Code 3)

The floors of the rooms recorded are frequently not visible, either because of fill or because they are missing. Where possible without excavation or destruction, we recorded coats of plaster and dimensions. The floor and the other enclosing parts of chambers are both features and locations in this recording system, which leads to some redundancy in their coding (i.e., code: feature=floor, code: part=floor).

The frequencies of floors recorded show, among other things, the visibility of floors at the various groups (Table 4.13). Thus, Group I and Group F have low counts because the former has many filled chambers and some partial cavates, while the latter has more noncavates. The very low count at Tsankawi, however, seems an underrepresentation, possibly caused by development of a casual attitude toward recording floors as features as the field season progressed. It is also true, however, that the Tsankawi group has many chambers containing substantial fill. Means for width and length are the same, indicating the tendency of cavates toward square or round bases, rather than toward rectangular, as would be more likely for masonry rooms.

Replastering of walls and floors gives a crude index of intensity and duration of room use, though the interval between plasterings is unknown and probably varied, and it is possible that at least two coats--one scratch and one finish--may have been minimal. The floor replastering data show that a few features at Group A were probably quite heavily used, since they have up to seven coats of plaster (Table 4.14). More than half of the observable cases show two or three coats of floor plaster. For rooms thought likely to have been storage rooms, the floor plastering data are quite different from the wall plastering data: while storage room walls have no plaster or only one coat, five of the nine "storage room" floors recorded have more than two plaster coats.

Ceiling (Code 27)

A major reason for including ceilings as features was to record the presence or absence of smoking; a separate entry also allowed for recording specific notes about the ceiling. Generally, we did not take measurements for ceilings since they are defined by the tops of walls, which we did measure.

Of the 122 ceilings recorded, only 14 are recorded as having plaster, and of those only 2 have two coats. The tables for smoking show that most cavate ceilings are smoked (Table 4.15). The unplastered and smoked ceilings include the majority of smaller rooms, which we thought most likely to have served for storage. The friability of the tuff and the absence of plaster would probably mean a steady sifting of fine particles on the occupants and contents of cavate chambers. Steen (1977:17; 1979) has suggested that cavates were intentionally smoke-blackened as part of chamber preparation, and smoke blackening in storage rooms supports that argument. Chamber interiors do appear to be somewhat more resistant to erosion than the immediately surrounding tuff, since a sort of rind is sometimes visible at the front edge of cavates. Heiken even suggests that cavate walls might have been prepared by heating and then dousing, which would accelerate formation of a patina on the tuff (G. Heiken, personal communication, 1986; see also Heiken 1979). G. White (1904:67) made an interesting observation about the tuff in Cappadocia: "This rock is so soft that it can be slowly whittled away with a knife, and doors, windows, stairs . . . and rooms greater and smaller are easily worked in it, though it does not wear away rapidly under natural agencies, and its surface hardens on exposure to the air."

There are reasons to remain somewhat skeptical of the attribution of most smoking in chambers to intentional preparation rather than to use. The amount of smoking that remains in cavates is quite variable, and large chambers

Table 4.13. Floor Occurrence and Dimensions.

A. Floor Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	10	3	5	6	2	26
Bowed rectangular	1	0	0	2	0	3
Trapezoidal	2	0	0	8	0	10
Circular portion	1	0	0	8	3	12
Triangular	2	0	0	5	1	8
Linear	0	0	0	1	0	1
Irregular	0	0	0	1	0	1
Total	16	3	5	31	6	61

B. Mean Floor Areas for All Shapes in Meters

Function	n	Mean	Standard Deviation	Minimum	Maximum	CV
All rooms	25	2.40	1.36	0.47	4.86	56.7
Habitation	16	2.97	1.17	0.92	4.86	39.4
Storage	6	0.93	0.39	0.47	1.60	41.9
Kiva	2	3.13		2.80	3.46	

Note: B, includes only rooms with 15 cm or less of fill and floors more than 70 percent complete.

Table 4.14. Floor Plaster Coats by Group and Function.

A. Floor Plaster Coats by Group

Coats	Group A	Group F	Group I	Group M	Tsankawi	Total
0	2	0	0	4	4	10
1	3	1	1	7	0	12
2	4	0	4	9	1	18
3	4	2	0	10	1	17
4	0	0	0	1	0	1
5	1	0	0	0	0	1
6	1	0	0	0	0	1
7	1	0	0	0	0	1
Total	16	3	5	31	6	61

B. Floor Plaster Coats by Assigned Function

Coats	Habitation	Storage	Kiva	Total
0	3	2	0	5
1	8	2	1	11
2	12	4	2	18
3	13	1	2	16
4	0	0	1	1
5	1	0	0	1
6	1	0	0	1
7	1	0	0	1
Total	39	9	6	54

Note: B, seven cases with unknown function not shown (5 of these have no coats).

Table 4.15. Ceiling Occurrence and Smoking by Group and Function.

A. Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	10	8	9	10	22	59
Oval	0	1	0	0	1	2
Trapezoidal	3	0	3	6	6	18
Circular portion	3	0	0	5	13	21
Triangular	3	0	1	3	3	10
Cylindrical	0	3	1	3	2	9
Total	19	12	14	27	47	119

B. Ceiling Smoking by Group

Absent/Present	Group A	Group F	Group I	Group M	Tsankawi	Total
Smoking absent	3	0	4	6	7	20
Smoking present	17	12	10	22	41	102
Total	20	12	14	28	48	122

C. Ceiling Smoking by Assigned Function

Absent/Present	Habitation	Storage	Kiva	Total
Smoking absent	8	11	0	19
Smoking present	68	22	8	98
Total	76	33	8	117

with many features seem to have the thickest carbon deposits. Moreover, successive coats of wall plaster can be seen to have become quite black. A photograph of a Cappadocian kitchen cavate (Blair 1970:129) shows extremely black walls, presumably resulting from cooking. Tuff is a porous material, and it seems likely that smoke black would readily adhere to it. Whether smoking was intentional or not, it probably helped stabilize cavate ceilings. Steen's and Heiken's suggestion of intentional smoking and heating of cavates immediately after excavation could be tested by careful removal of a section of wall and floor plaster to ascertain whether or not burning took place before any plastering.

Passage (Code 42)

A few of the cavate chambers studied were connected to other chambers by short tunnels that could not be considered rooms on their own. This means of reaching another room was less frequent than simple doorways. Instances of this feature were found at Group A (between A-32 and A-34), Group M (connecting M-56 and M-58) and Tsankawi (between TS-52 and TS-53). All three connect rooms with floors at somewhat different levels, so that the passages slope. The Tsankawi example is quite short, but it is more than just an interior door.

Combined Chamber (Code 53)

The procedure of recording upper and lower chambers separately because of differing shapes means that volumes of these chambers are not comparable to those recorded as single shapes. After computing volumes for the constituent parts, we combined them and entered them under this separate feature type with a part code for chamber, enabling them to be included in comparisons and averages.

Compass Location Point (Code 51)

Where possible, compass locations were tied to discrete, identifiable features. In some cases this was not possible. The points selected are described in the notes to the feature, as is the distance from the compass to the feature. Feature azimuths and heights in combination with the triangulated compass location allow reidentification of features.

Floor Features

Firepit (Code 4)

This code was reserved for formally constructed, lined pits that showed evidence of having been burned. We found relatively few because they are quite consistently placed at the outer edge of the chamber and thus are subject to deterioration. In addition, we did virtually no excavation, and depressed floor features are usually filled even in rooms containing very little floor fill. Especially given the high frequency of smoked chambers and of smoke holes, there is little doubt that firepits are substantially underrepresented relative to their prehistoric frequency (Table 4.16).

Visible firepits are especially abundant at Group A. We observed intact examples in unrecorded portions of Groups F and M. The recorded features vary considerably in size, which is surprising since they are generally located in small rooms.

Floor Burn (Code 5)

This feature covers cases in which there is a clearly localized burn on a floor, although no formal firepit was constructed. Though they are common in excavated rooms in Chaco, we observed relatively few in the cavates. We recorded a total of six floor burns, four in Group M and one each at Group A and Tsankawi. Group M thus held the largest number of floor burns as well as floors recorded (Table 4.13).

Table 4.16. Firepit Occurrence and Dimensions.

A. Firepit Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	2	0	0	1	1	4
Oval	1	0	1	0	2	4
Trapezoidal	1	0	0	0	0	1
Round	0	0	0	0	2	2
Rectangular solid	8	1	2	5	0	16
Total	12	1	3	6	5	27

B. Mean Dimensions by Grouped Shape in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
Oblong						
Length	13	0.56	0.175	0.30	0.93	31.5
Width	13	0.44	0.159	0.23	0.70	36.1
Volume	13	0.02381	0.01682	0.0000	0.0499	70.6
Round diameter	2	0.59		0.40	0.78	

Note: Only features considered more than 70 percent present are included, oblong includes oval, rectangular, and rectangular solid.

Subfloor Pit (Code 7)

This feature category includes pits for which we inferred no specific function. It is, then, a catchall for features that do not fall into categories such as firepits, probable postholes, or pits for loom anchors. Again, since we did not excavate, we observed such floor features at a rate far less than their probable actual occurrence (Table 4.17). At Tsankawi, for example, the fill and floor of TS-59 were vandalized after the room was recorded, exposing several pits and floor features that were not visible at the time of recording.

Though it was not possible to measure depths for some floor pits, they are all assumed to have depth. Thus, pits recorded as rectangular and as rectangular solids have been included in the same counts, as have round and cylindrical shapes. The volume means indicate how many of these features we were able to fully measure. The vandalized examples at Tsankawi suggest that some such features may be a good deal deeper than the 19 cm indicated as a maximum. As might be expected, there appear to be at least two categories here: those more like postholes (round in plan, with lower volumes) and those more like storage pits (oval or rectangular with higher volume).

Floor Depression (Code 36)

This is another descriptive code for features of unknown function. Some of these features are of appropriate size and shape to have been pot rests (see Figure 4.4).

Just as for wall depressions, we recorded a disproportionate number of floor depressions for Group A. One room there (A-47) contains two plastered examples 19-20 cm in diameter that are especially reminiscent of pot rests (Figure 4.4). There are a couple of much larger features in this group, but the majority fit into a size range appropriate for pot rests (Table 4.18).

Floor Pit Complex (Code 45)

We observed this feature type only at Tsankawi. It consists of clustered groups of more or less regular, concave depressions in the tuff (Figure 4.5). The age of these pits was uncertain, and so was their function. Because they are in the tuff itself, it is at least possible that they would have been covered by plaster flooring, and they may have resulted from the process of excavating the chamber out of the tuff. Since they are found inside intact cavates with no other signs of severe weathering, they cannot have been produced by natural erosion. They are almost certainly manmade but may have been produced by modern visitors. Many of the individual pits bear some resemblance to axe-sharpening grooves, and some may have had a similar function. There are several possible reasons why this feature type was recorded only at Tsankawi: Tsankawi has more exposed tuff floors and receives heavier modern visitation. It is also possible that there was some cultural or functional basis for the difference.

Posthole (Code 46)

Postholes are another feature type observed only at Tsankawi. We recorded 9 as parts of cavates and noted 9-12 more as exterior to recorded rooms. Some of the recorded examples are near the edges of chambers and probably formed part of partitions or closing structures. Others are interior and may only resemble postholes in size and shape; they may have been used for loom uprights or some other function. The exterior postholes are located on the bedrock "terraces" in front of several groups of Tsankawi rooms (TS-15, TS-22-TS-25, TS-54-TS-59). In these areas they are likely to have been part of masonry (and jacal?) structures. The use of more wood and less stone seems likely given the relative scarcity of rubble in the areas outside the middle and upper Tsankawi cavates. None of these features suggests the use of large beams: the greatest recorded diameter is

Table 4.17. Floor Pit Occurrence and Dimensions.

A. Floor Pit Occurrence by Type and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Oval	0	0	0	1	4	5
Rectangular solid	1	0	1	1	1	4
Cylindrical	2	0	0	4	2	8
Hemispherical	1	0	1	0	2	4
Total	4	0	2	6	9	21

B. Mean Dimensions by Shape in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
All shapes volume	11	0.01896	0.02942	0.00096	0.10070	155.2
Cylindrical volume	5	0.01013	0.01564	0.00095	0.03802	154.4
Cylindrical diameter	5	0.26	0.181	0.09	0.55	69.4
Cylindrical depth	5	0.14	0.054	0.05	0.19	37.7

Figure 4.4. Group of three floor depressions in A-47. The depressions are in the floor plaster and are extremely suggestive of pot rests. The very symmetrical ledge in the wall behind (recorded as a wall niche) is somewhat unusual in shape, though a similar feature was observed in Group F as well.

20 cm, and the average is around 12 cm, with unexcavated depths ranging from 7 cm to 40 cm.

Floor Ridge (Code 6)

Several rooms containing numerous features and having observable floors exhibit a raised floor feature, usually running across the width of the room (Figure 4.6). Sometimes the floor is lower on one side of the ridge than on the other. Rather than bisecting the room, the ridge seems to divide it into unequal portions, the lower side usually the smaller. These features may be related to mealing complexes, but we have little evidence and a fairly small sample. Hewett and others call them sleeping ridges. Future workers in cavates should be on the alert for complexes involving floor ridges, slots, metate rests, and wall depressions (Figures 3.1, 4.6, 4.7). Again, Group M, which had the most floors visible, also had the preponderance of floor ridges: 7 of the 11 recorded. One floor ridge was recorded at Tsankawi and three at Group A. The notion that at least some floor ridges functioned to form partitions is supported by our observation that the crest of several of these ridges seems to be broken away, as would have happened with the removal of a mortared-in plank.

Metate Rest (Code 40)

No metates were observed during the 1986 field season, either in place or on the slopes in front of the groups studied. Features called metate rests were reduced to inclined adobe lines on walls in all but one case; these lines extend from floor level to heights of around 20 cm (Figure 4.7a, Table 4.19). The lines are almost certainly the remnants of plaster cementing metates in place, but empirical proof for this statement is largely lacking. The exception is located at Group M and consists of an adobe ramp located a few centimeters away from the wall (Figure 4.6).

As can be seen in M-60 (Figure 4.7), mealing activities likely resulted in a complex of features: metate rests and worn areas in the wall from grinding, and perhaps slots and floor ridges for storage areas. To evaluate this possibility and to examine the occurrence of mealing features, Table 4.20 gives the frequencies of occurrence and co-occurrences of these feature types, in cavate rooms only. Given the invisibility of the majority of floors, the inventory is certainly partial. Only wall depressions less than 15 cm above the floor are

Table 4.18. Floor Depression Occurrence and Dimensions.

A. Floor Depression Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	2	0	0	0	0	2
Oval	1	0	0	1	1	3
Round	2	0	0	1	0	3
Hemispherical	2	0	0	1	1	4
Total	7	0	0	3	2	12

B. Mean Dimensions by Shape in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Diameter	10	0.24	0.164	0.05	0.60	69.0
Depth (circular)	10	0.09	0.106	0.00	0.30	113.9
Volume	10	0.00184	0.00363	0.00012	0.01001	197.1
Rectangular length	2	0.22		0.21	0.22	
Rectangular width	2	0.22		0.21	0.22	

Figure 4.5. "Floor pit complex" in TS-55. The depressions are in the tuff and were probably beneath the floor plaster. This particular group contains 20-25 pits.

included, which reduces the number of cavate wall depressions considered from 46 to 26. M-60 is the "type room" for this complex: it has all the features except a slot. In M-60 there would be two wall depressions to go with the two metate rests except that the "depression" is so large as to have been considered a floor-level niche.

The low frequency of these features in combination with the incomplete knowledge of floors (which especially affects counts of ridges and metate rests) makes statements about co-occurrence of these features tentative. Still, the small sample suggests that slots and floor ridges are likely to co-occur: five of seven slots in cavates were in rooms that also contained ridges. Wall depressions near the floor are much more common than metate rests, but four of six metate rests were associated with wall depressions. The associations between ridges and slots, and between metate rests and wall depressions are stronger than those outside these pairs; we encountered no chambers containing all four feature types (Table 4.20). Nonetheless, ridges, slots, and metate rests are more likely to be found in chambers having one of the other features types than they are to be found alone. If ridges and slots were in fact somehow related to storage, this finding suggests that storage and milling may have often taken place in different rooms.

Loom Anchor (Code 13)

In a surprising number of cases, we found wooden loops remaining in floors (Figures 4.8, 4.9). When enough floor is visible, these

Figure 4.6. *Complex of features in M-40 including the best example of a metate rest we observed. Note the shallow plaster basin at the base of the incline and the floor ridge passing across the room directly in front of the metate rest. There is a groove in the wall where the floor ridge intersects the wall which is suggestive of a "slot."*

features are usually found in groups of four or more; Hewett (1909b) says six to seven, and Peckham (1979:68) says six or more (see Figures 3.1, 4.8). Some form of cementing material is sometimes visible around the wood remnants. A. V. Kidder thought that the material used at Pecos was tamped-down ash (see Smith 1972:123); Peckham suggests compacted ash or clay. We thought it might be some form of clay, but we did not analyze the material.

Several attributes support the contention that these features are loom anchors. As noted, they usually occur in straight lines. In several cases they are found in chambers with distinctive beam holes and other ceiling features. They are also very similar to features interpreted in this way in the western Anasazi/Western Pueblo area, where there is some ethnographic continuity in their use (see Smith's summary and description, 1972:121-123; Kent 1983a:119-125). Like the examples described by Smith, several of these features are parallel to a chamber wall, which explains why they still exist in rooms that are heavily visited (several rooms at Tsankawi have floor remaining around the edge of the chamber with a worn area in the center). The most visible example we recorded, however, violates this pattern and runs more or less diagonally across the room (Figure 4.8).

Though we observed several instances of loom anchors, we found few whole sets (M-59

Figure 4.7. *Grinding complex in room M-60. a. Note the side-by-side plaster basins similar to that seen in M-40 (Figure 4.6). An inclined plaster line leading into the basin by the wall can be seen on the wall. The wall depression on the wall on the right is worn through the plaster, and a smaller, shallower plaster defect can be seen next to the deeper depression. b. B. Mills demonstrating how a grinder's feet could have formed a depression in the wall ("mano"=30 cm). This room also contained rock art (Figure 4.28) and is separated from M-59 (Figures 4.8, 4.15) by a combination tuff and masonry wall.*

Table 4.19. Metate Rest Occurrence by Location and Group.

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Floor	0	0	0	4	0	4
Right wall	0	1	0	0	0	1
Back wall	0	0	1	0	0	1
Total	0	1	1	4	0	6

Table 4.20. Co-occurrence of possible mealing complex features.

Feature Types per Room	Ridge	Slot	Wall Depression	Metate Rest	Sum of Features	Occurring in Cavates (n)
Single type	5	1	20	1	27	22
Two feature types						
Ridge and slot	3	4			7	3
Ridge and metate rest	1			1	2	1
Wall depression and metate rest			2	1	3	1
Three feature types						
Ridge, slot, wall depression	1	1	1		3	1
Ridge, metate rest, wall depression	1		1	2	4	1
Metate rest, slot, wall depression		1	2	1	4	1
Totals	11	7	26	6	50	30

Note: Cavates only; only wall depressions 15 cm or less above floor. Columns show number of occurrences of a feature and the number of cavates in which the features occur. For example, three ridges co-occur with four slots (seven features) in three rooms.

Figure 4.8. *Row of six loom anchors in cavate M-59; portions of the wooden loops are present in several of the holes and the use of different clay material to cement the anchors is visible in the hole in the center foreground. This room has a small back chamber, large floor-level niche, floor depressions, a slot (Figure 4.15) and other wall features, but no rock art. It was designated as a habitation room.*

Figure 4.9. *Close-up of a wooden loom anchor loop in TS-59. This is a very large room with a full complement of "kiva" features and elaborate rock art. This loop is in a remarkable state of preservation in spite of heavy visitation to the room, because it (and other loom anchors observed) is located just at the edge of the heavy traffic area of the floor. It was covered when we worked here but was exposed and damaged by vandals sometime between August, 1986, and April, 1987.*

and TS-65 contain the most nearly complete recorded sets). From the cases we observed, the looms appear to have been more than 1 m wide, but how much more is not clear. Hewett's maps (1909b:660-665) show 1.35-2.10 m for five sets of six to seven anchors, averaging 1.6 m (s.d.=0.3). Six aligned probable anchors in TS-65 form a line 2.2 m long, but they may not all be contemporaneous, and subsets of four or five suggest a width of 1.1-1.5 m. Peckham (1979:67) illustrates some kivas (not cavate "kivas") containing two to four sets of these features. He notes several arrangements, including location by the wall similar to those in the cavates:

> Although often occurring as single alignments, pairs of loom hole alignments may be on either side of the hearth, paralleling the east-west axis of the kiva, or at more acute angles to this axis, or close to and roughly parallel to the kiva wall on either side of the ventilator opening. Multiple sets of loom holes frequently occur in the same general location indicating that they occasionally had to be replaced. (Peckham 1979:68)

The traditional Pueblo looms shown by Kate Peck Kent are apparently held down by rocks or heavy logs, though one Hopi example may employ some form of anchor in the ground (1983b:11, 33, 59, 78). Kent also provides a drawing of a prehistoric loom employing loom anchors (1983a:120). Several of the looms she shows are located outdoors.

All the loom anchors are presumably some form of cylinder in section, but for most only a plane shape is observable (Table 4.21). Their absence at Groups A and F is probably sampling error, though upper loom supports are also absent in our samples from those groups. Where there is one loom anchor, as at Group I, there are surely others. The one there was suggested by upper supports and the wall features in the room, and only a small area of the shallow fill was cleared.

The diameter of loom anchors seems quite consistent. The unfortunate recent vandalism of an anchor at Tsankawi shows that they may be quite deep (at least 15 cm) and very regular cylinders below floor level. The construction apparently entailed boring a hole in the tuff floor of the chamber, inserting a bent twig (1-2.5 cm in diameter), and cementing the twig in place using a clayey substance. In the few cases observed, the clay is an olive-yellow color distinct from the surrounding tuff.

Step (Code 35)

In a few cases room floors appeared to have more than one level, and the feature dividing the levels was called a step. Two examples were recorded at Group M and one at Group I. It is quite conceivable that some no longer discernible room partition may have existed next to some steps. Two steps were also recorded in Group F (F-47); rather than dividing a room, however, these steps appear to have been stairs cut in the sloping back wall of a room in order to reach the higher cavate room (F-1) behind it.

Axe Groove (Code 50)

Seven examples of this feature were recorded at Tsankawi. The softness of the tuff raises some doubt that it would be effective in sharpening an axe made of hard stone, but an abrasive lap would be generated. Given erosion and location this functional assignment is speculative.

Adobe Collar (Code 52)

A single example of this feature "type" was recorded at Group F (F-37). It consists of an unburned semicircle of adobe that abuts the back wall just opposite the exterior door of a small chamber (Figure 4.10). The wall plaster

Table 4.21. Loom Anchor Occurrence and Dimensions.

A. Loom Anchor Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Oval	0	0	0	1	1	2
Round	0	0	1	4	15	20
Cylindrical	0	0	0	7	0	7
Total	0	0	1	12	16	29

B. Mean Dimensions by Grouped Shape in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Diameter	24	0.09	0.019	0.05	0.12	22.3
Depth	5	0.03	0.029	0.01	0.08	89.5

above the feature is worn and is also unburned. The collar is 4 cm high, and the diameter of the feature is 64 cm at the wall. Conjecturally, the enclosed area might have been used to hold pots.

Deflector (Code 44)

Deflectors in cavates are low walls next to the exterior opening or door of the chamber. The firepits we observed are nearly all in the same location, but not every firepit has a deflector associated with it. We recorded only three deflectors, one at Group I and two at Tsankawi, though the best example observed is in the upper, unrecorded part of Group F (Figure 4.11).

Wall Features

Large Floor-level Niche (Code 8)

Large niches either at floor level or slightly below it seem to be relatively common in Bandelier cavates (Figure 4.12, Table 4.22). The high counts are partly because the niches are large enough to be recognizable even in heavily eroded walls. Still, the niches were clearly part of the majority of cavates likely to have been used for habitation. They vary substantially in depth; the shallowest ones are borderline wall depressions, and the largest might be considered small back chambers (note that the maximum volume is greater than the minimum volume given for chambers). The basis for calling such a feature a niche rather than a chamber was primarily morphological. Niches are not constricted at the opening by a definable door; still, in some cases it was a matter of judgment whether to call them chambers or niches. There is little concrete evidence concerning their function; a few contain other wall features, but most do not. They are frequently smoked in the top, and often plastered, though the plaster coats may differ

Figure 4.10. The sole "adobe collar" observed by our crew. The collar is opposite the door in the small chamber of F-37. The wall plaster is worn behind the collar; a wall niche is present above to the left (scale=30 cm).

from those on the wall in which the niche is located.

For some reason, large floor-level niches are less often found on the left wall; we recorded approximately equal numbers of left and right walls, but nearly three times as many large niches are found on the right than on the left wall. They occur quite frequently in the back corners of the chamber, but corner locations do not show a similar preference for side (10 back right, 8 back left). The percentage of these features on back walls is somewhat higher than the percentage of back walls recorded might suggest, but since back walls are usually intact, the disproportion is not difficult to understand. This is reflected in the fact that one-fourth (33) of these niches recorded were located on noncavate back walls; clearly, in a room with three masonry walls and one tuff wall, the back, tuff wall would be the prime location for these handy features. The mean distance from the floor to the bottom of the opening of these niches is -3 cm. As would be expected from the feature name, about half were at floor level.

These features tend to have rectangular openings, since a section of a cylinder is rectangular. The difference in shape assignment in the two most abundant categories is a function of the morphology of the backs of the niches: some are rounded, others more rectilinear.

Figure 4.11. Well-preserved example of a deflector in upper Group F, Room 15 (this cavate was not recorded by the project). There is a basin firepit next to the chamber side of the deflector.

The coefficient of variation for volume for this feature is very high, no doubt reflecting variability in function within features in this category. The largest case (an oval feature nearly 1.8 m tall at Group A) is almost twice the volume of the next largest example. The vast majority of large floor-level niches, however, fall at the smaller end of the scale, ranging from 0.04 to 0.20 m^3 (Figure 4.13); features at Tsankawi and Frijoles follow similar distributions. Smaller examples could have accommodated a jar, for example, while some of the larger ones could have been for storing more items or food. Even when the extreme case is removed, the standard deviation for volume is greater than the mean (CV=112). In spite of the overall variability in volume, the mean volumes of this feature are remarkably similar across shapes, suggesting that although there may be several volume categories within the feature type, differing shape may *not* be a good indication of differing function. Over 80 percent of the relatively complete large floor level niches recorded are 0.2 m^3 or less in volume, but even within that group volume variability is high (CV=77.4), again suggesting a variety of functions for this feature type.

Wall Niche (Code 9)

Although this feature type might seem redundant with the large floor-level niche, the two seem to be distinct. Wall niches are generally much smaller than large floor-level

Figure 4.12. *Large floor level niches. Lower photograph also shows wall replastering to specified height providing a distinct "dado". a. An example of pairing of a small wall niche with a large floor-level niche in M-44. b. Example in A-47, with second large floor-level niche at the left edge of the photograph. Note the wear around the base of the opening.*

Table 4.22. Large Floor-level Niche Occurrence and Dimensions.

A. Large Floor-level Niche Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular solid	9	12	0	4	13	38
Oval	3	1	0	1	4	9
Trapezoidal	0	1	1	1	1	4
Cylindrical	0	1	0	0	1	2
Hemispherical	6	7	2	11	23	49
Truncated cone	1	0	1	1	0	3
Truncated pyramid	3	2	3	5	2	15
Conical	0	1	0	0	0	1
Spherical	1	0	1	0	3	5
Irregular	0	0	0	1	0	1
Total	23	25	8	24	47	127
Noncavate, grouped	2	2	0	0	0	4

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall	Back Corners	Front Corners	Total
Rectangular solid	7	22	3	0	5	1	38
Oval	2	7	0	0	0	0	9
Trapezoidal	0	3	1	0	0	0	4
Cylindrical	1	0	0	0	1	0	2
Hemispherical	7	26	4	2	6	4	49
Truncated cone	0	2	0	0	1	0	3
Truncated pyramid	2	9	0	0	4	0	15
Spherical	3	2	0	0	0	0	5
Irregular	0	0	0	0	1	0	1
Total	22	71	8	2	18	5	126[a]

Table 4.22. (continued)

C. Mean Dimensions by Shape in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
All shapes						
Widths	121	0.57	0.241	0.12	1.40	42.4
Heights	116	0.53	0.280	0.15	1.78	52.8
Depths	43	0.48	0.237	0.11	1.11	49.6
Volume	110	0.1281	0.1707	0.0039	1.2582	133.2
Round						
Diameters	56	0.58	0.261	0.12	1.40	44.8
Depths	51	0.50	0.238	0.15	1.07	44.7
Volumes	55	0.1256	0.1572	0.0042	0.6593	125.1
Rectangular						
Width	33	0.51	0.203	0.20	1.04	40.2
Height	33	0.47	0.175	0.15	0.58	39.2
Volume	32	0.0915	0.0845	0.0039	0.3103	92.3
Pyramidal						
Base width	14	0.63	0.215	0.35	1.10	34.2
Height	14	0.70	0.201	0.35	1.11	28.8
Volume	14	0.1737	0.1208	0.0220	0.4608	69.6
All height above floor	86	-0.03	0.107	-0.30	0.22	

Note: Only niches considered to be more than 70 percent complete are included. C, round includes cylindrical, conical, and hemispherical; rectangular includes rectangle, bowed rectangle, and rectangular solid.

[a]Conical niche is within another feature, which is in the right wall (not tabulated).

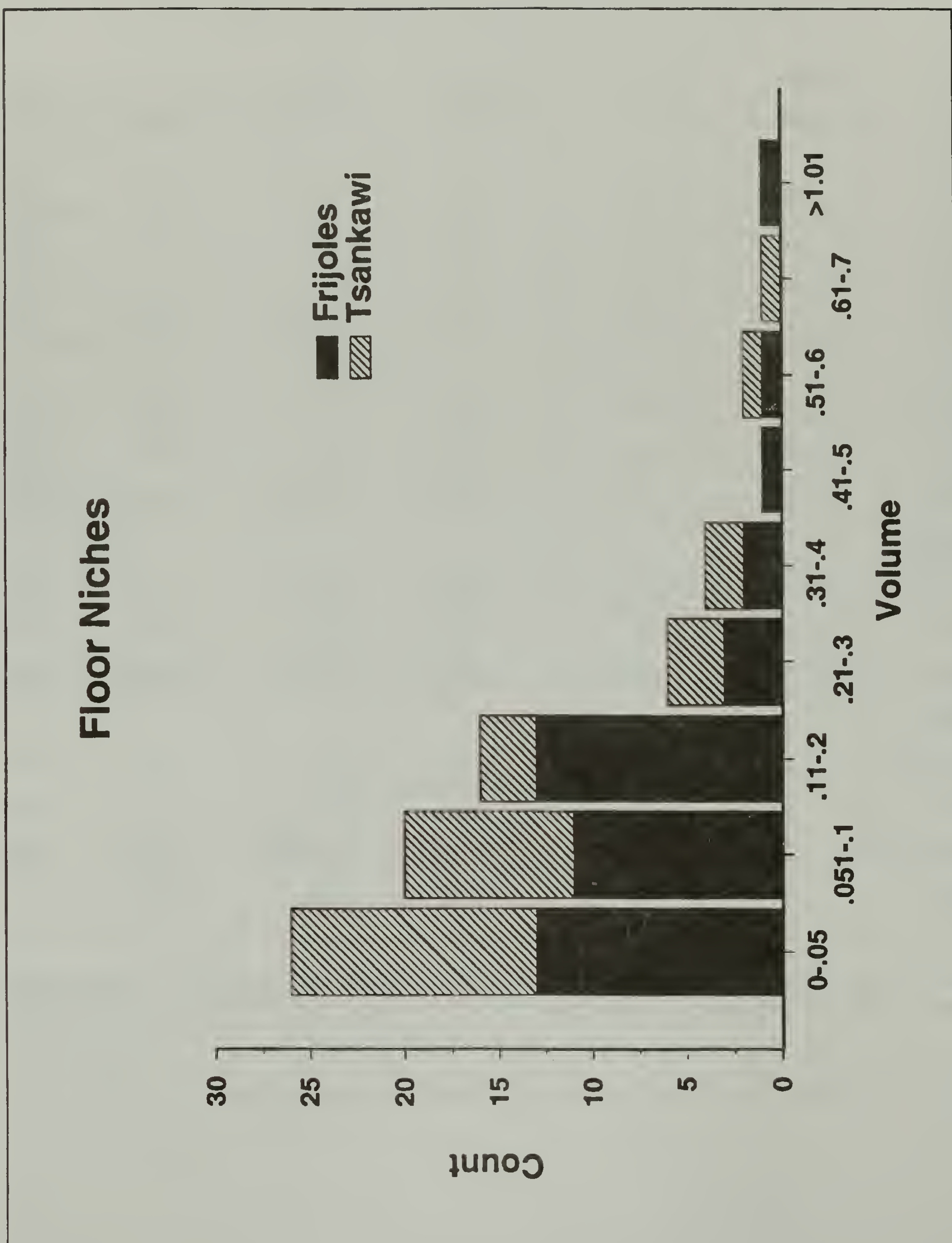

Figure 4.13. *Large floor-level niche volumes, with location indicated. Only features more than 70 percent present and with calculated volumes greater than zero are included, for a total n of 77, 45 of which are in Frijoles Canyon.*

niches, they are usually some distance from the floor, and they tend to be shaped differently from the floor-level niches (examples may be seen in Figures 4.4, 4.10, 4.12a). Wall niches are often quite carefully shaped, through built-up plaster work around the opening, careful excavation into the tuff, or some combination of the two.

The frequency and occurrence by group of wall niches are quite similar to those of the large floor-level niches (Table 4.23). Walls with large floor-level niches are probably more likely than others to have wall niches as well. The disproportionately low frequency of large floor-level niches on left walls is not matched by the wall niches, so that there is no one-for-one co-occurrence of the two niche types. We recorded 20 wall niches at or slightly below floor level, but the majority are 20-45 cm above the floor. Most are much smaller in volume than floor-level niches, with only a few reaching the mean volume for the latter (Figures 4.13, 4.14). Thus the two niche types seem fairly distinct in both wall placement and size (based in large part on definition, of course), though they overlap in both respects.

In some cases the two types of niches seem to be paired (Figure 4.12a). Given the similarity in counts, it is possible that these two niche types may have served complementary functions. Their co-occurrence in chambers and noncavates is shown in Table 4.24. Among rooms containing niches, niche occurrence can be divided approximately into thirds: chambers with wall niches only (37 percent), those with large floor-level niches only (35 percent), and those with both types occurring together (28 percent). The Tsankawi cavates are distinctive in having some chambers with larger numbers of niches of both types; while two of each type is the maximum for our Frijoles sample, one Tsankawi chamber has three of each, and several others have multiple wall niches and a single large floor-level niche.

Slot (Code 10)

Slots are somewhat enigmatic features. They are usually incised vertical ovals with their bases near the floor (Figure 4.15). Where the floor is visible, floor ridges seem to be associated with slots, but the number of cases is small (Table 4.20). These features seem to have been intended to hold the end of a plank, thereby forming low partitions of the room, perhaps for storage bins.

Although there are only 10 slots in the sample, their distribution has noteworthy aspects (Table 4.25). Slots are absent at Tsankawi, and half of those recorded are at Group M. There also seem to be more than might be expected in the right wall of the chamber. Three of the recorded examples are on noncavate back walls, reducing the opportunity to observe co-occurrence with floor features. Though variable, the dimensions could all accommodate planks or perhaps a slab (see Carlson and Kohler 1989:55). With the exception of the highest value of 25 cm, the mean height above the floor of observed slots is close enough to the floor to have held a separator for a substance such as grain, if the floor had been built up (as with a floor ridge).

Viga Hole (Code 11)

The assignment of several types of wall holes to feature categories involved some degree of subjectivity. Features were called viga holes if they were of sufficient size to contain a substantial beam and were located in such a way that roof support was likely. Particularly on open back walls to former masonry rooms, rows of probable viga holes with little vertical separation suggest remodeling episodes. Size, shape, and angle were the primary criteria for this feature assignment; in all we observed over 500 features we called viga holes.

Other chamber locations include ceiling (five holes) and an overhang above the cavate (one set of six). Forty percent (114) of the viga

Table 4.23. Wall Niche Occurrence and Dimensions.

A. Wall Niche Occurrence by Type and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	8	13	3	7	20	51
Oval	1	3	0	3	8	15
Cylindrical	6	4	0	3	7	20
Hemispherical	13	7	5	10	24	59
Truncated cone	0	0	0	1	1	2
Truncated pyramid	1	1	1	1	1	5
Conical	0	0	0	1	1	2
Spherical	0	0	0	0	1	1
Irregular	0	0	0	0	1	1
Total	29	28	9	26	64	156
Noncavate, grouped	2	3	0	0	0	5

B. Chamber Location by Shape

Shape	Right Wall	Back wall	Left Wall	Exterior Wall	Back Corners	Front Corners	Total
Rectangular solid	8	34	5	2	2	0	51
Oval	2	8	4	1	0	0	15
Cylindrical	1	14	2	2	1	0	20
Hemispherical	6	34	5	6	3	1	55
Truncated cone	0	0	1	1	0	0	2
Truncated pyramid	0	2	3	0	0	0	5
Conical	0	2	0	0	0	0	2
Spherical	0	0	1	0	0	0	1
Irregular	0	1	0	0	0	0	1
Total	17	95	21	12	6	1	152

Table 4.23. (continued)

C. Mean Dimensions in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
All volume	141	0.0248	0.0567	0.0001	0.3881	228.4
Round						
Diameter	81	0.25	0.181	0.06	0.90	72.4
Depth	79	0.24	0.221	0.06	1.30	92.6
Volume	79	0.0219	0.0526	0.0001	0.3793	240.2
Rectangular						
Width	46	0.27	0.202	0.06	0.84	73.8
Height	46	0.25	0.196	0.04	0.75	78.2
Depth	29	0.13	0.101	0.05	0.38	77.2
Volume	46	0.0284	0.0457	0.0002	0.1718	160.9
All height above floor	115	0.31	0.260	-0.21	1.48	83.9

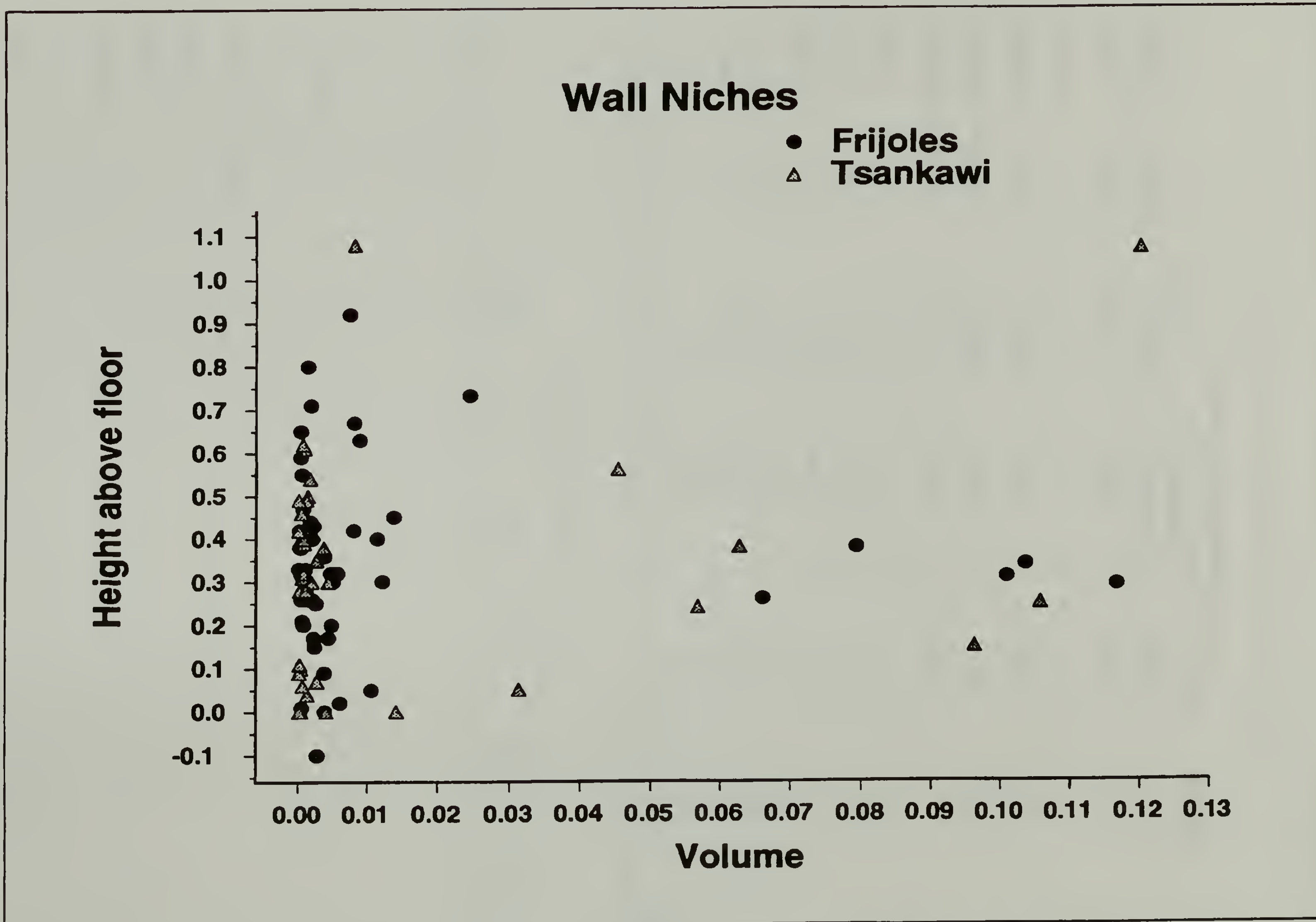

Figure 4.14. *Plot of wall niche height above floor (in meters) by volume (in m^3). Only niches from chambers with 20 cm or less of fill and niches considered to be at least 70 percent present are shown. Extreme heights over 1.4 m and volumes over .13 m^3 are excluded, for a total of 89 niches.*

Table 4.24. Co-occurrence of Floor-level and Wall Niches by Group.

Rooms with:	Group A	Group F	Group I	Group M	Tsankawi	Total
Floor-level niche only	10	11	6	8	19	54
Wall niche only	13	16	6	10	13	58
One of each type	2	2	2	6	2	14
Multiple of each	2	1	0	1	1	5
Floor-level > wall niches	2	3	0	2	3	10
Wall > floor level niches	2	1	0	2	9	14
Total rooms with niches	31	34	14	29	47	155
Total floor-level niches	23	25	8	24	48	128
Total wall niches	29	28	9	26	64	156
Maximum n floor-level niches	2	3	1	2	5	
Maximum n wall niches	2	2	2	2	7	

holes we recorded individually are associated with noncavate back walls, and almost as many viga holes were recorded in sets as individually. The combined counts demonstrate the importance of cliff-backed masonry rooms at these sites, particularly Groups A and F. The relatively high frequency of viga holes at Group A fits with the large number of "back wall" features there (Table 4.26).

Why use vigas in a cavate? Viga holes are present in "cavates" largely because many cavates had masonry closing structures. Also, the counts by location show only individually recorded viga holes, not those recorded in groups on noncavate forms. Still, features that are to all appearance viga holes do occur in closed cavates, suggesting either some ceiling or rack structure. Some of these may have been upper loom supports lacking other recognition criteria (Figure 4.24). Many such features have smoke-blackened interiors, suggesting that they may have served only to hold some form of beam for part of the period of use of the cavate.

Figure 4.16 gives an indication of the variation in viga hole height, diameter, and depth. There is a concentration of holes 10-15 cm in diameter, 15-25 cm in depth, and 1.2-1.6 m high. We recorded height above floor only for cavates; if we had included noncavate back walls, the mean would be larger. The height above floor is fairly consistent; indeed, some height above the floor is necessary for a hole to be assigned to this feature type. Although a few cases fall in the 1.8-2.0 m range that most moderns would consider a comfortable ceiling height, 56 percent of the included cases fall between 1.2 and 1.6 m above the floor (Figure 4.16). Given the values below 1 m and the

Figure 4.15. Good example of a slot in cavate M-59 (scale=30 cm). This room also contains loom anchors and a large floor level niche, but no recognizable milling features.

placement inside cavates, it is likely that if some of these viga-shaped holes did in fact contain vigas, the beams had functions other than ceiling support.

Possible Latilla Hole (Code 12)

This feature type is more ambiguous than the viga hole. Size and placement again contribute to its use. Occasionally series of small holes are found at about ceiling height, which may have been for latillas; these are the ideal case, but the category also includes less clear examples (Table 4.27).

The feature category was originally inspired by a structure by the Tsankawi trail, where there is a series of 10 closely spaced, flattened, hemispherical (or "ovals with depth") holes that clearly supported a roof above an area in front of a cavate (probably Lister's C-119). After all the present measurements had been taken, I returned to this set of "ideal" latilla holes and measured them; they are 0.07-0.13 m wide, 0.06-0.11 m high, and 0.06-0.09 m deep. They are thus somewhat larger than the average for other features recorded in this category, though the depths are similar. Figure 4.17 shows that the features placed in this category are generally smaller and shallower and the measurements more dispersed than viga holes (compare Figure 4.16). Given the mean viga hole diameter and that for possible latillas, it appears that the wood being used in cavates tended to be fairly small. Comparing the height

Table 4.25. Slot Occurrence and Dimensions.

A. Occurrence by Type and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Oval	1	0	0	0	0	1
Linear	2	0	1	0	0	3
Rectangular	0	1	0	5	0	6
Total	3	1	1	5	0	10

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left wall	Total
Rectangular	4	1	1	6
Oval	0	1	0	1
Linear	0	3	0	3
Total	4	5	1	10

C. Mean Dimensions of Oblong Shapes in Meters

Dimensions	n	Mean	Standard Deviation	Minimum	Maximum	CV
Width	10	0.06	0.027	0.02	0.11	42.4
Height	10	0.26	0.080	0.14	0.40	30.7
Depth	3	0.04		0.02	0.07	
Height above floor	5	0.14	0.14	-0.07	0.25	98.4

Note: C, oblong includes rectangular, oval, trapezoidal, and triangular shapes. Only features judged to be more than 70 percent present are included. All available cases and shapes are included in height-above-floor measurements.

Table 4.26. Viga Hole Occurrence and Dimensions.

A. Viga Hole Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	3	2	0	0	2	7
Oval	1	1	0	0	1	3
Cylindrical	59	11	8	42	19	139
Hemispherical	34	17	8	7	34	100
Truncated cone	0	4	1	5	9	19
Conical	0	2	2	0	9	13
Total	97	37	19	54	74	281
Noncavate, grouped	67	87	48	6	26	234

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall & Corners	Back Corners	Other	Total
Rectangular	1	4	2	0	0	0	7
Oval	0	1	1	0	0	1	3
Cylindrical	15	91	15	3	7	8	139
Hemispherical	7	77	5	4	5	2	100
Truncated cone	2	9	2	2	4	0	19
Conical	1	4	2	1	5	0	13
Total	26	186	27	10	21	11	281

Table 4.26. (continued)

C. Mean Dimensions by Grouped Shape in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Diameter	255	0.14	0.056	0.04	0.38	40.5
Depth	251	0.16	0.097	0.03	0.71	62.2
Volume	245	0.0026	0.0038	0.00003	0.0431	148.5
Height above floor	121	1.39	0.266	0.85	1.94	19.2

Note: Shapes included are cylindrical, hemispherical, conical, and truncated cone. Only features judged to be more than 70 percent complete are included. Heights are given only for chambers with 15 cm or less of fill.

measurements with those for viga holes shows that this feature class is on average lower than viga holes, contrary to what would be expected if "latillas" were placed on top of vigas. In only a few cases did these two types of holes occur together in the "proper" sequence; of 150 cavates or noncavates where either feature type occurs, only 10 have both types. As with viga holes, we can only speculate about the actual function of apparently structural holes inside cavates. Holes for small beams do seem to have been used, and it seems more likely that they supported shelves than the prehistoric equivalent to false ceilings.

Beam Seat (Code 30)

This code differs from the viga hole primarily in that placement and pairing do not suggest roof support. Size still suggests that a substantial piece of wood would have been inserted (Figure 4.18a). The distinction is somewhat subjective, and some crossover between the two categories would be likely if we were to reclassify all cases.

Other than a low frequency at Group F, there is little remarkable in the distributions of beam seats (Table 4.28). Compared to viga holes, features recorded as beam seats are much more often oval or rectangular, though the majority of openings are round; the mean diameter for beam seats is about two-thirds that for viga holes, and they are somewhat shallower on average (Figure 4.18b). Beam seats are more evenly distributed on chamber walls than are viga holes, though the majority are again found on back walls. Although a few possible beam seats were located near the chamber floor, around 70 percent are 0.8-1.4 m above the floor, with most of those in the 0.8-1.0 m range. Figure 4.18a shows a concentration of beam seats around 9 cm in diameter, 20 cm in depth, and 60-100 cm above the floor.

Indeterminate Hole (Code 28)

Cavates and noncavates have a great many small holes in their walls, and since almost none of the holes now contains identifiable remains, it is impossible to know what their function was, resulting in heavy use

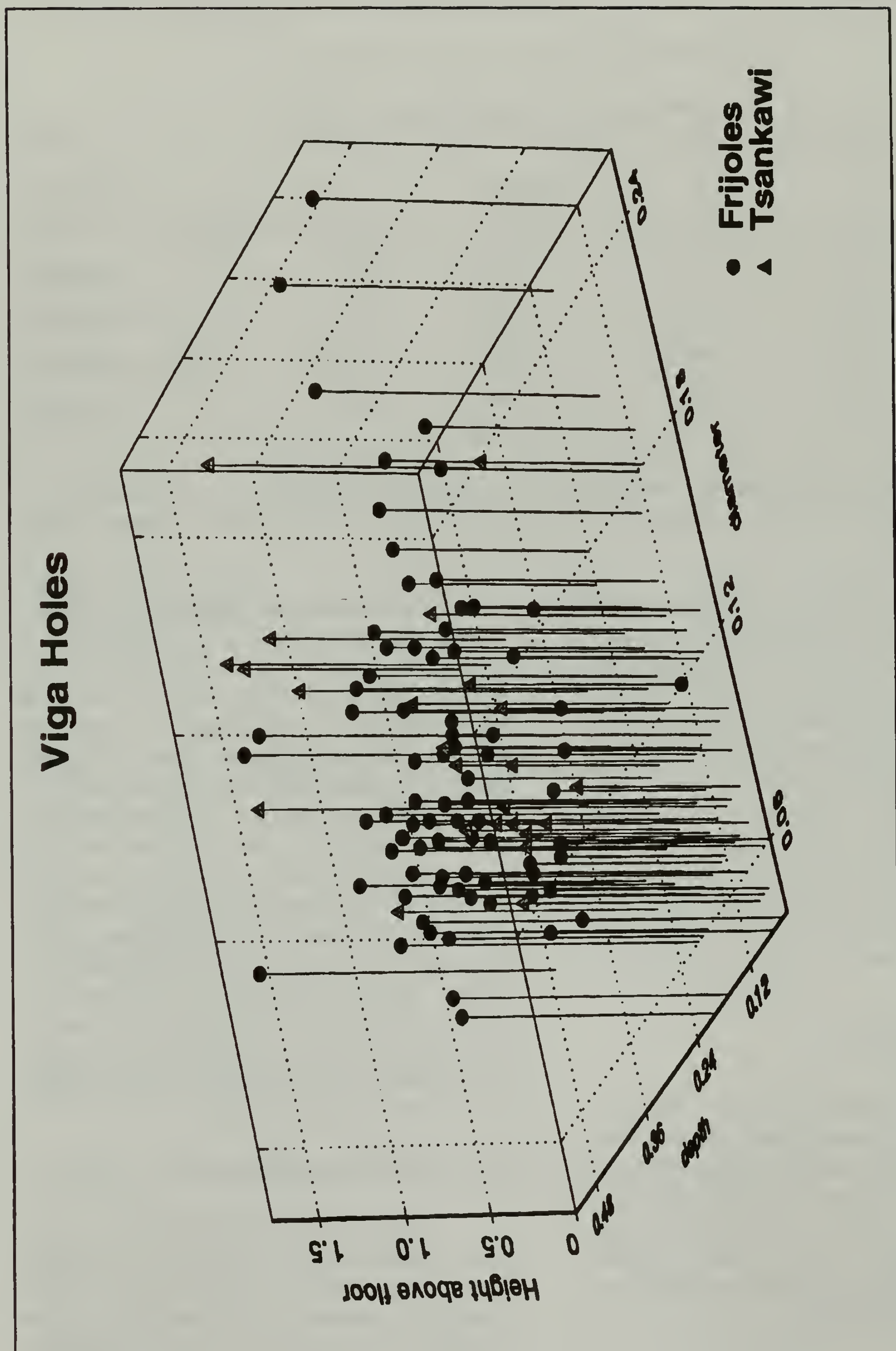

Figure 4.16. *Three dimensional plot of viga hole height above floor (vertical), diameter (horizontal, right) and depth (oblique, left), measurements in meters. Only features with round openings and measurable depth, features more than 70 percent present, and features from cavate chambers with less than 20 cm of fill are included. Two features with depths greater than 55 cm were excluded for increased graphic clarity. One hundred and three features, 79 in Frijoles, and 24 at Tsankawi are shown.*

Table 4.27. "Latilla" Hole Occurrence and Dimensions.

A. "Latilla" Hole Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Round	0	0	0	3	0	3
Cylindrical	10	2	0	3	8	23
Hemispherical	0	0	0	0	1	1
Conical	11	3	0	0	7	21
Total	21	5	0	6	16	48
Noncavate, grouped	10	0	3	2	0	15

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall & Corners	Back Corners	Other	Total
Round	0	3	0	0	0	0	3
Cylindrical	2	14	4	3	0	0	23
Hemispherical	0	1	0	0	0	0	1
Conical	6	8	2	3	1	1	21
Total	8	26	6	6	1	1	48

C. Mean Dimensions in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Diameter	46	0.04	0.018	0.02	0.08	39.7
Depth	43	0.09	0.037	0.03	0.20	41.4
Volume	45	0.00013	0.00016	0.00001	0.0007	128.9
Height above floor	36	1.09	0.303	0.40	1.64	27.8

Note: C, only cases more than 70 percent complete are included. Height measurements are only from chambers with 15 cm or less of fill.

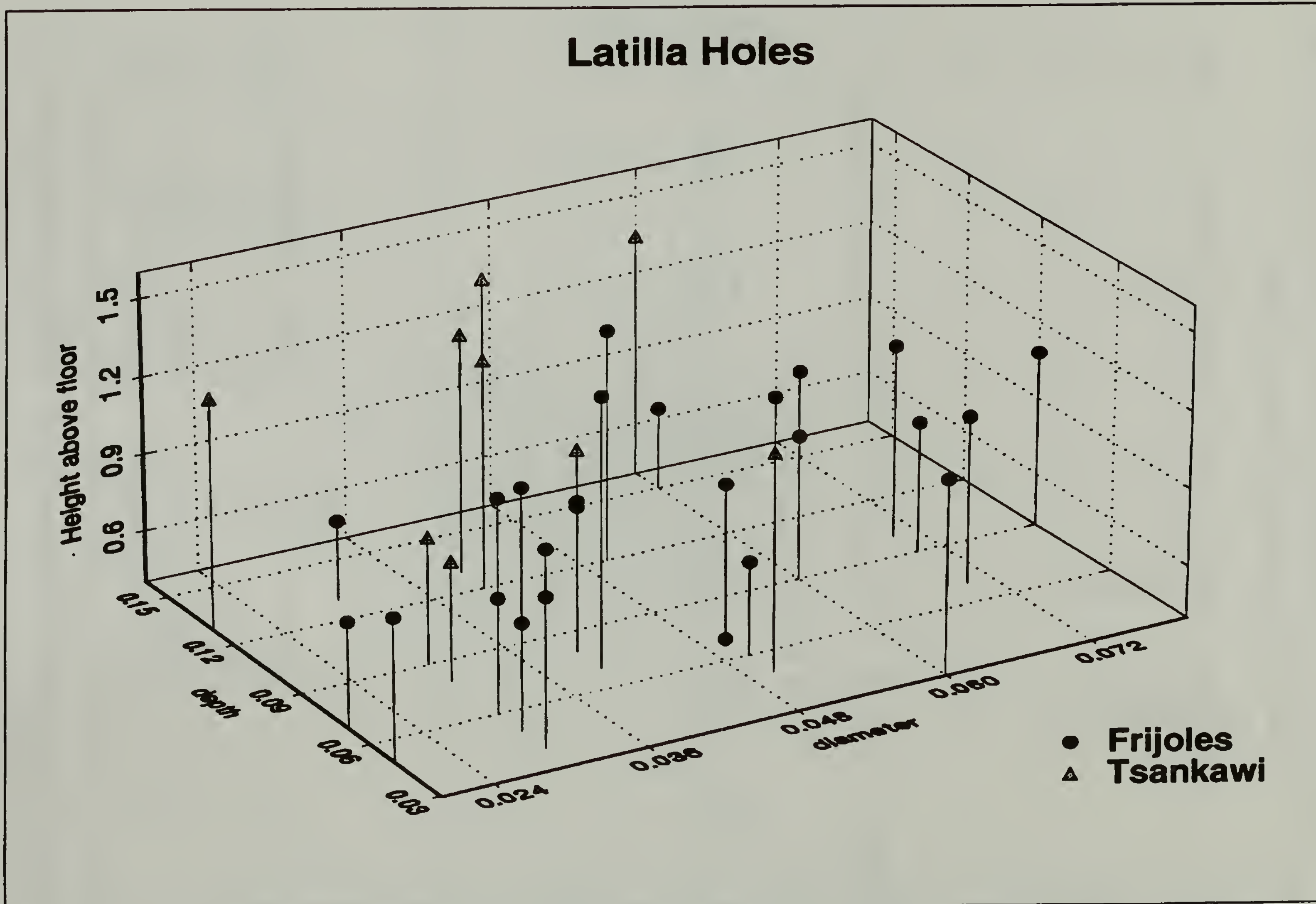

Figure 4.17. *Three dimensional plot of "latilla" hole height above floor (vertical), diameter (horizontal, right) and depth (oblique, left) measurements in meters. The smallest diameter and depth measurements are at lower left center. Only shapes with round openings and measurable depth, features more than 70 percent present, and features from chambers with less than 20 cm of fill are included, for a total of 34 features, 25 of which are in Frijoles cavates.*

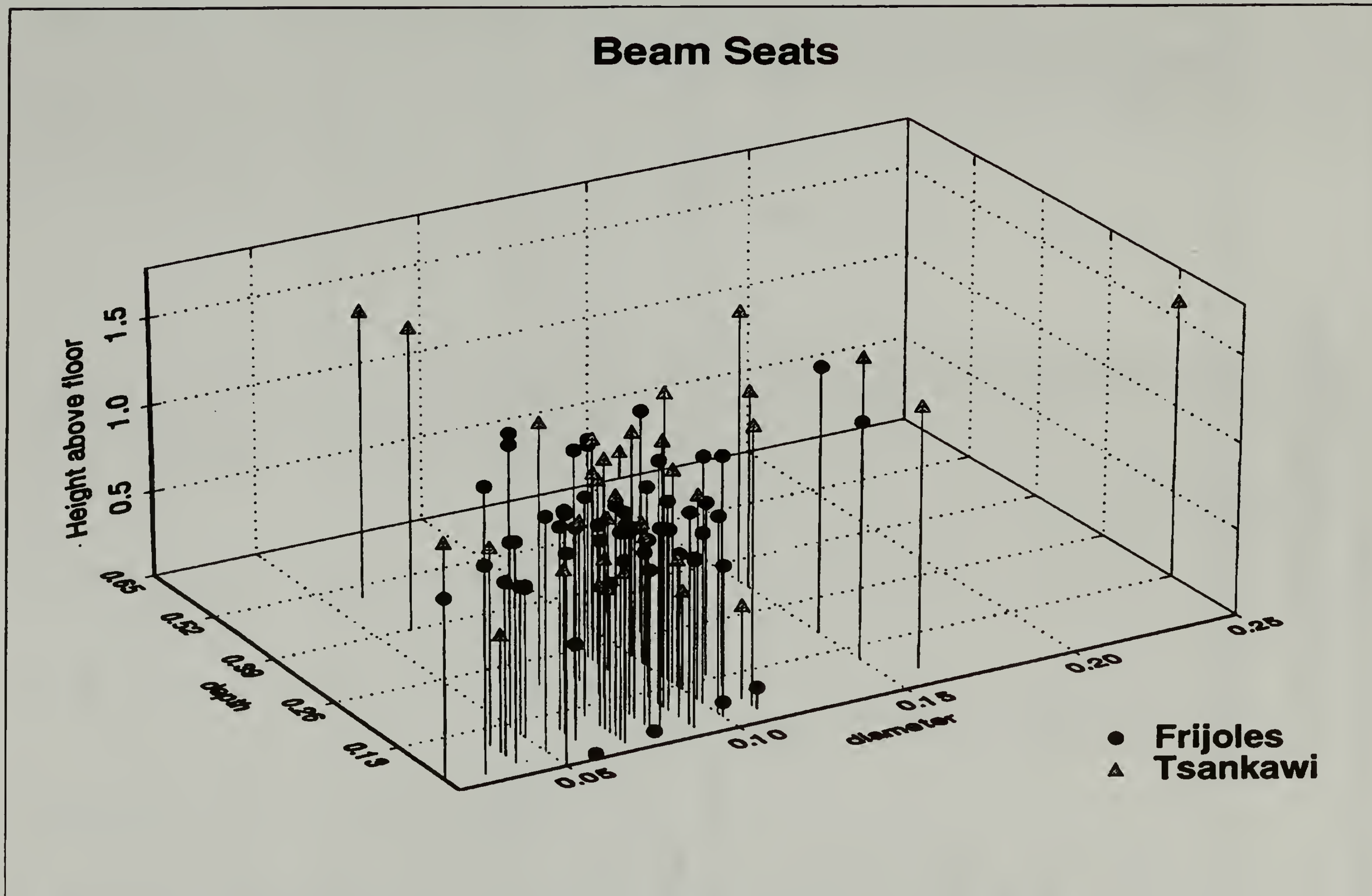

Figure 4.18a. *Three dimensional plot of beam seat height above floor (vertical), diameter (horizontal, right), and depth (oblique, left), measurements in meters. Note that the smallest diameter and depth measurements are at the lowest vertex. Only shapes with round openings, features more than 70 percent present, and features from chambers with less than 20 cm of fill are included; one case with a depth of 1.15 cm is excluded; 95 features, 60 percent of which are in Frijoles Canyon are shown.*

Table 4.28. Beam Seat Occurrence and Dimensions.

A. Beam Seat Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Oval	12	0	0	0	3	15
Rectangular	7	0	2	4	19	32
Cylindrical	6	0	3	16	27	52
Hemispherical	12	1	2	11	13	39
Truncated cone	1	3	2	3	7	16
Truncated pyramid	0	0	0	3	1	4
Conical	1	3	0	4	4	12
Irregular	0	0	0	3	2	5
Total	39	7	9	44	76	175
Noncavate, grouped	2	2	0	0	0	4

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall & Corners	Back Corners	Ceiling	Total
Rectangular	12	6	7	5	1	1	32
Oval	3	6	3	1	0	2	15
Cylindrical	10	21	13	5	2	0	51
Hemispherical	5	19	3	7	0	2	36
Truncated cone	2	9	4	0	1	0	16
Truncated pyramid	1	1	1	0	0	0	3
Conical	3	6	0	0	1	2	12
Irregular	3	0	2	0	0	0	5
Total	39	68	33	18	5	7	170

Table 4.28. (continued)

C. Mean Dimensions by Shape in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
Round						
Diameter	114	0.09	0.035	0.06	0.90	72.4
Depth	114	0.14	0.140	0.01	1.15	101.6
Volume	113	0.0010	0.0023	0.00001	0.0208	116.2
Rectangular						
Width	29	0.13	0.051	0.04	0.24	38.4
Height	29	0.09	0.045	0.06	0.17	30.8
Volume	29	0.0010	0.0009	0.0001	0.0040	96.7
Height above floor[a]	137	1.01	0.034	0.01	1.78	33.2

Note: B, two features of unknown shape and three located within other features are not shown.
[a]Heights above floor from chambers with less than 15 cm fill only.

of this feature type during recording. This category certainly includes features that had a wide variety of functions, as well as some holes that are either natural or postoccupational. While they often occur in groups at similar heights above the floor, they are distinguished from possible latilla holes in arrangement and inability to support a small beam; there is again overlap, as measurements and multivariate analyses clearly show. Most are fairly small, but a few large, truly indeterminate holes are also included in this category (Table 4.29).

The numbers of walls and features recorded in the five study areas can be used as a means for estimating how many walls would be expected at a group given an even or random distribution of wall features on walls. At Tsankawi there are considerably more holes than "wall expectation" and fewer at Groups A, I, and M. Some of this difference may result from differences in tuff at Tsankawi as compared to Frijoles: the top stratum at Tsankawi contains a great number of vesicles. We tried to be conservative in what we recorded as features (indeed we had to be, given the number of holes in some walls), but the tuff may have inflated the hole count. The poorer preservation of plaster at Tsankawi may also add to the higher count there, since fewer natural and/or disused holes remain covered by plaster.

The measurement data show that this feature category does indeed cover a variety of holes in the wall, including some very large ones (Table 4.29, Figures 4.19a, b-4.20a, b), and that they are located at all heights. The means, however, show that most of these holes are fairly small and tend to occur a little less than 1 m above the floor. Modally (Figures

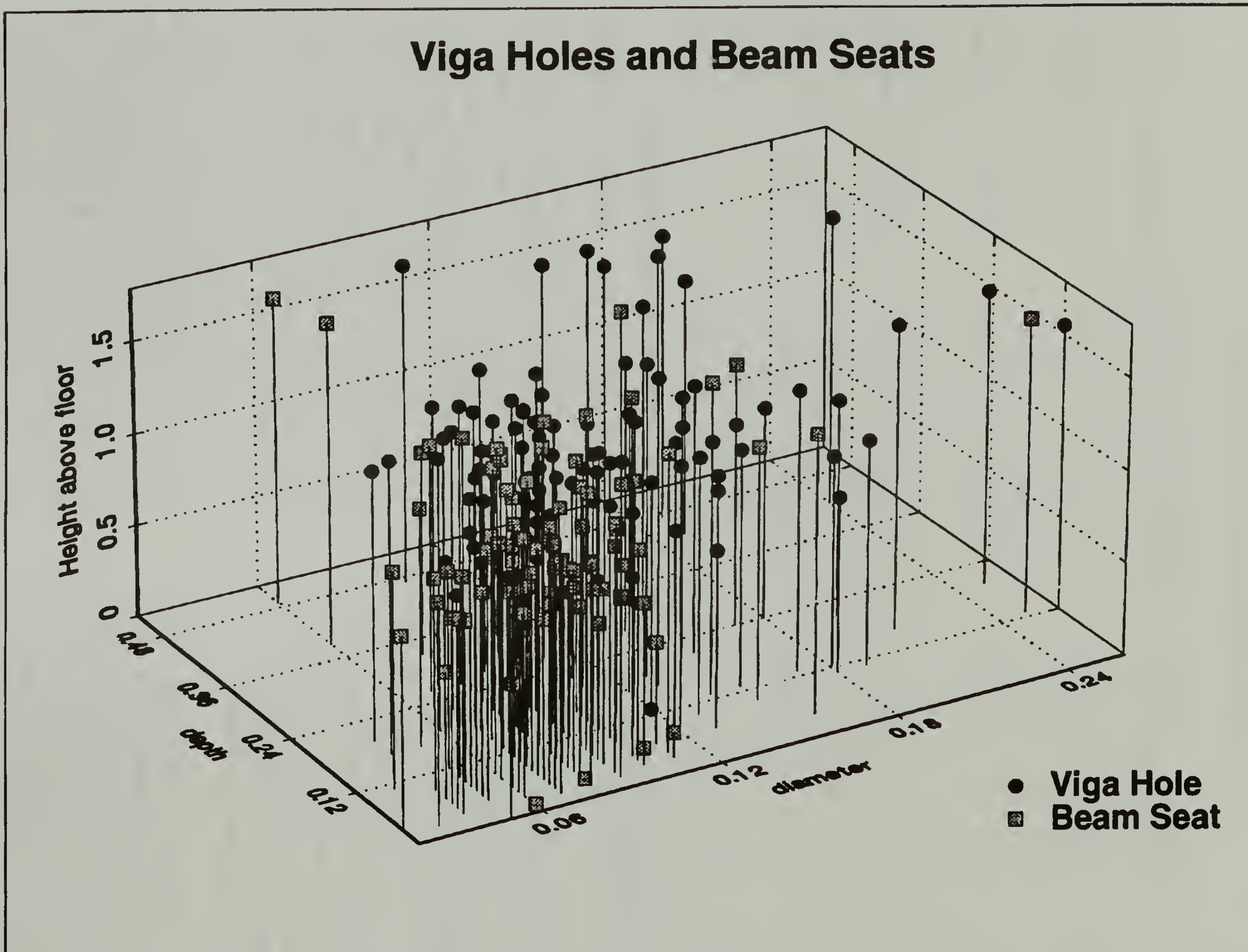

Figure 4.18b. *Three dimensional plot showing viga holes and beam seats on the same plot. The same selection criteria apply, for a total of 197 features shown, 69.5 percent of which are in Frijoles Canyon. Note that beam seats occur within the entire viga hole range, but they tend to be smaller and lower.*

Table 4.29. Indeterminate Hole Occurrence and Dimensions.

A. Indeterminate Hole Occurrence by Type and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	2	1	3	1	26	33
Oval	4	5	1	2	9	21
Circular portion	1	5	0	2	5	13
Cylindrical	43	22	29	49	147	290
Hemispherical	26	20	13	10	39	108
Truncated cone	0	1	1	3	8	13
Truncated pyramid	1	0	2	1	0	4
Conical	14	24	2	5	41	86
Irregular	0	0	0	1	2	3
Total	91	78	51	74	277	571
Noncavate, grouped	15	10	2	10	0	37

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall & Corners	Back Corners	Ceiling	Total
Rectangular	8	7	6	11	0	0	32
Oval	5	10	2	3	0	1	21
Circular portions	2	4	2	5	0	0	13
Cylindrical	56	119	62	35	4	11	287
Hemispherical	15	46	33	9	2	0	105
Truncated cone	5	4	3	0	0	1	13
Truncated pyramid	0	3	1	0	0	0	4
Conical	26	29	14	9	3	5	86
Irregular	0	0	1	0	1	1	3
Total	117	222	124	72	10	19	564

Table 4.29. (continued)

C. Mean Dimensions by Grouped Shape in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
Round						
Diameter	489	0.05	0.037	0.01	0.40	78.5
Depth	476	0.08	0.134	0.01	2.50	170.1
Volume	472	0.0008	0.0144	0.0000	0.3142	1812.5
Rectangular						
Width	33	0.09	0.056	0.02	0.32	58.9
Height	33	0.06	0.024	0.02	0.12	42.4
Volume	32	0.0004	0.0005	0.00002	0.0026	130.0
Oval						
Width	21	0.10	0.523	0.03	0.24	51.1
Height	21	0.12	0.151	0.01	0.60	125.2
Volume	11	0.0007	0.0014	0.00004	0.0050	188.5
All height above floor	411	0.86	0.399	-0.05	2.32	46.2

Note: B, seven cases in floor, unknown feature and unknown part are not included. C, includes only features that are 70 percent or more present. Round includes cylindrical, conical, and hemispherical shapes. Height above floor is only from chambers with less than 15 cm of fill.

4.19a, b), indeterminate holes are only 3 cm in diameter and 5 cm deep, and while the various sizes are fairly evenly split between Tsankawi and Frijoles, there is some tendency for smaller holes to be found at Frijoles and larger ones at Tsankawi (Figure 4.20a). Of 370 cases that met the criteria for inclusion in Figure 4.20a, 323 (87%) had diameters and depths of 10 cm or less. Even with removal of cases with extreme diameter and depth values, the mean diameter remained at 4 cm, and the mean height above floor remained at 84 cm. The mean height above floor is very close to what might be considered a "typical" plaster height in the cavates, and many smaller indeterminate holes do occur at the plaster line. In that location it is easy to visualize them as containing pegs on which things (canteens, clothes, and so forth) could be hung, and once in a while they do contain sticks. Another indication that some may have been for pegs is that the plaster around the openings is often broken away, presumably from removal of the peg.

Multivariate Analyses of Holes in Walls

As an alternative means of examining the many round holes in cavate walls, two multi variate techniques were applied to a set of features conforming to the following specifications:

Feature types: viga holes, latilla (?) holes, beam seats, and indeterminate holes

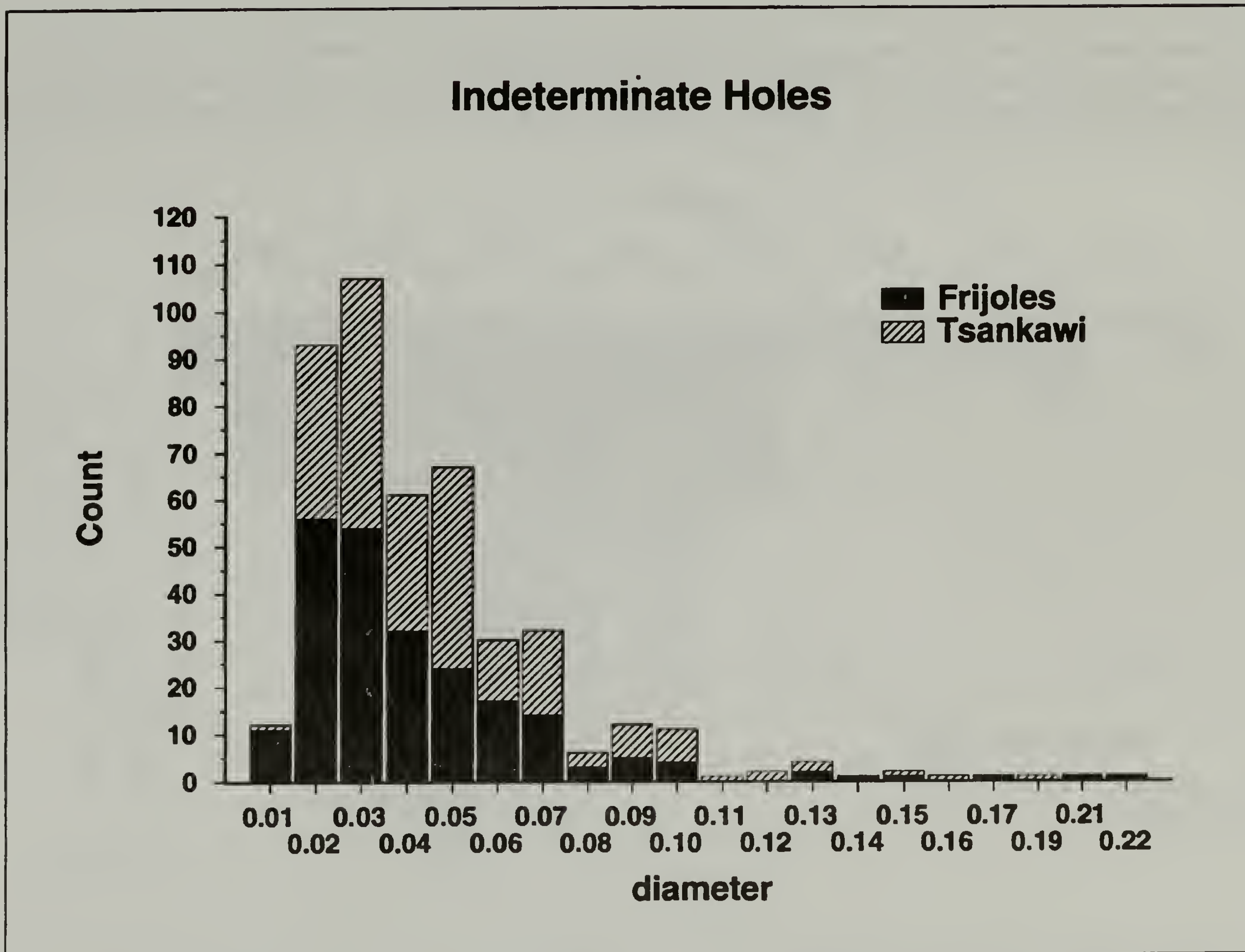

Figure 4.19a. *Histogram of indeterminate hole diameters subdivided by location in Frijoles Canyon and Tsankawi. Only holes judged to be at least 70 percent present, geometric solid shapes with round bases, features with measured diameters and depths, and features from cavates are included. Four hundred forty-six cases are represented, 51 percent of which are in Frijoles Canyon (overall mean is 4 cm).*

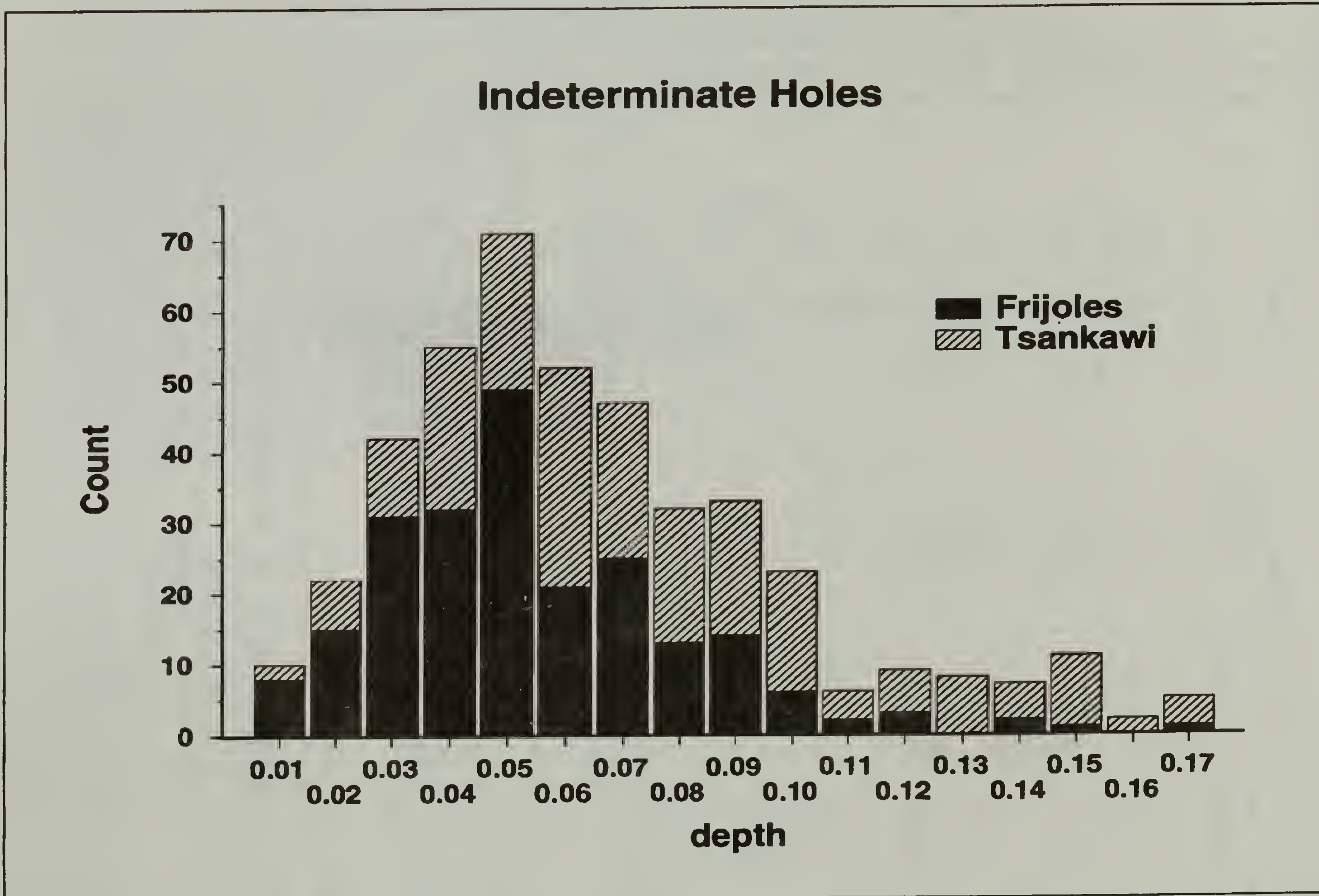

Figure 4.19b. *Histogram of indeterminate hole depths in Frijoles Canyon and Tsankawi. Only holes judged to be at least 70 percent present, geometric solid shapes with round bases, and features from cavates are included. Eleven cases with depths greater than 17 cm are excluded. Of the 435 cases shown, 51 percent are in Frijoles Canyon (the overall mean is 7 cm).*

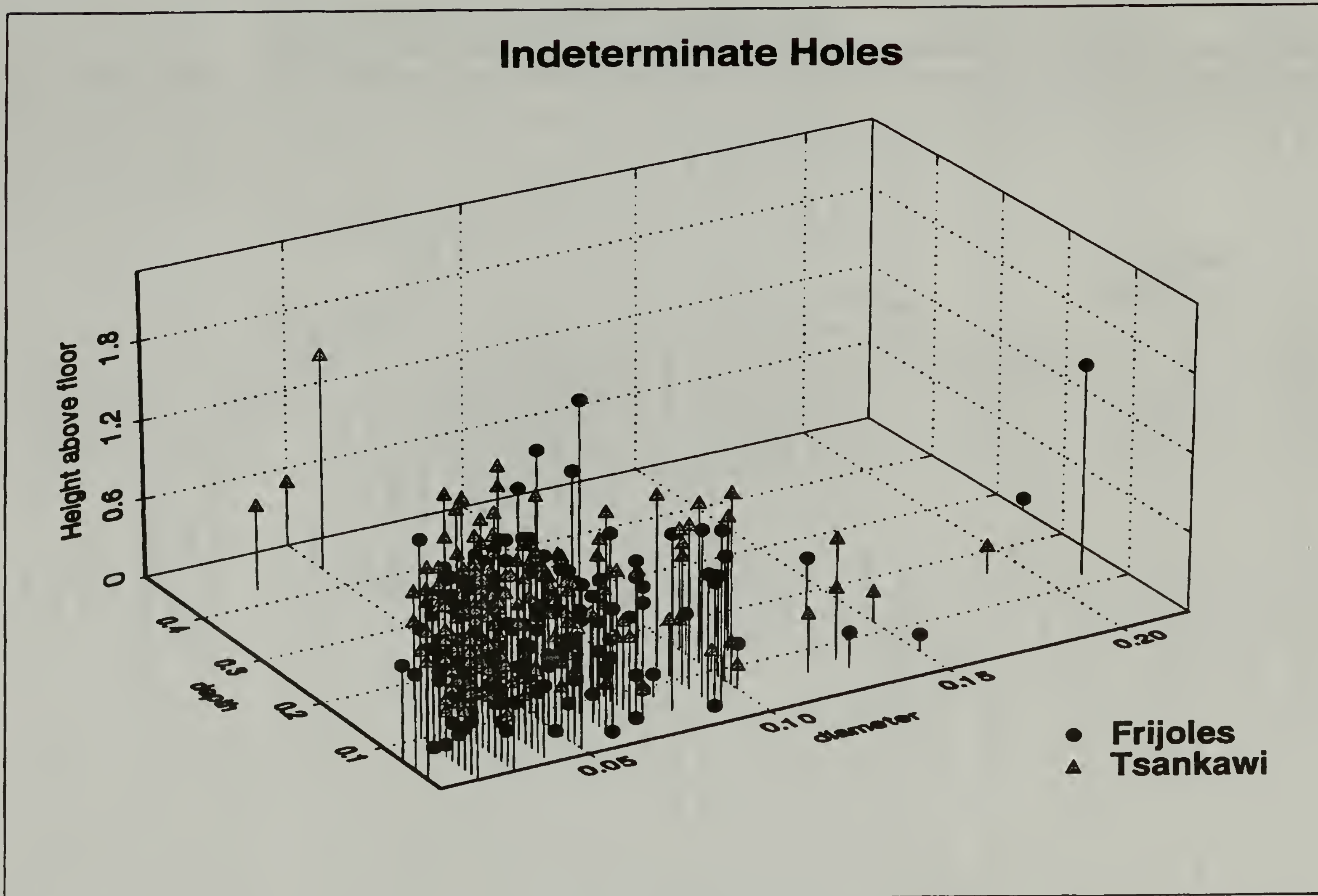

Figure 4.20a. *Three dimensional plot of indeterminate hole height above floor (vertical), diameter (horizontal, right) and depth (oblique, left) measurements in meters. The smallest diameter and depth measurements are at the vertex closest to the bottom of the figure. Only shapes with round openings and measurable depth, features more than 70 percent present, diameters less than 30 cm and depths less than 55 cm (which excludes 1 case), and features from chambers with less than 20 cm of fill are included, for a total of 370 features.*

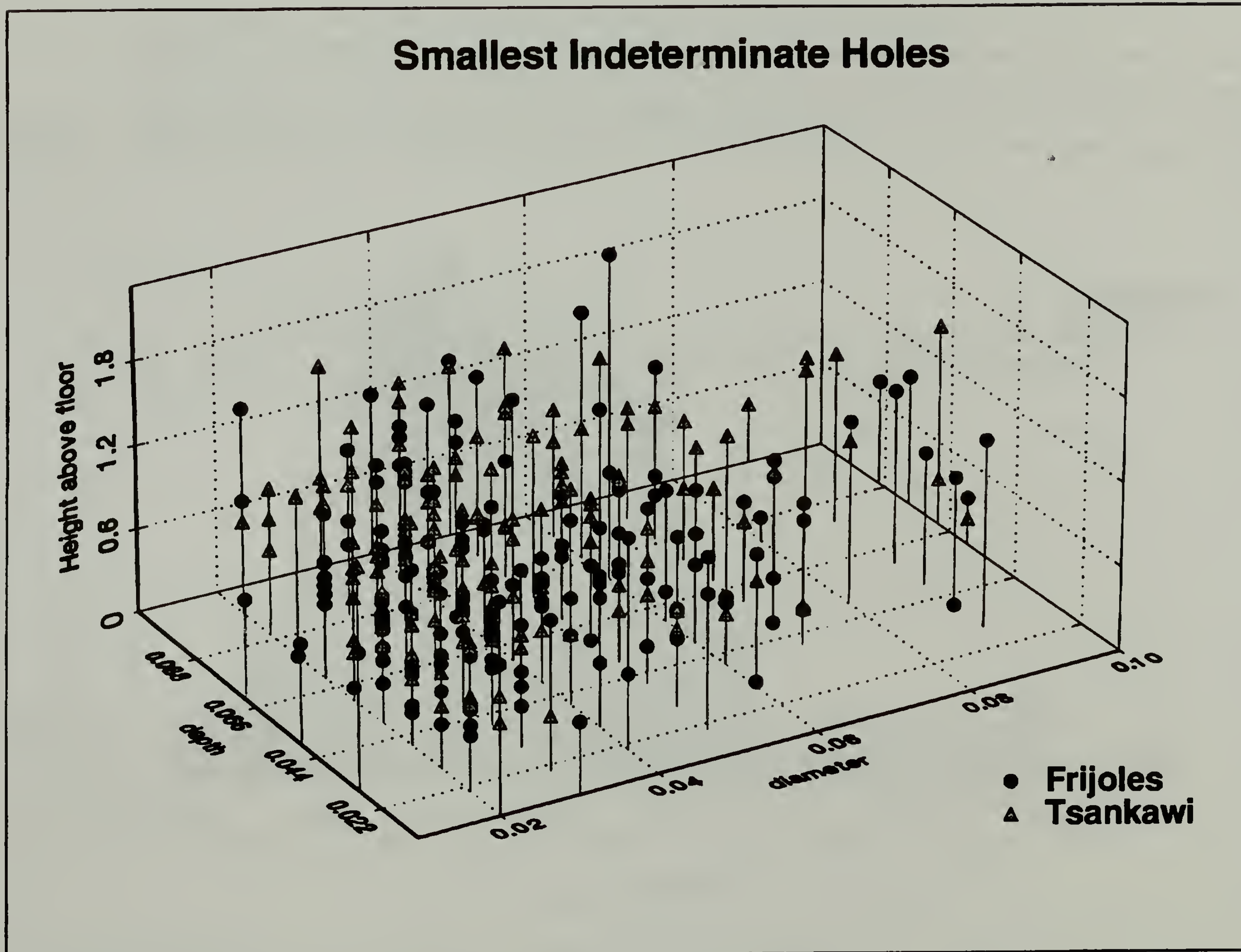

Figure 4.20b. *Three dimensional plot of indeterminate holes with diameters and depths of 10 cm or less. Only round-based shapes and features at least 70 percent present in cavates with less than 20 cm of fill are shown. Shown are 323 cases, of which 55.4 percent are in Frijoles Canyon.*

Shapes: round orifices, cylindrical, conical, truncated cone, and spherical (a maximum diameter of 40 cm was used to exclude a few very large cases)

Other criteria: only features judged to be at least 70 percent complete and located in chambers having less than 25 cm of fill (to control for completeness and accurate height above floor)

This pruning procedure and exclusion of features with missing values resulted in a group of 650 holes.

Cluster Analysis

A cluster analysis (SAS FASTCLUS procedure) was run requesting six clusters, based on diameter, depth, and height above the floor. Repeated passes were made through the data readjusting the cluster "seeds" and locating cases in the closest cluster. The six clusters identified by this analysis vary from 5 to 242 members (Table 4.30). Six clusters were requested, to allow the program to identify two clusters more than the four categories presumably present. Although the clusters do not correspond precisely to the feature types, the fact that cluster membership is greatly reduced by cluster 6 suggests that searching for more than six clusters would be inappropriate. Predictably, indeterminate holes are spread the most evenly over the most clusters, though two of the clusters comprise mostly features from this category. Viga holes also dominate a cluster, though they are split between two clusters.

The groups of holes created by this analysis (it should be remembered that the feature types were not provided to the cluster analysis) are recognizable by their means and form what may be useful--even functional--subdivisions of circular holes. Thus cluster 1, the group with the most members, consists of holes 2-8 cm in diameter located near the top of the plaster in many rooms. Cluster 2 contains considerably larger and deeper holes much higher on the wall, and cluster 3 is also well up the wall, though the holes are smaller, shallower, and lower. Cluster 4 is composed of much smaller holes lower on the wall. Clusters 5 and 6 are uncommon shapes and locations; both are deep, especially cluster 6, but cluster 6 is quite high (similar in height to cluster 3) and cluster 5 is near the floor. As might be predicted, the holes identified as viga holes are fairly consistent, though they come in two sizes.

Discriminant Analysis

This large group of round hole features was also analyzed using discriminant analysis (the SAS DISCRIM procedure; 645 cases analyzed, 5 omitted due to missing values). For the discriminant analysis the program was provided with types assigned and then calculated a profile for each feature type. Once again the variables used to describe the features were diameter, depth, and height above floor. The individual cases were then compared to the profiles and placed in the one to which they most closely conform. For this analysis the prior probability that a feature would fall into a given type was set at equal, which is not the case for the actual distribution, since indeterminate holes form 62 percent of the total. Because it is of interest whether or not "indeterminate" holes form an identifiable category, this is a reasonable prior condition. Based on a test of covariance matrix homogeneity performed by the program, within covariance matrices were used in the discriminant function.

The discriminant analysis gives an idea of the metric overlap among the feature types (Table 4.31, Figures 4.18b, 4.21). Thus, the majority of features called viga holes and beam seats are described by similar measurements, though there are probably at least two subgroups: one higher, larger, and deeper (viga hole means) and the other lower (about 1 m) and smaller. Each of these also overlaps with the

Table 4.30. Results of Cluster Analysis on Round Wall Holes.

A. Members and Means for Hole Clusters

Cluster	n	Near	Diameter	Depth	Height Above Floor
1	242	3	0.050	0.081	0.853
2	74	3	0.098	0.180	1.639
3	186	2	0.067	0.099	1.268
4	126	5	0.049	0.062	0.421
5	17	4	0.097	0.196	0.100
6	5	3	0.164	0.838	1.182

B. Cluster Membership by Assigned Feature Type

Cluster	Viga	Latilla	Indeterminate	Beam Seat	Total
1	16	18	173	35	242
2	47	1	18	8	74
3	49	15	80	42	186
4	0	1	117	8	126
5	1	0	13	3	17
6	3	0	1	1	5
Total	116	35	402	97	650

Table 4.31. Discriminant Analysis Classification of Feature Types.

	Computer-Assigned Type				
Original Type	Viga	Latilla	Indeterminate	Beam Seat	Total
Viga hole	80	16	1	15	112
Latilla (?) hole	1	30	4	0	35
Indeterminate hole	12	206	158	25	401
Beam seat	27	22	12	36	97
Total	120	274	175	76	645

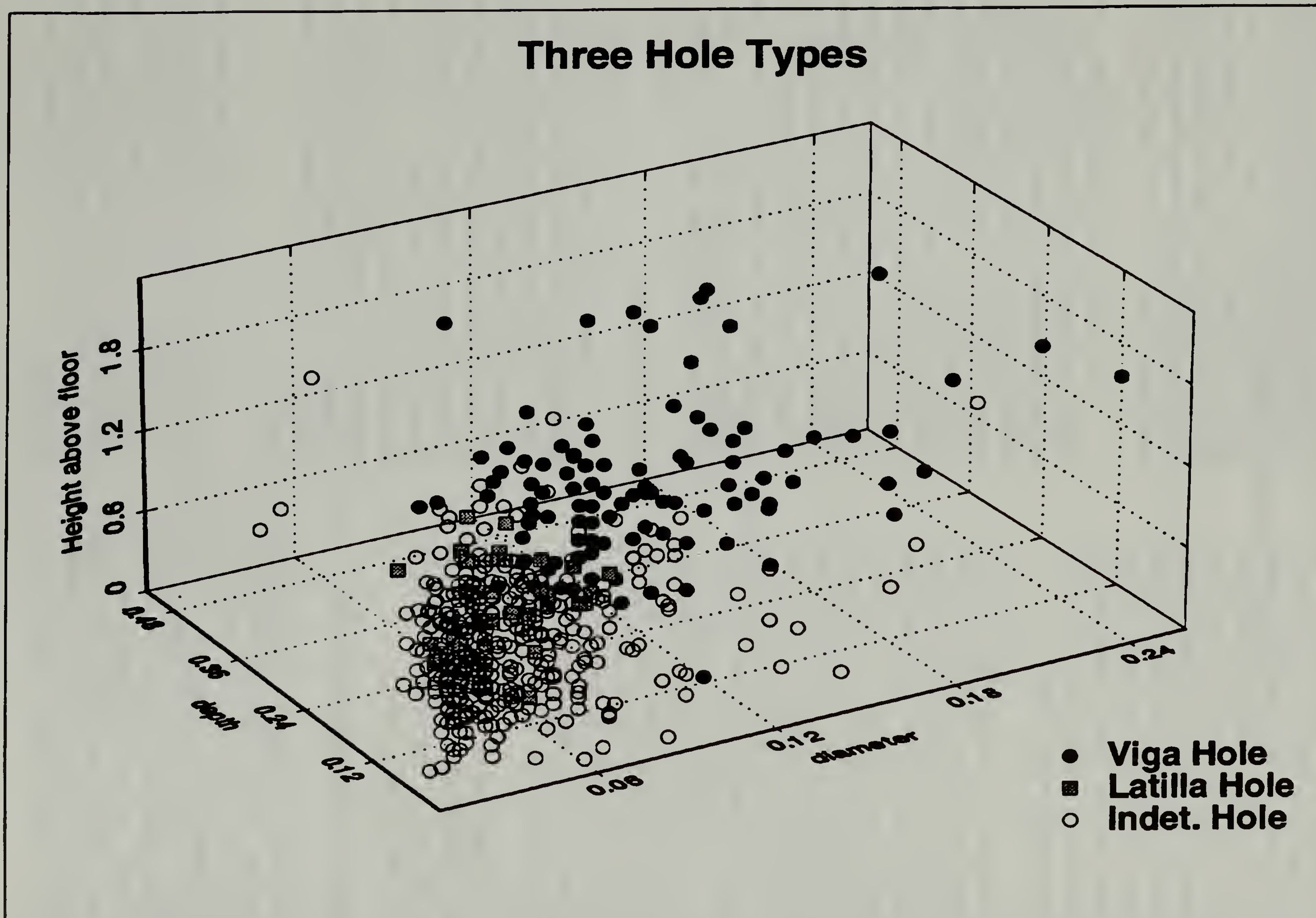

Figure 4.21. *Plot showing overlap of viga, latilla, and indeterminate hole distributions (beam seats not shown). Note that the cluster of indeterminate holes in the smaller dimensions overlaps with a number of latilla holes. Viga holes are fairly distinct in the higher, larger ranges with a few outlying indeterminate holes among them. A total of 507 cases is shown.*

other groups, which are smaller holes. Beam seat, as a category for features that are more difficult to interpret, shows considerably more overlap with the other two categories than does viga hole. The possible latilla hole group is the most consistent, probably at least in part because it is the smallest group. Indeterminate holes appear to fall into at least two main groups, more of which are like "latilla" holes than the smaller holes described by the measurements for the entire indeterminate hole group.

Preservation and feature variability will always mean that a large number of wall features will have to be placed in a category such as "indeterminate holes," but as used here, this category is too inclusive. In future recording of features in cavates more types of small wall holes should be recorded, subdividing the "indeterminate hole" category used in this study. Additional types suggested by the analyses and by observation include:

--peg holes. This type should be used for holes still containing portions of pegs or holes that show evidence for the removal of a peg. The group is likely to be fairly small, but isolating features with a known function will help place other, less easily interpreted features.

--small holes at or near the top of the wall plaster. As noted, these may have been for pegs, but that use is less clear. It can be compared to the peg hole category.

Possible Upper Loom Support (Code 14)

The clearest examples of upper loom supports are deep, vigalike holes near the top of a chamber. The holes occur in pairs at a considerable angle to one another. Hewett's reconstruction of these features shows forked logs projecting from the seats; I do not know if this is based on intact examples or on speculation. Features associated with these angled supports include grooves in the ceiling (presumably to accommodate a cross-bar) and rows of loom anchors in the floor. As can be seen in Kent's (1983b) photographs of traditional looms, ordinary vigas can suffice as upper loom supports for looms close to walls, and it is quite possible that some de facto loom supports were called something else. The low ceilings and inclined walls of many cavates, however, may have required more specialized upper supports.

The scarcity of identified upper loom supports at Groups F and A combined with the lack of loom anchors at those groups suggests that this pattern may be more than a sampling artifact (Table 4.32). Loom supports tend to be cylindrical holes in or near the ceiling of the chamber in which they are found. As we recorded these features, we came to recognize that in addition to their location, their angle of entrance into the ceiling was an important attribute. Because of the lateness of the realization and the difficulty of measuring it, however, we did not record this angle. The observed cases suggest that they are on average larger than viga holes and can be very deep.

Smokehole (Code 15)

Features called smoke holes are very commonly found near the chamber entrance. It seems likely that some smoke holes were separated from the door by a lintel, since some probable smoke holes now show as enlargements of the tops of doors, sometimes associated with grooves for rock or wood lintels. Smoke holes are usually quite large in diameter and angle up as they pass to the outside. Size, angle, and placement well up the wall are the most important criteria in assignment of this feature type.

Smoke holes are slightly more abundant at Groups F and I than might be expected based on overall feature counts, and they are markedly infrequent at Group M (Table 4.33). This emphasizes the fact that Group M rooms made especially heavy use of masonry closing walls. The chamber locations show the strong (and in

Table 4.32. Loom Support Occurrence and Dimensions.

A. Loom Support Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Trapezoidal	0	0	0	1	0	1
Rectangular	0	0	0	0	1	1
Cylindrical	1	0	3	2	14	20
Hemispherical	0	0	0	0	2	2
Truncated cone	0	0	0	0	1	1
Conical	0	0	0	0	3	3
Total	1	0	3	3	21	28

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Ceiling	Total
Rectangular	0	0	0	1	1
Trapezoidal	0	1	0	0	1
Cylindrical	3	4	2	11	20
Hemispherical	0	0	0	2	2
Truncated cone	0	1	0	0	1
Conical	0	0	0	3	3
Total	3	6	2	17	28

C. Mean Dimensions of Circular Shapes in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Diameter	26	0.13	0.070	0.06	0.35	48.2
Depth	26	0.38	0.317	0.08	1.75	83.4

Table 4.33. Smokehole Occurrence and Dimensions.

A. Smokehole Occurrence by Type and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Oval	0	3	2	0	2	7
Trapezoidal	0	0	0	0	1	1
Triangular	0	1	1	0	0	2
Rectangular	0	0	0	0	1	1
Cylindrical	11	7	5	2	21	46
Truncated cone	1	0	0	0	0	1
Total	12	11	8	2	25	58

B. Chamber Location by Shape

Shape	Exterior Wall	Back Wall	Left Wall	Ceiling	Left Exterior Corner	Floor	Total
Rectangular solid	0	0	0	0	1	0	1
Oval	7	0	0	0	0	0	7
Triangular	1	0	0	1	0	0	2
Trapezoidal	1	0	0	0	0	0	1
Cylindrical	35	1	4	4	1	1	46
Truncated cone	1	0	0	0	0	0	1
Total	45	1	4	5	2	1	58

C. Mean Dimensions for Circular Shapes in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Diameter	39	0.23	0.073	0.06	0.35	32.2
Depth	39	0.49	0.226	0.15	1.01	46.2

a majority of cases necessary) preference for placement of smoke holes in the exterior wall. Clearly, they tend to be cylindrical holes bored through the cliff, but as with upper loom supports, the fact that most angle upward needs to be noted in addition to the recorded data.

Vents (Code 16)

Vents differ from smoke holes in two respects: they are horizontal rather than angled upward and they are generally found lower on the wall (see Figure 2.21b to left of door). Any hole passing through a wall that is not either a door or a smokehole was called a vent. Openings into other rooms as well as to the outside are included in this feature type. Like smoke holes, vents are predominantly cylindrical holes in the exterior wall. They, too, are infrequent at Group M and relatively abundant at Group F (Table 4.34).

Groove (Code 31)

Judging from differing size, location, and orientation, this feature category covers several probable functions. We observed some examples in ceilings, where they may have accommodated loom cross-bars; examples high on walls might have supported roofing ("wall ledge" would have been a more appropriate code for these); some may have helped support vertical partitions; and some may have been decorative. This code, then, describes a feature of questionable function (Table 4.35).

Wall Depression (Code 37)

Wall depressions are usually shallow concavities in tuff walls. Some of these features are plastered over, while others are clearly abraded through the plaster into the tuff. These features rarely have enough of a shelf at the base to hold anything (indeed, features with any shelf at all would probably have been called niches rather than wall depressions). Wall depressions are found at varying heights above the floor, but it seems likely that those close to the floor in the vicinity of mealing features resulted from grinders' feet pushing against the wall (Figure 4.7, Table 4.20). Mills made this observation in the field, independent of Chapman's reconstruction (Hewett 1909a:451) showing the same probable function.

Wall depressions are somewhat more abundant at Groups A and F (including the noncavate observations) than would be expected given numbers of features recorded (Table 4.36). These features also tend to be placed in back walls and corners and right walls as opposed to other chamber locations. The associated depression and metate rest in M-60 are located in the back corner of the room (Figure 4.7). The great variability in size, and thus probably in source and function, is visible in the mean volumes and areas and their coefficients of variation (Table 4.36C).

Wall Ledge (Code 41)

Occasionally a substantial ledge is found near the top of a chamber. Most likely, these features were an alternative roof support to viga holes, though they are much less common (see Figure 2.16b above door). The examples we encountered did not seem to have suitable width or flatness for storing items. Such ledges may have paralleled the main roof support of the room, serving to support secondary roof and/or floor members.

Vertical Ceiling Hole (Code 47)

Of 59 examples of this feature (also known as Panowski holes), we recorded 58 at Tsankawi and one at Group A. The code was added during the Tsankawi recording, so it was not available at Groups F, I, and M, and the first half of A, but few if any vertical ceiling holes are likely to be present in those groups. The nature of the tuff at Tsankawi may in part

Table 4.34. Vent Occurrence and Dimensions.

A. Vent Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Oval	0	2	0	0	0	2
Trapezoidal	0	1	0	0	0	1
Rectangular	0	1	0	0	0	1
Cylindrical	4	4	3	3	12	26
Truncated cone	1	0	1	0	0	2
Total	5	8	4	3	12	32

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall	Ceiling	Other	Total
All Shapes	2	2	6	20	1	1	32

C. Mean Dimensions for Round Shapes in Meters

Dimension	n	Mean	Standard Deviation	Minimum	Maximum	CV
Diameter	23	0.18	0.068	0.04	0.33	38.6
Depth	23	0.35	0.153	0.09	0.60	43.2

Table 4.35. Groove Occurrence by Shape and Group.

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Linear	2	0	0	1	3	6
Rectangular	0	0	0	0	1	1
Cylindrical	0	0	1	0	0	1
Total	2	0	1	1	4	8

Note: Grooves were located on exterior, right, and back walls (two or three on each wall type), and one case was on a ceiling (a loom support).

Table 4.36. Wall Depression Occurrence and Dimensions.

A. Wall Depression Occurrence by Shape and Group

Shape	Group A	Group F	Group I	Group M	Tsankawi	Total
Rectangular	3	0	2	2	2	9
Rectangular solid	7	3	1	1	2	14
Oval	5	0	0	1	5	11
Cylindrical	1	2	0	0	0	3
Hemispherical	5	3	1	2	8	19
Conical	1	1	1	1	0	4
Trapezoidal	2	0	0	0	1	3
Circular portion	1	0	0	0	1	2
Linear, irregular	0	2	1	0	0	3
Total	25	11	6	7	19	68
Noncavate, grouped	0	16	3	0	0	19

B. Chamber Location by Shape

Shape	Right Wall	Back Wall	Left Wall	Exterior Wall & Corners	Back Corners	Other	Total
Rectangular	1	18	2	0	0	2	23
Oval	3	5	2	0	1	0	11
Trapezoidal	0	2	1	0	0	0	3
Cylindrical	3	0	0	0	0	0	3
Hemispherical	8	7	1	0	1	2	19
Conical	0	1	2	0	1	0	4
Circular portion	0	0	0	0	1	1	2
Linear, irregular	1	2	0	0	0	0	3
Total	16	35	8	0	4	5	68

Table 4.36. (continued)

C. Mean Dimensions by Shape in Meters

Shape	n	Mean	Standard Deviation	Minimum	Maximum	CV
Rectangular solid volume	14	0.03167	0.0711	0.0006	0.2676	224.6
Hemispherical volume	18	0.01905	0.0313	0.0001	0.1031	164.1
Oval area	10	0.1531	0.1379	0.0154	0.4779	90.1
Rectangular area	7	0.7004	1.2910	0.0391	3.6100	184.3
Height above floor[a]	23	0.34	0.218	0.04	0.86	63.4

[a]Heights above floor include only chambers with less than 15 cm fill.

explain their presence there, and it is unlikely that we overlooked their presence in the Frijoles sample recorded before the Tsankawi recording. The features consist of cylindrical vertical holes in the ceiling, sometimes extending to remarkable depths: the deepest recorded is 97 cm. The average depth is 18 cm, and the majority are 5-10 cm deep. The holes are usually fairly small in diameter (mean of 4 cm, with 95 percent of cases less than 10 cm) and are often extremely regular. They sometimes look mechanically created, but many have smoke-blackened interiors and thus appear to be ancient. They seem generally to occur in groups; the occurrences range from 1 to 12, averaging 4 per cavate. The function of this feature type is unknown; they may be related to weaving, partitions, or construction. The vesicular nature of the upper stratum of Tsankawi tuff also opens the possibility that some are natural, though some are unquestionably artificial.

Narrow Wall Incisions (Code 48)

These features are also almost unique to Tsankawi, with the exception of a single case at Group A. The code was also added during the Tsankawi recording, so it was not available at Groups F, I, and M. As is true of vertical ceiling holes, codes were added as new features were observed, and we did not note these features before working at Tsankawi. Differences both in tuff type and in prehistoric activity, rather than recording differences, account for most of the distributions in this sample. If this feature were as common in the Frijoles cavates as it is at Tsankawi, we would have added it sooner. The incisions are usually vertical or close to it, and are 1-2 cm wide, 1-3 cm deep, and up to 30 cm long (Figure 4.22). They appear to be incised by grinding. They generally occur in groups and were usually recorded as groups rather than individually; 26 cases are recorded. They seem most often to be in smaller, unfinished rooms, though they are not confined to such rooms. Many more may be covered by plaster. It is possible that they were meant to help hold plaster, but this seems doubtful; they are more likely some artifact of construction, perhaps of cutting out blocks of tuff to be knocked free. Eleven of the cases recorded are on back walls, and eight are on right walls.

Hand-or-Toe hold (Code 33)

Generally these are not features one would expect to find inside rooms. The cases we observed either were cliff features (e.g., trails at Group A) or may result from remodeling. At Group F in the area of F-21, F-22, F-24, and F-25, for example, rooms appear to have extended quite far up one part of the cliff; probably after the rooms were gone (but perhaps before or even intermediate to building phases) a hand-and-toe hold route was apparently put across the same part of the cliff. The only individually recorded cases with rooms in our sample are four examples from Group M; two extramural sets were recorded as noncavates at Group A. A group of 13 holds was recorded at Group A, and 16 more were recorded as a group at Group F.

Incised Dado (Code 29)

We invented this feature type to include an observed phenomenon. In five cavates we

Figure 4.22. Narrow wall incisions in TS-24. This feature type was observed almost exclusively at Tsankawi, and may be the result of cavate excavation or may have been to help plaster adhere to the wall. The vesicular nature of the top layer of the tuff at the Tsankawi group is visible here.

recorded a distinct abraded band around substantial portions of the base of the chamber as defined by the top of the fill; in most cases the chambers containing this "feature" also had substantial amounts of fill. These bands are consistently 30-40 cm wide by about 6 cm deep, so that they seem intentional. We now believe, however, that incised dados are postoccupational damage, probably caused by large animals (probably sheep and goats, maybe burros or cattle) bedding down in chambers and rubbing against the walls. This interpretation is supported by the frequent association of dung with this "feature," and by its location at the top of the fill.

Cliff Niche (Code 49)

Cliff niches are distinctive features found only at Tsankawi. They consist of rectangular depressions in the tuff, mostly apparently outside of rooms, though quite possibly adjacent to rooftops. They look a great deal like fold-down metates, but hinges are lacking and gravity appears to be quite normal in the area. A group of five is located near TS-25 (Figure 4.23), where there is also a great deal of rock art. Indeed, they might even be considered rock art, as it is hard to impute a function to them. They are arranged so that three are next to one another and two more are widely spaced but close to the same level. Though they are several centimeters deep, the bases slope enough that it would be impossible to put anything in them. In the right light they look like doors, and they may have been designed to make the settlement look larger than it was from a distance (much as a cat tries to look big when frightened or a moth feigns to have large, scary eyes). The mean dimensions of the seven cliff niches we recorded are 0.62 m high by 0.37 m wide by 0.18 m deep. Mean door dimensions are fairly similar (0.70 m high by 0.56 m wide), and the cliff niche ranges fall well within the ranges for doors (Table 4.7).

Another pair is located in the Tsankawi cavate group west of LA 50976, in the area of Lister's C-88-C-91. These niches are also located at the head of the rincon, on the caprock stratum, above cavates and probable masonry rooms. Of all the cliff niches observed, only one of these two is deep enough at the base (36 cm) to hold something.

Rock Art

More often than not the rock art visible appears to be incomplete due to combinations of plaster deterioration, weathering, and vandalism. Usually rectangular boundaries of figures were estimated and measured for recording, though it was occasionally possible to measure actual features. June Crowder recorded the rock art separately (see her summary at the end of this chapter; see also appendix 4 at the end of this study), so the rock art entries on our recording forms were usually quite general. The rock art was categorized by subject matter and means of manufacture, with any form of painting being termed a pictograph and any form of incision or pecking a petroglyph. Petroglyphs thus include the fine-line scratching in plaster that seems to have been quite common; Chapman (1916; in Hewett 1938) found this style of rock art especially interesting (see also Schaafsma 1980:285). Pictographs include any figures painted on the walls. We observed several colors of paint, including yellow, red, black, white, and green, and there are some figures that appear to have been done in a thin wash of plaster different in color from the wall plaster. Pictographs of all forms are less well preserved than incised or pecked rock art, harder to discern, and less frequent.

The various rock art codes were applied as follows. Where two codes are present, both a petroglyph and a pictograph code were used. Geometric figures with definable geometric layout (codes 20, 22) include terraced figures,

Figure 4.23. Four of the five cliff niches in the cap rock behind the Tsankawi cavates recorded by this project. Note that the bases of the niches are not flat enough to stand anything on.

rectangles, circles, and crosses. Zoomorphic figures most commonly include parrots and other birds and Awanyus or horned (or plumed) serpents (codes 21, 23; Figures 4.24-4.28; Schaafsma 1980:255-288). Frequently it is clear that rock art exists, but it is either no longer a recognizable form or it may include several categories; these cases were called indeterminate (codes 24, 25). Early in the recording we observed handprints, which are a common prehistoric Pueblo form, and added a code for them (code 32); we did not, however, observe any more of them. The case we observed would be considered a pictograph since the prints are negative figures apparently done by spraying paint around an outspread hand. Anthropomorphs, on the other hand, proved to be fairly common (codes 34, 38); included in this category were fairly naturalistic figures (dancers and hunters) and supernatural figures (masks, katsinas, ogres). (See Figures 4.24-4.28.) The rock art tallied here does not include the examples observed at Groups A and I and at Tsankawi that are not associated with rooms (June Crowder did record these panels; see appendix 4).

Since the majority of the rock art present consists of some small (and usually undeterminable) fraction of the original, we have not included measurements for the various panels, though measurements are present in the data base.

Figure 4.24. *Large katsina-like figures in TS-59. There is a terraced figure between them and an Awanyu line continues from them to the left. This chamber also contains a mask or katsina incised in the plaster next to a wall niche. This is the largest chamber recorded and that with the most features; it contains an array of loom features, floor features, and niches; viga holes and a low plaster "dado" are visible. The viga holes visible in this photo are of the variety that do not seem necessary for roofing; the presence of loom anchors and other upper loom supports in this room suggest that these "vigas" may have been involved with weaving.*

Not surprisingly, Group M and Tsankawi, the two groups with the most cavates have the preponderance of rock art (Table 4.37). Although they attract vandalism, cavates provide good conditions for preservation of rock art. Vandalism is most severe at Group A, increasing the chance that examples were overlooked there. Group M is notable for having the greatest variety of figures and media, including some elaborate polychrome panels, both within and outside the recorded sample. Group A is unusual in containing nearly equal numbers of painted and pecked or incised examples, while painted elements are infrequent at Group F. Though it is not apparent in the tables, the rock art at Tsankawi is notable for its larger scale. June Crowder summarizes her recording of rock art at the end of this chapter.

Two preservation variables complicate the differences noted by Crowder between Tsankawi and Frijoles. First, the rimrock at Tsankawi is harder than any of the exposed cliffs in Frijoles--presumably that is why it is

Figure 4.25. *Large bird figures remain on either side of the door of TS-40, and a probable cloud motif is over the door. These figures are in the open on the very soft red tuff layer at Tsankawi, and must have been quite deep to have survived.*

Figure 4.26. *Probable bird figure incised through some of the smoked tuff wall; F-23.*

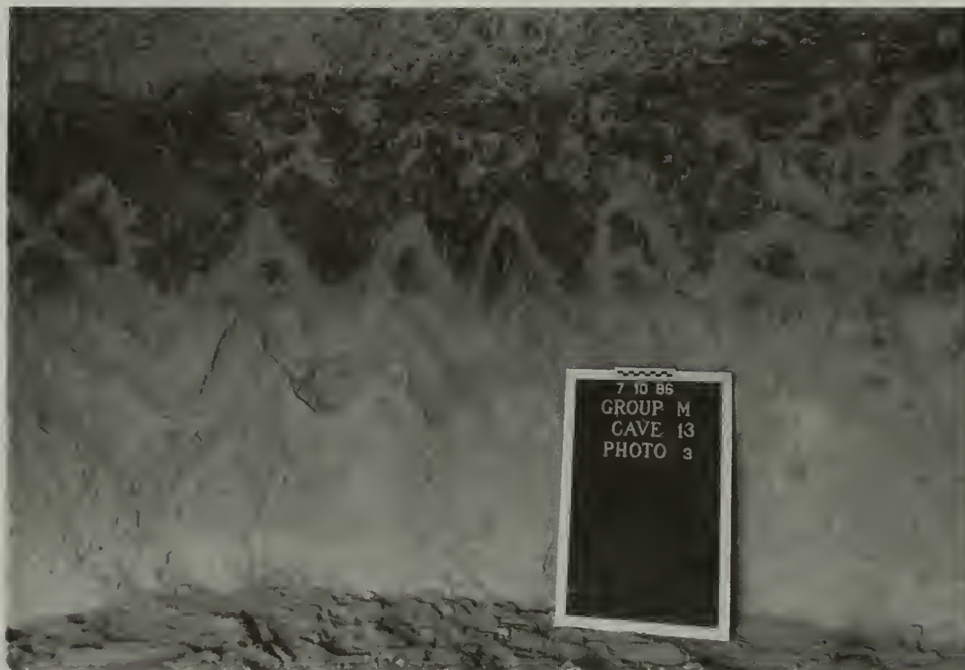

Figure 4.27. *Parallel zigzag lines, possibly Awanyus, in M-13; deeply chipped and abraded lines like this were seen elsewhere in Frijoles and also at Tsankawi. Patches of white paint are visible on the wall (this chamber also contained a handprint outlined in white). Vandalism to plaster is visible (scale=10 cm).*

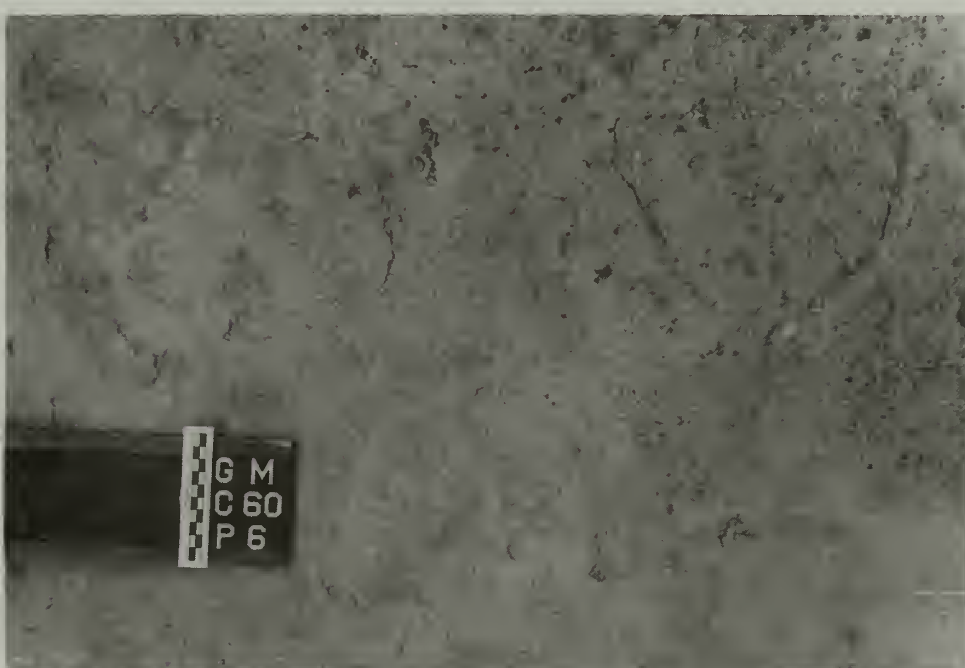

Figure 4.28. *Two masks or faces side by side in M-60. Notice how the figures appear to have been plastered over. This room also contains two metate rests (see Figure 4.7).*

Table 4.37. Rock Art Occurrence and Chamber Location.

A. Rock Art Occurrence by Type and Group

Rock Art Code	Group A	Group F	Group I	Group M	Tsankawi	Total
Geometric petroglyph	4[a]	4	0	4	6	18
Zoomorphic petroglyph	3[a]	4	6	9	12	34
Indeterminate petroglyph	3	4	4	8	12	31
Anthropomorphic petroglyph	2[a]	1	2	4	7	16
Geometric pictograph	2	0	4	1	0	7
Zoomorphic pictograph	0	0	0	2	3	5
Indeterminate pictograph	8	1	1	7	5	22
Anthropomorphic pictograph	0	0	0	3	1	4
Hand print pictograph	0	0	0	3	0	3
Total	22	14	17	41	46	140

B. Chamber Location by Type

Type	Right Wall	Back Wall	Left Wall	Exterior Wall	Ceiling	Other	Total
Geometric petroglyph	3	6	2	3	2	0	16
Zoomorphic petroglyph	9	11	8	1	1	2	32
Indeterminate petroglyph	2	7	2	2	0	1	14
Anthropomorphic petroglyph	6	13	5	2	4	1	31

Table 4.37. (continued)

Type	Right Wall	Back Wall	Left Wall	Exterior Wall	Ceiling	Other	Total
Geometric pictograph	0	7	0	0	0	0	7
Zoomorphic pictograph	0	4	1	0	0	0	5
Indeterminate pictograph	7	13	1	0	0	1	22
Anthropomorphic pictograph	1	0	2	1	0	0	4
Hand print pictograph	0	1	2	0	0	0	3
Total	28	62	23	9	7	5	134

[a]Each includes 2 group-recorded examples.

caprock. The remarkable extramural rock art at Tsankawi is confined to this caprock layer; the extramural rock art in the groups in Frijoles is now uniformly eroded and difficult to see, making comparisons difficult. Second, the plaster in Frijoles is more often in better condition than that at Tsankawi. Much of the Frijoles rock art we encountered was incised in the plaster, so that Frijoles and Tsankawi are again not quite comparable. Moreover, the rock art inside Frijoles chambers is not comparable to Frijoles cliff figures. These further cavate caveats do not imply disagreement with the differences noted by Crowder: there are several petroglyphs inside cavates at Tsankawi that are like nothing we saw in Frijoles, and it is likely that the extramural art was also different when it was all new.

Steen (1979) gives the name Mortandad Style to bold figures incised through smoke blackening into the light tuff, creating a strong contrast between the white figure and the black background. He says this style occurs in a small area from Bayo to Ancho Canyons, the immediate vicinity of Tsankawi. Figures include Awanyus, Kokopellis, dancers, birds, and the Toltec sun god. Several cavates at LA 50976 contain rock art that fits this definition. Steen considers this style to have been only briefly used in the late fourteenth century, though the ceramics found by James Maxon (1962) in a "cave kiva" containing Steen's prime examples of the style suggest to him a date of 1325. An important criterion of Steen's definition of the style seems to be that the incised lines are free of soot. As Maxon notes, "Apparently either there were few fires in the kiva after the figures were carved, or they were periodically cleaned, as the incised areas have little or no soot remaining in them" (Maxon 1962:2). It is unclear whether an expert in the Mortandad style would classify the sooted figures in TS-59 (Figure 4.24) as belonging to that style. It may be that a later date for the style is correct, and that it represents use of the cavates after their primary occupation. Rock art executed in this fashion is either much rarer or absent in Frijoles cavates, perhaps lending some support to the notion of a territorial boundary between Frijoles and Tsankawi, at least in more recent times.

Summary of Detailed Rock Art Study

June Crowder

The data recorded during this investigation are summarized in Table 4.38 and the tables in appendix 4 at the end of this study. The types of rock art and individual cavate contents are shown for both petroglyphs and pictographs for cavate Groups A, F, I, and M in Frijoles Canyon and for the selected group at Tsankawi (LA 50976). In addition, the cliff-face petroglyphs associated with the recorded groups are noted. Appendix 4 concludes with a brief correlation of the rock art recorded during this survey with that done by Chapman in 1916.

Table 4.38 presents a breakdown of cavates containing rock art types as defined in Table 4.39. Though I made no formal comparisons between this rock art and the examples described by Polly Schaafsma, our examples fall within the area and style she defines as the Tewa Division of the Rio Grande Style (Schaafsma 1975, 1980).

Many of the cavate walls and ceilings have multiple petroglyph designs. Because it is difficult to enumerate motifs and desirable to simplify the presentation of the recorded information, Table 4.38 and the group data in appendix 4 present the frequency of cavates containing each design type occurring within each cavate group, rather than the absolute frequency of each motif. The few pictographs found were for the most part unidentifiable. They are included in the summary table of each group as the number of cavates containing pictographs (appendix 4), with a brief description of each in the individual cavate table.

The objective of this investigation was to record the type, number, and condition of petroglyphs and pictographs in selected areas of Frijoles Canyon and in a sample at Tsankawi. The photographs we took can serve as a baseline against which to measure the effects of natural erosional forces, pollution, and vandalism over time. For example, in this survey, I matched 23 drawings from Frijoles Canyon done by Kenneth Chapman in 1916 (later published in Hewett's *Pajarito Plateau and Its Ancient People* [1938]) with the originals. Of these 23, 3 show severe deterioration and 3 show slight deterioration resulting from loss of wall plaster.

There are three major differences between the cavate wall drawings in Frijoles Canyon and those in Tsankawi. First, several two-horned serpents were found at Tsankawi but none in Frijoles Canyon. Second, Frijoles Canyon cavates contained many stylized parrots and other birds, while none was found at Tsankawi. Third, Tsankawi contained a larger number of anthropomorphic figures.

In Frijoles Canyon, there was a noticeable difference between the art on the cavate walls and that on the cliff faces. The cavates contain a richer variety of art and more ceremonial figures than do the cliff faces. Art on the cliff faces at Tsankawi shows more variety than that at Frijoles Canyon and corresponds more closely to the cavate wall drawings.

The total number of cavates that contained rock art was 46, of which 17 were in Group A, 7 in Group F, 4 in Group I, 6 in Group M, and 12 in LA 50976 (Tsankawi). In these cavates, 98 percent of the rock art was incised petroglyphs, 1.7 percent was abraded petroglyphs, and 0.3 percent pictographs. The cliff-face rock art from both Frijoles Canyon and Tsankawi consists only of petroglyphs.

Table 4.38. Cavates Containing Rock Art by Group and Motif.

Motif	Group A	Group F	Group I	Group M	Tsankawi	Total
Abstract	8	4	3	4	7	26
Geometric	4	3	3	3	2	15
Geometric abstract	1	1	2	0	0	4
Cross	1	0	0	0	1	2
Zigzags	1	0	0	1	0	2
Pictograph	4	1	1	3	1	10
Anthropomorphs	0	0	1	0	6	7
Ceremonial figure	0	2	2	0	2	6
Human figure	0	1	0	1	0	2
Mask	0	2	1	3	1	7
Hunter	0	0	0	1	0	1
Flute player	0	0	0	0	2	2
Stick figure	0	0	1	1	0	2
Realistic animal	0	0	1	1	0	2
Realistic bird	1	0	0	0	2	3
Realistic snake	1	1	0	0	2	4
Serpent	0	0	0	0	1	1
Two-horned serpent	0	0	0	0	2	2
Serpent motif	0	0	0	0	2	2
Snake motif	0	0	0	0	2	2
Stylized bird	0	1	0	1	0	2
Stylized parrot	0	0	1	0	0	1
Stylized insect	0	1	0	0	0	1
Terrace	0	1	0	0	1	2
Total aboriginal motifs	21	18	16	19	34	108
Cavates with art	17	7	4	6	12	46
Modern graffiti	11	3	1	0	3	18

Table 4.39. Rock Art Nomenclature.

Abstract	Includes curvilinear forms (different circular patterns), straight and curved lines, miscellaneous forms (dots, etc.)
Geometric	Connected straight lines forming a design
Geometric abstract	Design that has abstract elements and geometrics connected
Terrace	Geometric with stepped sides
Zigzags	Lines with sharp angles in alternate directions
Anthropomorphic	"Boxlike" drawing of the human figure
Ceremonial figure	Elaborately decorated (especially headwear) human figure
Human figure	Realistic rendering of human figure (modern?)
Masks	Both simple and stylized masks
Quadruped	All animal types not falling into the realistic category (cliff-face figures only in this sample)
Realistic animal	Drawings of identifiable animals
Realistic bird	Figures easily identified as birds
Realistic snake	Figures easily identified as snakes
Serpent	Extremely long and wide snake figure
Serpent motif	Extremely long and wide snake figure without a head
Snake motif	Any double-line figure of a snake without a head
Stylized bird	Elaborate drawings of birds
Stylized parrot	Elaborate drawings of birds with definite parrotlike beaks
Pictograph	Painted figures
Modern graffiti	Names initials, dates, etc.

5

Preliminary Functional Analysis of Cavate Chambers

Ultimately, one of the main things we want to know about cavates is their prehistoric function. Archaeological determination of function is ideally based on several categories of evidence, such as associated artifacts, debris from activities, well-grounded analogy to ethnographic groups, and architectural morphology. In the present study, we are limited almost entirely to the last category. Functional inferences must therefore be tentative; they are based on the study of feature co-occurrence, chamber size, and estimates of intensity of use.

Feature Co-occurrence

To examine feature co-occurrence, the cavate feature data set was used to generate a second data set through a series of merges from various data sets; each case of the new data set is a cavate (noncavates are excluded). The variables are chamber volume, coats of plaster, and the occurrence of ten feature categories (see Table 5.1). Variable values for the feature categories are the sum of all the occurrences of features in a particular category. Number of plaster coats was taken from the back wall of each chamber, or added manually from a consciously selected wall for cavates without back walls recorded. Volumes were included by merging information from the feature lines for chambers. The result was a data set with 175 cases profiling the cavates recorded, though fewer cases had data for the plaster and volume variables (Table 5.1).

The categories contain the following feature types:

Walls: all masonry and natural walls

Holes: indeterminate holes and possible latilla holes

Beam features: viga holes, beam seats, and wall ledges

Niches: wall niches and large floor-level niches

Floor features: floor, firepit, floor burn, floor ridge, and floor pit

Rock art: each recorded group of rock art (but not every figure)

Doors: interior and exterior doors

Vents: smokeholes and wall vents

Other features: grooves, wall depressions, deflectors, narrow wall incisions

Loom features: loom anchors and upper loom supports

Table 5.1. Summary of Chamber Attribute Occurrence.

Attribute	n	Mean	Standard Deviation	Minimum	Maximum	Median
Number of features[a]	175	13.3	11.51	1	64	10
Plaster coats	165	1.8	1.97	0	9	1
Volume	156	3.62	3.10	0.3	18.6	2.9
Walls	175	3.0	1.20	0	6	3
Holes	175	3.3	4.30	0	24	2
Beam features	175	1.8	2.76	0	15	0
Niches	175	1.1	1.49	0	8	1
Floor features	175	0.9	1.31	0	6	0
Rock art panels	175	0.7	1.95	0	13	0
Doors	175	0.6	0.78	0	4	0
Vents	175	0.5	0.98	0	6	0
Other features	175	0.5	1.07	0	9	0
Loom features	175	0.3	2.03	0	24	0

[a]Excluding walls.

Some rare feature types and ceilings are not included. The minimum occurrence column in Table 5.1 shows that no feature type occurs in every cavate. Ten chambers have no walls recorded; these "chambers" are mostly very irregular or partial (a few at Group M were "remotely recorded" by means of a ranger calling down observations). These ten have been excluded from the rank-order correlations of occurrence (Table 5.2), as have floor features, since recording them depends on depositional accident. The same could be said for loom anchors, but they are included because loom supports are visible.

A matrix of Spearman rank-order correlations (r_s) for feature counts was generated for the chamber data set (Table 5.2). Given that many chambers will be tied at zero or one for some features, the rank-order correlations of feature occurrence cannot be considered reliable predictors of the likelihood of finding feature a if feature b is present. Siegel (1956:210) states that the effect of ties is to raise the value of r_s, though there is relatively little impact, at least on small data sets. Although the nonparametric correlation is more appropriate to these data, experimental runs with Pearson Correlations give similar orderings of association. The correlations provide some ordering of associations among features, volume, and plaster coats, with the proviso that infrequent feature types tend to have lower maximum r_s values. Since feature counts are retained, the

Table 5.2. Co-occurrence of Feature Categories in Chambers.

Feature 1	Feature 2	Neither	F1 Only	F2 Only	Both
Holes	Beam support	50	43	16	66
Holes	Niches	49	32	17	77
Holes	Vents	60	64	6	46
Holes	Other features	60	73	6	36
Holes	Rock art	59	74	7	38
Holes	Loom features	65	100	1	10
Niches	Rock art	74	59	7	35
Niches	Floor features	58	41	23	53
Niches	Vents	70	54	11	40
Niches	Loom features	80	85	1	9
Beam supports	Niches	58	23	35	59
Beam supports	Vents	75	49	18	33
Beam supports	Loom features	90	75	3	7
Vents	Floor features	77	22	47	29
Rock art	Floor features	84	15	49	27
Rock art	Loom features	128	37	5	5
Floor features	Loom features	96	69	3	7
Other features	Loom features	127	38	6	4

correlations also give added dimension to the straight co-occurrence data (Table 5.3). Quite understandably, we find a fairly good association between chamber volume and the number of features present, but there is less likelihood that a larger chamber will have been plastered many times. Generally, and again predictably, the matrix shows that large numbers of features tend to occur together (see especially the feature number correlations in Table 5.2).

Among the many correlations, several deserve note. The presence of niches seems to correlate well with holes, beams, volume, rock art, and plaster coats. There are somewhat surprising correlations between floor features and rock art, and floor features and plaster coats. These correlations may result in part from the fact that chambers showing floor features tend to be well-protected, well-preserved ones. The correlation between art and vents may be in part similarly explained, and the correlation between vents and doors is related to the presence of intact exterior walls. The

Table 5.3. Spearman Rank-Order Correlations of Feature Category Co-occurrence.

A. Plaster Coats, Number of Features, Walls, and Holes with Other Feature Types

Feature	Volume	Plaster Coats	Feature n	Walls	Holes
Volume	1.000	0.378	0.631	0.247	0.485
n	148	143	148	148	148
Plaster coats		1.000	0.460	0.064**	0.386
n		160	160	160	160
Feature number			1.000	0.389	0.798
n			165	165	165
Walls				1.000	0.275
n					165
Holes					1.000
n					165
Beam supports	0.411	0.386	0.596	0.171*	0.373
n†	148	160	165	165	165
Niches	0.543	0.467	0.685	0.216	0.5220
Vents	0.445	0.320	0.556	0.451	0.403
Rock art panels	0.266	0.384	0.527	0.111**	0.300
Floor features	0.225	0.472	0.371	-0.069**	0.118**
Loom features	0.222	0.134**	0.274	0.071**	0.184
Doors	0.234	0.093**	0.426	0.469	0.309
Other features	0.226	0.060**	0.390	0.180*	0.246

Table 5.3. (continued)

B. Beams, Niches, Vents, Rock Art, and Floor Features with Loom and Door Features

Feature	Beams	Niches	Vents	Rock Art	Floor
Beam supports	1.000	0.443	0.225	0.245	0.208
n†	165	165	165	165	165
Niches		1.000	0.335	0.379	0.289
Vents			1.000	0.309	0.200
Rock art panels				1.000	0.343
Loom features	0.184	0.273	0.134**	0.171*	0.235
Doors	0.168*	0.247	0.480	0.168	-0.029**
Other features	0.117**	0.194	0.174*	0.221	0.189

C. Loom Features and Doors with Other Features

Feature	Loom	Doors	Other
Door	0.046**	1.000	0.147**
Other	0.100**		

Note: The feature numbers used do not include walls as features; values for volumes are rounded to the nearest 0.1 m^3 for the calculations.

*Associated probability of no correlation greater than 0.01 ($.01 < p < .05$).
**Associated probability of no correlation greater than 0.05.
†The *n*s for all succeeding lines in this block are the same as for this line.

correlation between loom features and rock art is surprisingly low, an outcome surely influenced by the fact that TS-64 has 24 loom features (top rank) and only one rock art panel. Visibility and preservation again influence the relatively strong correlation between loom features and floor features; the correlation shows that loom features do occur with other floor features.

Plastering and Smoking

Plastering and smoking of cavates offer the best means for estimating duration and intensity of use of cavates. The majority of cavates exhibit wall plastering, but the finish of the coats and the number applied are quite variable (see Tables 4.9, 4.10). Although it is not possible to determine the interval between plasterings, the presence of several coats of plaster seems a good indication of maintenance of the room; when numerous coats are present, they are usually smoked, which in turn shows that the maintenance was occasioned by use of the room. If this reasoning is valid, we may ask such questions as which rooms are maintained, whether apparently long-used rooms contain more features, and whether large rooms are more frequently maintained than smaller ones.

The maximum number of plaster coats recorded is 10, with the most on a back wall 9 (and thus transferred to the chamber data set). Table 5.4 shows the co-occurrence of coats of plaster and number of features, excluding walls.

This tabulation gives dimension to the Spearman correlation value of 0.46 for plaster coats and number of features. That is, chambers with very few features clearly tend to have little plaster, and the rooms that have the most features tend to show at least some replastering. Still, some rooms have multiple replasterings and relatively few features, and the rooms with the most features are not those with the most plaster coats. This finding may be related to personal variation in level and frequency of maintenance. It also seems to indicate that the rooms that were used the longest (or maintained the most frequently) were not those in which the most activities took place. Because the correlation between coats of plaster and chamber volume is even lower ($r_s=0.38$), it is tempting to suggest a division between rooms of everyday use (smaller, more often replastered) and special-use rooms (larger, more features, less often plastered). This interpretation is countered, however, by the fact that all the largest chambers are located at Tsankawi, where plaster is either less frequent or less well preserved.

These data give some indication of the periodicity and perhaps reason for replastering. On all walls with many coats of plaster, at least some of the coats are smoked, but all the coats are smoked in only a few cases (Table 5.5). Often, we found that the most recent coat looked quite clean, which may say something about abandonment practice or may indicate that that was the desired state (barring some unfortunate, unknown recent attempt at "restoration"). In the 150 walls of rooms designated as storage rooms, only 21 percent were smoked (the maximum number of coats in these rooms is two). In rooms assigned to the habitation group, on the other hand, 71 percent of 303 walls showed some smoking, while 86 percent of 29 "kiva" walls showed smoking.

Cluster Analysis

Each chamber recorded on a cavate form was assigned to a functional category by the recorders. These categories include habitation, storage, "kiva," and unknown. We based these assignments on the presence of various feature types, chamber size, and wall treatment. Merely tabulating functional categories by these features only shows how much latitude the recorders allowed for each category (that is, it quantifies their mental templates for each function). The

Table 5.4. Plaster Coat-Feature Number Co-occurrence.

Number of Features	0 Coats	1 Coat	2 Coats	3-5 Coats	6-9 Coats	Total	Percent
1-2	9	6	3	0	0	18	10.9
3-4	8	8	0	1	0	17	10.3
5-6	8	10	2	2	0	22	13.3
7-9	5	7	3	2	2	19	11.5
10-12	6	6	1	3	0	16	9.7
13-16	4	5	2	5	2	18	10.9
17-20	1	4	3	7	1	16	9.7
21-25	3	4	2	6	3	18	10.9
26-41	2	1	3	5	4	15	9.1
43-64	0	1	2	3	0	6	3.6
Total	46	52	21	34	12	165	99.9

analysis can be taken one step further by performing a quantitative classification analysis based on measurements and the presence of features and plaster. Such an analysis allows us to see if this more objective approach finds different categories and whether the subjective classifications are to any degree independently created.

The co-occurrence information is suggestive (Table 5.2), but it rapidly becomes unwieldy because of the very large number of possible combinations. In an effort to place chambers in groups based on feature occurrence, several cluster analyses were performed using the SAS FASTCLUS procedure. The following variables were included: volume, plaster coats, number of holes, number of niches, number of beam supports, and number of rock art panels. Infrequent and inconsistently observable categories, such as loom and floor features, doors, and some other features, were not included, and completeness and fill filters were also applied, resulting in a group of 127 rooms.

Analyses were done requesting 6 and 10 clusters. The sizes of the clusters formed are quite different. In the 6-cluster version, one cluster contains 78 of the cases; the 10-cluster version breaks this cluster into two clusters of 57 and 25 (some cases change cluster membership when new clusters are present). Though it generates several clusters with only a few members, the 10-cluster analysis is presented because variability in function is a focal question. Even with 10 clusters, cases that are far from the cluster seed in large clusters are intuitively unlike the cluster profile (see appendix 5).

The clusters formed by this procedure on the whole make intuitive sense, though a few placements seem odd based on a knowledge of the room and other preconceptions. Once again,

Table 5.5. Smoking of Plaster Coats.

		Number of Smoked Coats							
Total Plaster Coats	No Smoke	1	2	3	4	5	6	7	9
No coats	126	55[a]							
One coat	93	48							
Two coats	19	40	6						
Three coats	4	25	16	3					
Four coats	2	10	12	5	1				
Five coats	1	2	4	17	3	0			
Six coats	0	0	3	3	7	0	0		
Seven coats	0	0	2	0	3	1	0	1	
Eight coats	0	0	0	0	0	0	2	0	
Nine coats	0	0	0	0	0	0	0	1	1
Ten coats	0	0	0	0	0	0	0	2	0
Total	245	180	43	28	14	1	2	4	1

[a]One "coat" of smoking on no coats of plaster indicates a smoked, unplastered surface.

it is important to recognize that the program "knows" only the variables given it and that each of those variables is given equal weight. That is, as far as the program is concerned a chamber's volume is just as important to its placement as the number of indeterminate holes, and for this analysis it did not consider the presence of loom features or the scope of the rock art (merely the abundance of the panels). As is apparent in the comparison of cluster placement to assigned function, the clusters also indicate that subdivision of the assigned categories is possible and that the categories do overlap. Cluster membership for individual cases is given along with volume, plaster coats, and number of features in appendix 5.

The cluster means give a fairly good idea of the characteristics of each cluster (Table 5.6). Cluster 6 chambers are relatively low volume, have few plaster coats, and few features. They thus correspond fairly well to what we called storage rooms, though some chambers we thought to be habitation rooms are included. This cluster also accounts for most of the chambers placed in the unknown function category. This cluster is found in all groups, more or less proportionally to the size of the sample included from each group. Therefore, it may be suggested that such low-activity rooms were a part of the complement of all cavate settlements, and that they were likely to have been for storage.

Four clusters (1, 2, 3, 7) contain rooms only from Tsankawi. As noted earlier, many Tsankawi rooms are considerably larger than those recorded in Frijoles, and large size is an

Table 5.6. Means, Membership, and Correspondence to Assigned Function for Chamber Cluster Analysis.

A. Cluster Means for Chambers

Cluster	n	Volume	Plaster	Holes	Art	Niches	Beams
1	2	5.48	1.5	22.5	2.5	2.0	4.0
2	5	10.92	1.6	10.0	1.0	4.0	2.6
3	3	17.04	3.0	13.7	7.7	5.3	8.7
4	4	5.60	5.8	6.2	0.8	2.8	11.8
5	13	5.24	4.9	9.1	1.0	2.3	2.3
6	57	2.16	1.1	0.5	0.2	0.5	0.3
7	2	15.15	1.0	5.5	0.0	4.0	5.5
8	2	3.99	3.0	3.0	12.0	1.5	1.5
9	25	3.01	1.7	5.6	0.6	1.3	1.0
10	15	4.30	1.7	2.3	1.2	1.4	5.5

B. Chamber Cluster Membership by Group

Cluster	Group A	Group F	Group I	Group M	Tsankawi	Total
1	0	0	0	0	2	2
2	0	0	0	0	5	5
3	0	0	0	0	3	3
4	2	0	0	2	0	4
5	5	5	0	1	2	13
6	9	4	10	12	22	57
7	0	0	0	0	2	2
8	0	0	1	1	0	2
9	3	5	5	1	11	25
10	1	0	2	8	4	15
Total	20	14	18	25	51	128

Table 5.6. (continued)

C. Chamber Cluster Occurrence by Assigned Function

Cluster	Habitation	Storage	Kiva	Unknown	Total
1	1	0	1	0	2
2	4	0	1	0	5
3	1	0	2	0	3
4	3	0	1	0	4
5	13	0	0	0	13
6	15	35	0	7	57
7	2	0	0	0	2
8	0	0	2	0	2
9	17	5	0	2	24
10	13	1	0	1	15
Total	69	41	7	10	127

important aspect in three of these Tsankawi-only clusters. Clusters 3 and 7 contain the largest rooms in the sample; the difference between them is that Cluster 3 rooms not only are the largest but also have some of the highest feature counts (in addition they have multiple plaster coats, while the cluster 7 rooms do not). All attributes suggest that TS-20, placed in cluster 3 and called a habitation room by the field recorders, should be considered in the same category ("kiva," if you will) as the other rooms in cluster 3 (TS-59 and TS-66). In fact, the recorders noted the presence of upper loom supports and suggested that the room was possibly used as a "kiva." The frequency of rock art is very high in the chambers in cluster 3. The two members of cluster 1 are well within the size range for Frijoles chambers; they differ, however, by having fewer coats of plaster than other rooms with an equal number of features and by containing an inordinate number of hole features. Cluster 2 may be characterized as large rooms containing many features but little rock art, few coats of plaster, and many niches; TS-64, the single chamber containing the most weaving features of any recorded and called a "kiva," is placed in this group. This cluster is easy to understand as a group of large chambers with intermediate numbers of features, especially because loom features were not included in the analysis.

Clusters 4 and 5 might be considered "typical" high-activity Frijoles rooms. Volumes are relatively high for Frijoles, and the chambers have many features (but infrequent rock art) and many coats of plaster. The difference between the two is primarily a high frequency of beam-supporting features in the Cluster 4 rooms. A couple of Tsankawi rooms fall within this constellation of attributes. Cluster 8 contains two Frijoles "kivas" that are in fact quite similar, M-13 and I-19. They are both entirely enclosed, relatively small chambers with much rock art (this cluster has the highest mean frequency of rock art) and abundant other features. I-19 also contains loom features and floor features not used in the analysis.

Cluster 9 is a good deal like cluster 6, the storage cluster, though its members are somewhat larger and have more abundant features of all types; the majority of this cluster was classified as habitation rooms rather than storage rooms. This cluster may indicate the existence of a group of rooms exhibiting less evidence for intensive activity but still differing from small, featureless rooms. Cluster 10 seems to be yet another small increment in apparent activity; rock art, niches, and especially beam supports are more frequent in this group than in clusters 6 and 9.

The chamber cluster analysis is really only a starting point for attempting to identify functional variability in cavate chambers. The criteria could be refined and the combinations elaborated through the use of more feature types with tighter definitions. Much more information is needed on the functional significance of the features themselves. Still, the differences and similarities in the classifications do suggest that this may be a useful approach to examination of larger samples.

6

Interpretation and Conclusion

The field recorders on this project were asked to attempt to assign one of three general functions to each cavate: habitation, storage, or "kiva" (Table 4.3B). These assignments are of course subjective, but they are also in a sense multivariate, because a human observer can form an impression based on a great many attributes that are difficult to quantify for supposedly objective classification by machine. The distributions of features within the field function groups are instructive (Table 6.1).

This tabulation shows clearly the existence of a fairly large group of cavates that have small numbers of features and that do not look "lived in." There is also a much smaller number of cavates that show a great deal of evidence for activity, perhaps beyond just habitation.

In 1952 Watson Smith published a chapter called "When Is a Kiva?" in which he neatly demonstrated that what archaeologists called kivas could not be defined by any single feature (Smith 1952:154-165; see also Thompson 1990). Moreover, he showed that there were large areas of overlap between regular rooms and kivas in terms of size and feature occurrence. Having concluded that even within areas there is a great deal of architectural variability in kivas, Smith made several observations that remain useful here:

> It seems to me that the most convincing determinant in most cases lies not in the specific features of any particular room taken in the absolute, but rather in that room's relationship to other rooms in the architectural unit of which it was part. . . .
> It is my feeling that in a large number of cases a given room may have served for both secular and ceremonial uses, and that in most of those cases there is no way whatever of certainly determining the fact. On the other hand, there are many cases in which the relationships of a particular room within its architectural complex, its difference in shape or size from other associated rooms, and it positional relation to them, will be of greater significance in its identification than any or all of its internal features as such. (Smith 1952:161-162)

Peckham (1979) further elaborates the lack of consistency in ceremonial structures for the Rio Grande.

Given the constraints imposed by "the medium" (cliffs) on cavate placement, form, and size, the problems reviewed by Smith are compounded for cavates. The use of the term *kiva* has three aspects: architectural, functional,

Table 6.1. Frequencies of Features by Assigned Function.

Number of Features	Habitation	Storage	Kiva	Unknown	Total
1-5	8	34	0	8	50
6-10	14	13	0	7	34
11-15	16	4	0	1	21
16-20	20	0	2	0	22
21-30	27	3	1	0	31
31-40	3	0	1	0	4
41-64	3	0	4	0	7
Total	91	54	8	16	169

Note: Excludes the wall category; some rare feature types are not included.

and semantic. In addition to the architectural variability noted for "kivas" in general, surely there was also considerable functional variability, as adumbrated by the chamber cluster and other analyses (see chapter 5). Semantically, the connotations of the term itself may or may not be warranted.

Stephen Lekson (1988) has persuasively argued that the term *kiva* as applied to prehistoric Pueblo archaeology and also the ceremonial connotations that it bears are more an artifact of political and practical aspirations of early twentieth-century archaeologists than the result of good archaeological evidence for the ceremonial use of kivas. Hewett was a prime proponent of early "kivas," and it was probably he who started the tradition of cavate kivas (Hewett 1909b:655-663). It seems extremely likely that the term is misleading as to the function of larger cavates with multiple features and rock art. Even the very largest cavates would not hold a gathering of any size. The many features of some larger examples are at least as likely to be the result of use primarily as a habitation room as they are to be the result of use as a ceremonial chamber. Among the attributes that prompted Hewett to call some cavate rooms kivas are a "ceremonial opening," murals, and rows of six or seven loops, which we call loom anchors, in the floor. He called the loops "a feature to be found on the floor of nearly every kiva that has been examined in this region" (1909b:660). These three features are present in all three kivas described by Hewett. Other features present at some of the kivas he describes are partial subterraneity, densely smoked walls, a plaster dado, a firepit, a *sipapu*, a posthole for a sun observation post, and an altar (or at least the place for one). While one of the three is the "largest cave kiva that has been found, another is "about 8 feet by 8 feet in dimension" (about 2.4 x 2.4 m; 1909b:658, 655).

Loom anchors *are* associated with kivas in other prehistoric Pueblo areas (see, e.g., Smith 1952:159; Magers 1986:270-271) and in the Rio Grande (Peckham 1979), but this means only that similar activities took place in some cavates and some other prehistoric Pueblo "round rooms," not that such rooms were strictly ceremonial in nature. The practice of weaving in Hopi kivas, however, does strengthen the link between prehistoric and ethnographic kivas. It also serves as a caution that strict partitioning of daily activity from the ceremonial realm is not a realistic perspective for pueblos, prehistoric or modern (see also Steen 1977:17). Loom anchors in cavates tend to be found in chambers with many features, some of which are rock art panels. During fieldwork, our impression was that if one or two looms were set up in a chamber there would be room for little else, though perhaps looms could be taken down so that chambers could be used for other functions. Historically, cotton weaving took place mostly in the winter at Hopi (Kent 1983b:27), which raises interesting if hard-to-verify possibilities for the seasonality of use of cavates. Many of the old photographs of Pueblo weaving published by Kent (1983b), however, show weavers working at outside looms, indicating that interior weaving was probably only a portion of the industry.

Some cavates, then, were used for multiple activities and were probably somewhat similar to earlier prehistoric Pueblo kivas found to the west. Any conclusion about the ceremonial use of these rooms by a specific social group, such as a clan, would be extremely speculative, and one must keep in mind the severe space limitations of these rooms. To identify small cavates used for individual meditation cells or personal kivas (see Steen 1977:14) would be virtually impossible.

Smith's point that some rooms are distinctive in some way--shape, size, placement, features--is well taken with regard to cavates. Of the eight chambers that were considered to fit the "kiva" pattern, four are in the Tsankawi sample, and three of those are nearly contiguous (TS-59, TS-63, TS-66). This concentration of large, high-activity rooms suggests that most cliff suites with cavates probably had such a room; at Tsankawi, where a higher percentage of rooms were cavates rather than partial cavates or mostly masonry, more such rooms are visible. But were they "kivas"? In the sense of a feature where many people gathered for ceremonies, probably not. On the basis of little evidence, I would suggest that function probably took place at the various large masonry structures that are near most dense groups of cavates. In the sense of a room where ritual observance and preparation sometimes took place, doubtless these chambers were kivas. Clearly, after all these years, we still need to know not only when is a kiva but what is a kiva. At least archaeologically, the term now covers too many sins.

Another function suggested for cavates is that of field house. Preucel has studied Pajarito field houses in depth (Preucel 1985, 1986a,b), and has suggested that the cavates in our study could have performed that function (R. Preucel, personal communication, 1988). Dietrich Fliedner (1975) mentions "small caves" that have been modified in the vicinity of Unshagi on the Jemez River and suggests that these features too may have been used by small groups tending fields. The smallest of the groups in the present study was part of a site of at least 50 rooms, and all are in close proximity to further aggregations of population. This context does not suggest structures intended primarily for tending nearby fields, but much more isolated cavate rooms are present around the plateau in locations that do suggest this function. Comparison of such locationally distinct cases to the metric and feature profiles generated in the present study will help show whether they conform to general cavate construction and layout or whether they have distinctive attributes that pertain to their function.

Whatever the function of individual chambers, the loom features found in cavates indicate that weaving was probably a very important, perhaps even major activity on the Pajarito Plateau. Detection of the presence of loom features is subject to several variables of preservation and deposition, and there is little doubt that rooms for which we did not record loom features do in fact contain them. Even so, 10 of 175 (6 percent) chambers recorded had loom features observed. Some of the 175 are not in any condition to retain evidence of loom features, many others are far too small to contain a loom, and the floors of still others are not visible without excavation. If we grant that about 100 of these rooms were used for living activities, the percentage is even higher. The Pajarito Plateau seems an unlikely place to grow cotton, though the Spanish found the Pueblos growing it as far north as the mouth of the Rio Chama (Kent 1983b:5). This high frequency of loom features raises a host of questions: Was cotton a major crop? Was raw cotton a major import? Were the cavate inhabitants weaving some other fiber? Was weaving an important economic hedge for plateau inhabitants, an entrée into the broader fifteenth-century economy? Whatever the answers to these questions, the apparent importance of weaving at these sites casts a different light on the historic association of weaving with the Hopi area (see Kent 1983a,b).

Cavate Use and Relationship to Large Surface Pueblos

All the cavate groups included in this study are to some degree spatially associated with large, free-standing pueblos, similar to the pattern observed elsewhere on the Pajarito Plateau (Preucel 1987). Group A is perhaps the farthest removed from such a site, but it is only 1 km from Tyuonyi, and there is an apparently sizable site on the south side of the Rito between Ceremonial Cave and Group A. Group F is the closest to two large sites: Tyuonyi and the unexcavated house (Tyuonyi Annex - LA 60550) just to its east. Group I is close to these sites as well, Group M is above Rainbow House, and the LA 50976 cavates at Tsankawi are just below Tsankawi Pueblo (LA 211). The broad chronological information available (Tables 2.1, 2.3) indicates that the two site types were used contemporaneously. The relationship between these two types is of great interest, but knowledge of the actual function of either type is at present so sketchy that discussion of the relationship must take the form of a listing of possibilities and the data available to support them. In assessing these relationships, we should consider that although the two site types make a neat archaeological dichotomy in terms of location and present appearance, this difference was probably less during occupation. The cavate groups studied in Frijoles were all substantial masonry structures that also happened to have back walls and some rooms that were part of the cliff. The plan of Long House (also known as Group D) with its tiers of masonry rooms and multiple stories is a good example; in all probability Group A was a site comparable to Long House in size and layout.

Bandelier (1971) envisioned that the two types of structure were contemporaneous, that the people living in both were members of the same tribal unit but belonged to different clans, and that those in the cavates were somehow slightly less reputable. His vision accepts (or helped create) the received wisdom that large masonry structures were places where people lived year-round, and there does seem to be a great deal of overlap in feature type between cavates and free-standing pueblos. Both Bandelier and Hewett conceived of the large pueblos as "community" structures, and that concept has some appeal: they have a visibly organized layout as opposed to the seemingly more accretionary cavate/cliff sites. McKenna's ceramic analysis of limited cavate surface samples suggests that the cavates may have higher frequencies of culinary wares than the larger pueblos, which may be interpreted as indicating a greater domestic use of the cavates.

Preucel (1987) has proposed using a succession model for occupation of the Pajarito Plateau. The latter two stages of his model (equating to the Late Coalition and the Early Classic) involve increased population concentration. Densely settled groups of cavates are an effective means of aggregating population with minimal loss of productive land either on mesa tops or in canyon bottoms. Once again, the complementarity of free-standing masonry pueblos and cavate-using "talus pueblos" seems important. The type and degree of relationship is of critical importance to analyses such as Preucel's: should cavate floor areas be included with those of adjacent free-standing pueblos, or should the two types of structures be considered separate "sites"?

Conclusion

Any archaeological project has aspirations on several planes. On a mechanical and methodological level, this study presents a system for recording cavate rooms and features in a relatively rapid, reproducible fashion. Details of definitions and technique could certainly be refined; the metric analyses of the data collected as well as the experience of using the system on a large body of data point toward some of those refinements. The features studied were recorded in sufficient detail using enough different media that for these groups cultural resource managers have the information required for monitoring and preserving an important and rich archaeological resource.

The studies of occurrence, co-occurrence, and metric variability will allow comparison with features and rooms--whether in cavates or not--recorded elsewhere on the Pajarito Plateau, to isolate morphological groups within general feature categories. Here the level of aspiration rises to determining function and, beyond that, better understanding culture history and ultimately cultural process. As is frequently the case, these aspirations are frustrated to varying degrees. The experiments with cluster analysis suggest that it is a potentially useful means of identifying classes of features or rooms that may have functional significance. The results of the cluster analysis also corroborate the indications from the other analyses that the broad storage-habitation classification has many subcategories of use and that it is probably possible to identify them. Though cavates provide a great deal of "cheap" data, one must remember that they are often only parts of sites. To fully understand those sites requires seeking information from the whole.

Some questions remain largely unanswered, such as the question of a cultural boundary separating the Tsankawi area from the Frijoles area during the occupation of the cavates. We found some hints of such a boundary: features and rock art occurring only at Tsankawi, chamber size, and ceramic distributions. The indications are far from clear-cut, however, and those relatively small differences are seen against a backdrop of great similarity in a majority of other attributes. In that sense, though, the differences resemble those between the linguistically different ethnographic groups that claim these two areas (Tewa and Keres). Other issues, such as the relationships among the Frijoles cavate groups or between the cavates and the large free-standing pueblos, or the impetus to occupy and abandon cavates, remain speculative. Further research is necessary to shed light on these questions.

This project is only a starting point for understanding and recording cavates on the Pajarito Plateau. The sample is sizable, but it is a very small percentage of the cavates that are "out there." The study shows that cavates vary considerably, and, once subdivisions are made, the small sample size relative to the variability becomes apparent. All of the cavates included are from major clusters, and there are isolated ones which would make interesting comparative material. Excavation data from cavates would add important missing dimensions to this study, but, as shown by the nearly limitless numbers of potential combinations made apparent by this study (only a fraction of which have been explored here), cavates are remarkable for the amount of information available *without* excavation.

The information available in cavates provides a perspective on prehistoric architecture that is rarely available from excavation. Correctly and necessarily, the focus of excavation data is the floor; more often than not, information on the rest of the room stops a few centimeters above the floor. In a cavate room, on the other hand, full, constructed walls and ceilings may still be observed, and the preservation is frequently excellent. In cases where floors have not been exposed to human and animal wear, preservation of organic materials and feature components is also likely to be very good. The numbers and variety of features on walls and ceilings catalogued by this study show how incomplete the floor perspective on prehistoric life can be. The high state of preservation in many cavates does not, however, mean that the information still available in cavates (with or without excavation) will last forever. Cavates on the Pajarito and elsewhere owe their existence to the softness of the rock into which they are dug. This means that features are continually degrading, especially where they are often visited. Archaeologists and managers should therefore take every opportunity to catch as much of the perspective provided by cavates as possible before it weathers away or is vandalized. There is much to be done, but there is solace in the thought that a great deal of information can be captured at a relatively low cost.

Appendices

Forms Used in Recording, 1986

Cavate Room Record

Record number:

Date: Recorder:

Site number: Cavate group: Cavate no.:

Photo key: Quad:

Location: ¼ ¼, Sec. T R UTM: E N

Elevation:

Exposure/orientation of exterior opening: ° TN

Height above PGS of base of opening: m

Fill: type approximate depth m

Estimate of completeness of room:

Evidence for construction:

Estimate of natural vs. excavated space:

Masonry:

Cavate rooms in group up-canyon down-canyon

Stability:

Unusual tuff characteristics:

Nonhuman use:

Function:

Room notes: ______________________________

____

____

____

Features

Doors:

No.	Type	#	Location Part/Az.	Shape	Measurements a	b	c	w th.	Geo f	To room	Photo	Feat f

Door notes: ______________________________

____

***Cavate*______*Page*_______*Record No.*______**

Chamber:

No.	Type #	Locat. Pt./Az	Shape	Measurements a	b	c	d	Geo f	Plaster n	sm-n	clr	ht	Damage h	n	Fea	Notes f
		/ °														
		/ °														
		/ °														
		/ °														
		/ °														
		/ °														
		/ °														
		/ °														

Notes for no.:

____

____

____

____

____

Features

No.	Type #	Location Part/Az.	Shape	Measurements a	b	c	deep	Geo f	Height /floor	Photo	Fea f
		/ °									
		/ °									
		/ °									
		/ °									
		/ °									

***Cavate*_______*Page*_______*Record No.*_______**

Features:

No.	Type	#	Location	Shape	Measurements					Geo	Height	Photo	Fea	Notes
			Part/Az.		a	b	c	deep	f		/floor		f	
			/ °											
			/ °											
			/ °											
			/ °											
			/ °											
			/ °											
			/ °											
			/ °											
			/ °											
			/ °											
			/ °											

Feature notes for no.:

Noncavate Cliff Feature Record

Date: Recorder:

Site number: Record number:

Cavate group: Room number:

Photo key: Quad:

Location: ¼ ¼, Sec. T R Elevation

Feature type:

Human damage: Natural damage:

Connected with cavate:

Evidence for construction:

Masonry:

Stability:

Dimensions:

No.	feature/part	shape	w	h	depth	gf	photo	ff

Features:

No.	Type	n	shape	size range	gf	photo	ff

Notes:

Procedures and Codes for Recording

Procedures and Codes for the Cavate Form

Feature here is an inclusive term that includes chamber portions, doors, walls, firepits, and loom anchors. There are certain classes of information which do not apply to certain sets of features (firepits do not go to other rooms, and a wall does not need a precise location). Remember that codes can be added for things not covered in this list; added codes are documented as to definition and date of addition in a later part of this appendix.

All measurements are in meters, with the number of decimal places reflecting the accuracy of the measurement.

Record no.

Every cavate record receives a record number which serves to tie together basic information and feature information. This is a very good number to get right on all the forms.

Site

Laboratory of Anthropology numbers (LA___) were assigned. Surprisingly, only a few of the cavate groups had LA numbers: Group D or Long House=LA 13665; Group E or Hewett's Sun and Snake Houses= LA 13664; Tsankawi itself=LA 211 (cavates around Tsankawi had no LA numbers). The following numbers were used in the field in 1986: Upper Group M LA 50020; Upper Group A LA 50021; Group I LA 50022; Lower Group F LA 50023; Tsankawi Group LA 50024. In late 1987 I was informed that these numbers were already in use in the LA system and that the official numbers would be Upper Group M LA 50972; Upper Group A LA 50973; Group I LA 50974; Lower Group F LA 50975; Tsankawi Group LA 50976. All handwritten records and photo boards etc. reflect the *field* LA numbers.

Cavate group

Hewett group, our subgroup, or other identifier.

Number

Assigned to individual rooms by this project unless Lister's or some other number is known (see Tsankawi discussion).

Photo key

This entry was not used in 1986 due to the lack of appropriate photos; it was intended to refer to a frontal location photo.

Exposure/orientation

Taken by placing Brunton in the center of the main cavate opening and reading the azimuth; significant shading, etc., of opening should be noted.

Height above PGS of base of opening

Vertical distance; intended to monitor how high one would have to climb or build to reach the opening. If the opening is buried give as negative value; -99 if not reasonably estimable.

Fill Type:

0 clear floor
1 disintegrated tuff
2 dung + tuff
3 aeolian/alluvial
4 high organic content
5 tuff + dung + organic
6 aeolian/alluvial + tuff + organic

Approximate depth: Fill depth is frequently variable across a floor: attempt to estimate a mean. Use a probe in rooms with considerable fill.

Estimate of completeness of room

1 complete
2 greater than 3/4
3 greater than 1/2
4 less than 1/2

Evidence for construction

0 none visible
1 digging stick-like marks in ceiling
2 shaping of opening
3 digging stick + shaped opening
4 shaped corners
5 digging stick + shaped corners
6 digging stick + shaped corners and opening
7 floor-leveling fill (beneath plaster floor)

Estimate of natural versus excavated space

1 completely excavated
2 at least half excavated
3 at least half natural
4 mostly natural

Masonry

0 absent
1 single thickness large tuff blocks
2 small tuff chunks with abundant mortar
3 blocks present but not retaining visible coursing

Cavate rooms in group

Give the number of cavate rooms up-canyon and down-canyon in the whole group (not the sample group but, for example, all of Group A). This should include partial cavates which might not be fully recorded by this study. This observation relates to the apparent pattern that larger, "kiva" cavates seem to occur toward the ends of groups.

Stability

1 apparently stable
2 deterioration evident, lesser threat
3 deterioration evident, continuing, greater threat
4 major problem, collapse or other major loss may be imminent

Unusual tuff characteristics

0 none
1 softer than usual
2 harder than usual
3 unusual variation, stratification
4 many large fibrous chunks
5 highly porous
6 soft red tuff

Nonhuman use

0 none visible
1 ungulates
2 pack rats
3 bats
4 insects
5 combinations
6 birds--raptors and vultures
7 birds--other
8 other rodents

Inferred room function

1 habitation
2 storage
3 "kiva"
4 successive uses: both storage and habitation
5 insufficient evidence for inference

These functions are obviously normative and based on limited, perhaps unrealistic, attributes. Thus, habitation rooms are intermediate in size, smoked, and usually have vents, while "kivas" have more rock art and loom anchors, and are larger. Storage rooms usually are so called because they are not smoked, have less attention to plaster, and fewer features, and are often smaller. Refinement of these labels is highly desirable, and recorders should be mindful of ways of doing so. "Insufficient evidence" should be used sparingly.

Room notes

This is a space for verbal annotation of the base information code entries and about the room as a whole (for example, *why* is it a storage room and *what is* the imminent threat?). A word or two on the location relative to other rooms can be useful when sorting through a large pile of forms. Remember that there is no need to talk about features--each one gets its turn on stage individually in the next section of the form.

Features

Though subdivided here for the purpose of the form, every entry here is a feature with its own code, which is in turn described by other codes and measurements. Not every modifying code will be applicable to every feature. It is possible to take verbal notes for each feature; if you do so, mark the code line with a prominent *N* so that the person entering the data knows to look below for the note.

Feature numbers

We have two types of feature number plus the feature code: every feature receives its own number which is sequential within the cavate record, designated on the forms by "No."; this number is entered first, and when the form is finished the highest "No." should be the same as the total number of features in the room. The other type has to do with duplicate features in the same room (e.g., firepits 1 and 2); it is designated by *#*. There was some confusion as to wall numbering in 1986; each wall has a specific location code, leading to the logical (but wrong!) conclusion that there is right wall 1 and back wall 1. The course followed instead is that there are several natural walls in the structure and they are numbered sequentially and located by chamber location codes, just as are other features.

Feature Type:

1	chamber
2	exterior door: doors opening onto the canyon; this will include doors that open into now missing masonry rooms.
3	floor
4	firepit (formal, lined)
5	floor burn (not a formal firepit)
6	floor ridge
7	subfloor pit
8	large floor-level niche
9	wall niche
10	slot
11	viga hole
12	smaller (latilla?) hole
13	loom anchor
14	possible upper loom support
15	smokeholes: often determinable by placement, angle, smoking
16	vents other than 15
17	natural (i.e., tuff) wall
18	masonry wall
19	interior door: doors opening into another room.
20	geometric petroglyph
21	zoomorphic petroglyph
22	geometric pictograph
23	zoomorphic pictograph
24	indeterminate petroglyph
25	indeterminate pictograph
26	exterior opening: the present openings of many cavates could not now be considered doors but need to be recorded
27	ceiling
28	indeterminate hole

29	incised dado: wide recessed band around base of chamber
30	beam seat: lacks pairing, opposites, other features of viga holes
31	groove
32	handprint (define medium in notes)
33	hand/toe hold
34	anthropomorphic pictograph
35	step
36	floor depression
37	wall depression
38	anthropomorphic petroglyph
39	chamber corner
40	metate rest
41	wall ledge: possibly for supporting a roof
42	passage
43	combination masonry and tuff wall
44	deflector
45	floor pit complex
46	posthole
47	vertical hole in ceiling (Panowski hole)
48	narrow wall incisions
49	cliff niche: large shallow rectangular niches not inside rooms
50	axe groove

<u>Doors</u>

Defined as holes large enough to go through, leading either to the outside or to another chamber; exterior openings are also recorded here. Another chamber does not include the large wall cists with large openings which will be considered features. Doors connecting rooms should be recorded only once and merely noted in the other room.

<u>location</u>:	code taken from chamber codes and measured by azimuth from center of the chamber to the center of the door
<u>shape</u>:	see list of plane shapes
<u>w,h</u>:	width is always horizontal here, height vertical
<u>wall thickness</u>:	measured at mid-door
<u>to room</u>:	give cavate number

<u>Chamber</u>

This records the attributes of the main room by wall. The numbers on the following chamber features are used to give locations of features, such as niches and doors. 1 & 2 are presently not used.

<u>3 Complete chamber</u>:	this code is used when the whole chamber can be described by a single form
<u>4 Chamber base</u>:	in recognition that some chambers are best measured as the combination of two geometric solids, base and top allow splitting of the interior space
<u>5 Chamber top</u>:	the base of this imaginary solid should, of course, match the top of the base
<u>6 Floor</u>:	refer to plane shapes, give dimensions of extant floor
<u>7 Exterior</u>:	the side closest to the canyon, in most cases with a door communicating with the canyon

<u>8 Right</u>: the side to the right of the exterior door
<u>9 Back</u>: opposite the exterior wall
<u>10 Left</u>: left of the exterior

Cavate rooms do not have four walls in the same sense that masonry rooms usually do; some arbitrary separation of walls is required, but there is usually some basis for it. Some small, spherical rooms seem to be best treated as having right and left walls only. If there is no entrance from the canyon (i.e., a room opens only into another cavate), we will treat the entrance as "exterior." This may happen, but I think it will be very rare.

<u>11 Ceiling</u>: areas need not be recorded here because measurements from wall tops have already been taken, but smoking, features, plaster, and damage are to be observed
<u>12 Exterior-right corner</u>
<u>13 Right-back corner</u>
<u>14 Back-left corner</u>
<u>15 Left-exterior corner</u>
<u>16 Within another feature</u>

<u>Shape</u>
See list of geometric shapes.
<u>Measurements</u>
a,b,c, and d are defined for each shape as necessary

<u>Geometric fraction (Geo f)</u>
Refers to fractional shapes, for example 0.3 of a hemisphere or 0.5 of a truncated cone. Obviously these are estimates; they control for measurement of irregular shapes and estimate the area actually present (see also discussion in text).

<u>Plaster</u>
<u>Coats</u>: give total number of coats evident
<u>Smoked</u>: give the number of coats that show smoking; it is possible, clearly, to have 0 coats of plaster and still have smoking (recorded as 0 coats, 1 smoked)
<u>Color</u>:
1 tan
2 yellowish
3 reddish
4 several
5 brownish
6 black
7 white or grayish
<u>Height</u>: a very consistent feature is for the plaster only to extend partway up the side of a room; if possible record the intentional stopping height; for computer purposes, note that plaster height and height above floor for features such as niches (see below) are distinct variables.

Damage

This is a two-column code; it consists of natural damage and historic human damage.

Human:
0 absent
1 minor graffiti
2 major graffiti
3 graffiti plus other modifications
4 obvious wear
5 serious wear plus other effects (tourist blasting)
6 minor vandalism
7 heinous vandalism

Natural:
0 absent
1 moderate wind/water damage
2 severe wind/water damage
3 moderate cliff deterioration
4 severe cliff deterioration
5 cliff deterioration and wind water--moderate
6 cliff deterioration and wind water--severe

Features

Numbering as above, and selection of type from the list.

Location

To the left of the slash give the chamber feature code; to the right give the TN azimuth from the center of the room. Beginning July 14, the practice was adopted of noting measurement of distance from Brunton to measured feature for at least three of the chamber aspects (e.g., chamber corner or wall midpoint) in order to have angle and distance, which will allow better reconstruction of where the azimuths were taken from and the meaning of the azimuths for the other features, without having to take measurements for every feature. Two types of features present special problems for location recording: those in the center of the room and linear floor features (such as the ridges occasionally seen on floors). The center of the floor will be designated 999°; azimuths for linear features on walls and floors have been left blank.
Shapes and measurements from list of shapes; measurement *d* is for height, thickness, depth as applicable, unless a specific order is required by the shape being measured.

Height above floor

Measured to the base of wall and ceiling features from the floor; give negative value if the base is below floor level. In rooms containing enough fill that the floor could not be reached, measurements were taken to the top of the fill. These heights can be corrected by the computer by adding in the fill depth, or screened out in cases with a great deal of fill.

Feature Fraction (Fea F)

This is again a judgment, though a more subjective one than geometric fraction. Feature fraction is an estimate of the portion of the prehistoric feature that we have been able to measure (whereas geometric fraction is an estimate of the portion of the geometric solid chosen that is present). The value can be 1.0 for whole features, or less than or greater than 1.0, depending on the kind of deterioration present. This gives added detail to the overall completeness estimate for individual portions of the room. It is helpful to think of this estimate as a confidence band--features with FF's greatly deviant from 1.0 can be omitted from calculations.

Notes

Keyed to sequential feature numbers; it is useful to note associations with other features, especially viga hole pairings. In recording features it is possible to succumb to a sort of tunnel vision in which the feature is all the recorder sees, or at least records. Thus, while we want to know about each loom anchor, what is more important to the big picture is how wide the loom was; *put that important, if infrequently encountered, information in the notes!* (this is a true story based on real recording).

List of Shapes

Plane

	a	b	c	d
1 rectangular	horizontal	vertical		*
2 bowed rectangle	horizontal	vertical		*
3 oval	horizontal	vertical		*
4 trapezoid	base	height	top	*
5 round	diameter			*
6 triangular	base	height		*
7 natural oval	horizontal	vertical		*
8 linear	width	length		*
9 irregular	width	length		

*Measurement d will designate height, thickness, or depth for features or wall thickness at mid-door for doors (a plane shape with a depth is obviously a solid if one of those works better).

Solid

	a	b	c	d
10 rectangular	width	length	height	
11 cylindrical	diameter	height		
12 hemispherical	diameter	radius(h)		
13 truncated cone	base d	height	top diameter	
14 truncated pyramid	base w	base ℓ	top ℓ	height
15 cone	diameter	height		
16 irregular solid				
17 sphere	diameter			
18 pyramid (4-sided)	base w	base ℓ	height	

Volumes for component solids will be calculated and summed by the computer.

Added Attribute States by Date of Addition

Note: This information is presented with the date of addition because it conditions when certain codes could not have been utilized.

7/8/86
Fill type 5 tuff-dung-organic mixture; it should be noted that the dung-tuff order does not imply relative quantity

Evidence for construction
- 4 shaped corners
- 5 digging stick marks plus shaped corners
- 6 digging stick marks, shaping of opening, and shaped corners

Tuff characteristics
- 4 high clastic content--leads to greater friability (seems very common at Group M)

Feature types
- 26 exterior opening (not a door)
- 27 ceiling (redundant with location, but needed)
- 28 indeterminate function hole
- 29 incised dado--wide groove parallel to floor (M2)
- 30 beam seat--hole large enough for a beam or pole but somehow apparently not a viga (position, pairing etc.)
- 31 groove

Plaster color
- 5 brownish
- 6 black

Solid shapes
- 14 truncated 4-sided pyramid (a=base w, b=base ℓ, c=top ℓ, d=ht)
- 15 cone (a=diam, b=ht)

7/9
Function
- 5 insufficient evidence to infer

Features
- 32 handprint rock art
- 33 hand-or-toe hold
- 34 anthropomorphic petroglyph
- 35 step

Chamber location
- 12 corner between exterior and right walls
- 13 " " right and back walls
- 14 " " back and left walls
- 15 " " left and exterior walls

7/9 continued
Solid shapes
 16 irregular solid

7/10
Feature type
 36 floor depression
 37 wall depression
 38 anthropomorphic petroglyph

Chamber location
 16 within a feature

7/13
Feature type
 39 chamber corner (especially for locations)

7/14
Feature type
 40 metate rest

7/15
Feature type
 41 wall ledge (as for roof support)

7/16
Feature type
 42 passageway

7/17
Chamber location
 17 overhang--as on a projection past the front of a cavate

Solid shape
 17 sphere

7/21
Feature type
 43 combined masonry and natural wall

7/22
Masonry
 3 few blocks with no visible coursing remaining

Plane shape
 9 irregular (give length and width anyway)

7/24
Feature type
 44 deflector (just inside door, adjacent to probable hearth)

7/31
Tuff characteristics
- 5 highly porous, vesicular
- 6 very soft, coarse, and red

Feature type
- 45 floor pit complex
- 46 posthole
- 47 vertical ceiling hole (Panowski hole)
- 48 narrow wall incisions

Plaster color
- 7 white to gray

8/1
Feature type
- 49 cliff niche (large rectangular niches as at Tsankawi)
- 50 axe-grinding groove

4/2/87
Feature type
- 51 Brunton station location point not otherwise coded as a feature

Materials Collected in 1986

	Cavate	Date	Item
FS 1	M-37	7/11	Possible human coprolite
FS 2	M-61	7/15	Possible human coprolite
FS 3	M-65	7/16	Fused carbonized corn with kernels attached
FS 4	TS-43	8/12	Human infant bones: right (?) femur, fibula, mandible fragment, rib, temporal (right?)
FS 5	A-57	8/14	Corn cob and possible squash rinds

Documentation of Data Transfer from UNM to NPS

The following data set members were transferred to the NPS system. The SSD extensions were generated by SAS:

CAVBAS.SSD	This data set contains base information on each structure recorded as a cavate. It includes location information, fill and condition information, date spans, and notes (approximately 144 kilobytes [K]).
CFEAT.SSD	The full data set for cavate features, including measurements, location, shape, type, notes (around 2.1 megabytes [2100 K or 2 Mb]).
CAVEAT.SSD	An analytical data set for cavate features in which base information is included for each feature, and from which verbal notes have been removed; all variable values are numeric (about 1 Mb).
NCBS.SSD	Base information for noncavate features (about 146 K).
NCFEA.SSD	Noncavate features; as discussed elsewhere, some of these features are recorded in groups with size ranges (404 K).
NONCV.SSD	An analytical data set for noncavate features that includes only features recorded singly and does not include verbal notes; all variable values are numeric (131 K).
CHAMBER.SSD	A generated data set in which each line represents one chamber; the variables are locational and give numbers for various grouped feature counts (about 76 K).

Two tapes are being kept by the National Park Service Santa Fe office. Both are in SAS format. One contains the above data sets in AOS/VS (DG) format and reflects corrections and additions to the data sets after transfer to the NPS system. This tape also has some SAS programs used in the analysis on it. The second tape remains in OS (IBM) format and contains the data sets as of January 1988.

The following data sets are in DOS Personal Computer formats on 3½" disks at the National Park Service:

<u>SPSS-PC+:</u>
Data:

ALLCAVAT.SYS:	2845 cases from cavates; 47 variables, some labelled
ALLFEAT.SYS:	3396 cases individually recorded features; 38 variables
NONCAVAT.SYS:	551 cases from noncavates; 31 variables, some labelled
CHAMBER.SYS:	130 cases combined and corrected chambers only; 47 variables

SPSS Formats and value labels:
CAVFMT
NONCVFMT

ASCII:
These files are ASCII versions of the above. They are in fixed format, with "." as a missing value marker.
ALLCAVAT.DAT
ALLFEAT.DAT
NONCAVAT.DAT
CHAMBER.DAT

SAS PC
CAVEAT.SSD: cavate features with base information (similar to ALLCAVAT.SYS)
NONCV.SSD: noncavate features similar to NONCAVAT.SYS

SAS Program for Calculation of Volumes and Areas

Note: Instructions are upper-cased and annotations are lower-cased following the line they describe.

```
IF (SHAPE=11 OR SHAPE=12 OR SHAPE=15) AND MB=0 THEN MB=MD;
```
Cylinder and hemisphere depths were variously recorded as MB or MD; this assures that all depths will be found in MB.
```
IF SHAPE=10 AND MC=0 THEN MC=MD;
```
Again standardizes the location of depth measures in MC.
```
IF (SHAPE=14 AND MA>MB) THEN ME=((MB/MA)*MC)
IF (SHAPE=14 AND MA<MB) THEN ME=((MA/MB)*MC)
```
Generate the width of the upper base of a truncated pyramid assuming that the bases are proportional. The conditional should not be necessary if the longest dimension of the lower base is entered first (as intended); this did not always happen, however, and the conditional assumes that the longest dimension of the top base is measured and will be proportional to that of the lower base.
```
IF SHAPE=18 THEN VOL=((MA*MB*MC)/3)*GF
```
Volume of a pyramid.
```
IF SHAPE=17 THEN VOL=((3.142*(MA**3))/6)*GF;
```
Volume of a sphere times the GF.
```
IF SHAPE=15 THEN VOL=(1.047*((MA/2)**2)*MB)*GF;
```
Volume of a cone times the GF.
```
IF SHAPE=14 THEN
VOL=(MD/3((MC*ME)+(MA*MB)+SQRT(MA*MB*MC*ME)))*GF;
```
Volume of a truncated pyramid times the GF. ME is the generated width of the upper base (as above), and the square root of the areas of the bases is the mean proportional.
```
IF SHAPE=13 THEN
VOL=1.047*MB*(((MA/2)**2)+((MC/2)**2)+((MA/2)*(MC/2)))*GF;
```
Volume of a truncated cone times the GF.
```
IF SHAPE=12 THEN VOL=1.047*MB**2*(3*(MA/2)-MB);
```
Volume of a hemisphere.
```
IF SHAPE=11 THEN VOL=((3.142*(MA/2)**2)*MB)*GF;
```
Volume of a cylinder times the GF.
```
IF SHAPE=10 THEN VOL=(MA*MB*MC)*GF;
```
Volume of a rectilinear solid times the GF.
```
IF SHAPE=6 THEN AREA=(.5*(MA*MB))*GF;
```
Area of a triangle times the GF.
```
IF SHAPE=5 THEN AREA=(3.142*((MA/2)**2))*GF;
```
Area of a circle times the GF.
```
IF SHAPE=4 THEN AREA=(.5*MB*(MA+MC))*GF;
```
Area of a trapezoid times the GF.
```
IF (SHAPE=3 OR SHAPE=7) THEN AREA=((((MA+MB)/4)**2)*3.142)*GF;
```
Circular approximation of oval areas by averaging the axes, halving the value, squaring and multiplying by pi, all times the GF.
```
IF (SHAPE=2 OR SHAPE=1) THEN AREA=(MA*MB)*GF;
```
Area of a rectangle times the GF.
```
IF SHAPE<8 AND MD>0 THEN VOL=AREA*MD;
```
Calculates the volume for plane figures with depth measurements recorded.

This procedure was carried out for all cavate features and all individually measured noncavate features.

Retained Cavate Computer Outputs

Note: These are on file at the National Park Service Southwest Regional Office, Santa Fe.

I. Base Data
  A. Early Oracle output, uncorrected (1986)
    1. Cavbase variables
    2. Noncavbase variables
    3. Cavate levels
    4. Noncavate levels
    5. Cavate exposures, fill depths
    6. Listing of cavate base information
    7. Tabulations of cavate variables
    8. Tabulations of noncavate variables
  B. Listings following successful conversion to UNM/IBM format
    1. Cavate base data 2/19/87
    2. Noncavate base data 2/19/87
  C. SAS formatting
    1. Cavate formatting 3/9/87
    2. Creation of notes variable, trial list 3/13/87
    3. Catalog base data set 3/15
    4. Format noncavate base data 3/12/87
  D. Listings--Correction copies
    1. Listing of base data with corrections marked; notes A,F,I 3/14
    2. Base data notes for Group M and Tsankawi 3/15/87
    3. Noncavate base data and notes, corrections marked 3/16/87
    4. Addition of UTMs
    5. Addition of new LA number, renames field LA 3/4/88
    6. Line corrections 3/14/88
    7. Listing of cavate base data for Groups F and I 3/16/88
    8. Photo listing for cavate base data 5/3/87
  E. Tabulations
    1. Cross-tabulations of cavate base variables 4/11/87
    2. Cavate HPGS by group and level 5/3/87
    3. Noncavate base data cross-tabulations 4/11/87

II. Feature Data
  A. Oracle outputs, before data checking
    1. Formats for CAVFEAT, NONCAVFEAT 9/86
    2. Frequencies, type shape, count, measurements, with and without nulls
    3. (4 outputs)
    4. Listing of cavate features, uncorrected 9/86
  B. Listings following conversion to UNM/IBM format
    1. Cavate features 2/20/87
    2. Noncavate features 2/20/87
    3. Generation to disk
  C. SAS formatting
    1. Cavate formats 3/11/87
    2. Noncavate formats 3/11/87

D. SAS listings, correction copies
   1. Cavate feature data 3/17/87
   2. Cavate feature notes 3/19/87
   3. Noncavate feature data 3/28/87
   4. Noncavate feature notes 3/28/87
   5. Listing of features with shapes 13 and 14 by BJM to check/correct measurement order
   6. Feature photo generation and listing by photo 5/1/87
   7. Feature photos sorted by feature type 5/6/87

E. Feature tabulations
   1. Cavate and noncavate features by shape by group, by shape by part, by shape by cavate type, all features 4/19/87
   2. Cavate features, type by group 5/9/87
   3. Comparison of CFEAT+NCFEA with CAVEAT+NONCV data sets, feature type by group 3/3/88
   4. Counts of all noncavate features 2/24-6/88
   5. Cavate features group by feature type PC-SAS 3/3/89
   6. Noncavate features group by feature type 3/4/89
   7. Occurrence of viga and latilla holes by record no. 2/26/88 + other notes
   8. Niches--type co-occurrence, height above floor 2/24/88
   9. Milling feature co-occurrence 3/3 and 3/13/89

F. Feature metrics
   1. Generation of volumes and areas, fill groups--test 4/18/87
   2. Volume and area means by type and shape 4/19/87
   3. Feature metric replacements, refined shape breakdown, counts by shape 5/1/87
   4. Door and niche dimensions 5/8/87
   5. Niche, beam seat, indeterminate hole dimensions 6/19/87
   6. Indeterminate hole dimensions and breakdowns 2/88
   7. Mean dimensions for conical and cylindrical features, wall and floor areas 5/7/87
   8. Firepit and floor pit dimensions; plaster height to HAFL ratio by feature type 6/19/87
   9. Fire pit and floor pit, floor depression dimension breakdowns 2/88

G. Feature condition
   1. Feature type by natural and human damage 2/26/88
   2. Wall damage by group and part; hearth listing 5/5/87
   3. Smoking on walls and ceilings by plaster, function, group 3/10/88
   4. Moderately and unweathered walls: plaster coats and heights, and plaster color by part, group, function 3/25/88
   5. Plaster color by group: all walls, back walls 6/9/89
   6. Floor plaster coats by group and function; wall plaster coats by features, smoked coats 1988

H. Multivariate analysis of features
   1. NCSS Cluster analysis of indeterminate and latilla holes 6/18/87
   2. Cluster analysis attempt for several hole types 7/19/87
   3. Cluster & discriminant analysis: several hole types 3/4/88

III. Chamber data
- A. Listings and attributes
  1. Creation of chamber data set, some frequencies 6/10/87
  2. Listing of chamber data set, frequencies of attributes by group and function 7/19/87
  3. Generation of location index, tabulations 2/26/88
  4. Repairs to data set 3/14/88
  5. Listing of corrected and updated chamber data set 3/23/88
- B. Tabulations and analyses
  1. Chamber metrics by group, function, shape (from feature, rather than chamber data set) 6/19/87
  2. Shape by niche 2/26/88
  3. Means, breakdowns, group comparisons, t-tests for chamber volumes 2-3/88
  4. Means for chamber volumes by group combining habitation and "kiva" classes 3/5/89, 3/9/89
  5. Tables of feature number by plaster coats, chamber data 3/14/88
  6. Co-occurrence of feature groups 3/21/88
  7. Feature occurrence correlations, all and selected chambers 3/23/88
  8. Location index cross-tabulations 4/4/89
- C. Multivariate analyses
  1. Discriminant analysis by function and group, first attempt 7/19/87
  2. Discriminant analysis by function and group, different variables 3/25/88
  3. Cluster analysis, Ward's method 3/3/88
  4. Feature cooccurrence and cluster analysis 3/14/88
  5. Fastclus with 6 and 10 clusters, different variables 3/16/88
  6. Chamber clusters with listings 3/18/88
  7. Fastclus analyses, listings different clusters and iterations 3/21/88

IV. Data management
- A. Transfer from NPS format to IBM format
  1. First attempts 2/5/87
  2. ASCII tape with incorrect block sizes 2/18/87
  3. UNIX tape index showing incorrect block sizes from NPS 2/18
  4. Regeneration of UNIX data (M. Prine) 2/19/87
  5. Generation of data from tape to UNM disk 2/19/87
- B. Tape index for UNM formats
  1. Tape on file at NPS in IBM format (CAVUNX) 2/20/88
- C. Transfer SAS formats and data to NPS system
  1. Six data sets to tape 12/16/87
  2. Seventh set to tape 1/14/87
  3. XCOPY for export data set 2/11/88

V. Listings of corrected files
- A. Contents and listing of CAVBASE.SSD--cavate base data
- B. Contents and listing of NCBASE.SSD--noncavate base data
- C. Contents and listing of CFEAT.SSD--cavate feature data
- D. Contents and listing of NCFEA.SSD--noncavate feature data
- E. Contents and listing of CAVEAT.SSD--cavate feature analysis set

1. Frijoles data
2. Tsankawi

F. Contents and listing of NONCV.SSD--noncavate feature analysis (single features only)
G. Contents and listing of CHAMBER.SSD--chamber analysis set

VI. Various SAS GRAPH programs for generating figures

Photographic and Videotape Data

Photo Rolls, Formats, and Numbering Conventions

4 x 5

These were numbered only by group and exposure number, and were so entered. Photo A-2, for example, corresponds to the number written on the negative and the photo record.

Rock art (35 mm)

The Crowders assigned roll numbers for this series; they have had the prefix CRA (Cavate Rock Art) attached. CRA10:12,13 indicates black-and-white rock art roll 10, exposures 12 and 13.

Color slides (35 mm)

There is only one roll of slides; it has been labeled CC (Cavate Color); CC1:5 is Cavate Color Roll 1, exposure 5.

NPS rolls (35 mm)

Four rolls were used during the recording session, two were shot before the season started, and three were shot in April 1987. All these rolls were given the prefix CAV; the four used during the season were CAV1-CAV4, while the two taken before were CAV8 (taken by Toll in April) and CAV9 (taken by A. Ireland, also in April 1986). CAV9 is all distant shots of whole groups from across the canyon, and was not entered on any data lines. CAV8 includes a number of shots from groups in which we did not record. Also included with this group are three rolls (CAV5-CAV7) taken in April, 1987 by B. Crowder and W. Toll to prepare frontal drawings, to rephotograph a few more cavates shown in Lister's photos, to fill in some gaps, and to reproduce Lister's 1939 photos of cavates in which we worked in 1986. Only a few of the April 1987 (CAV5-CAV7) shots were entered on data lines.

Video Tapes

Videotapes were taken for all cavate areas recorded. These provide color shots of all walls and features as of summer 1986, along with verbal commentary, except for a few tapes on which there were some audio problems (these problems were partially corrected by voice-over after recording).

The tapes are in VHS format and are kept at the Southwest Region offices of the National Park Service, Santa Fe.

Appendix 3: Base Information, Threatened Cavates, and Room Stability

Computer Output of Most Base Information for All 1986 Cavate Forms

Variable abbreviations are as follows:

RC#	Record number
GP	Cavate group
CV#	Cavate number
ELEV	Elevation
EXP	Exposure in degrees true north
PGS	Height above present ground surface
F T	Fill type
FIL DPT	Fill depth (cm)
COM	Completeness
CON	Evidence for construction
NES	Natural vs. excavated space
M	Masonry
UP	Rooms up-canyon
DOWN	Rooms down-canyon
STAB	Stability
TUFF	Tuff type
NHUSE	Nonhuman use
FUNC	Function assignment

On this listing zeros show as blanks

Note: Variable values and definitions can be found in Appendix 1.

RC#	DATE	RECORDER	GP	CV#	ELEV	EXP	PGS	FT	FIL DPT	COM	CON	NES	M	UP	DWN	STAB	TUFF	NHUSE	FUNC
67	16-JUL-86	HWT/BF	A	1	6210	175	1.04		.00	4	1	1			129	2	3		1
68	17-JUL-86	HWT/BF	A	2	6210	141		1	.01	3	4	1		1	126	2			1
106	22-JUL-86	BPP/HWT	A	4	6220	154	2.88	1	.05	1	3	1		4	125	1		4	2
75	18-JUL-86	HWT	A	10	6220	178	1.70	1	.01	2	1	2	1	9	120	4			1
76	17-JUL-86	BJM/HWT	A	11	6220	260	1.05		.00	4		2		10	119	3			5
80	21-JUL-86	HWT	A	13	6210	267	1.97		.00	2	5	2	1	14	115	2		4	1
82	21-JUL-86	BJM/BPP	A	15	6210	215		3	.00	4	1	2		16	113	3	3	5	1
85	21-JUL-86	BPP/BJM	A	18	6210	219	.30	3	.02	1	4	1		18	109	2	3	7	1
86	21-JUL-86	HWT/ERB	A	20	6230	178	5.10		.00	4	7	2		20	106	4	4		5
90	21-JUL-86	HWT	A	22	6210	225	.00	1	.07	1	4	1	1	20	106	4	3		1
89	21-JUL-86	BJM/BPP	A	23	6210	175	.50			3	4	2		24	104	3	3	4	1
97	22-JUL-86	BJM	A	29	6210	180	1.95	3	.02	4	5	2		31	98	3		4	1
104	22-JUL-86	HWT/BPP	A	30	6220	250	3.60	3	.01	3		3	2	33	95	3		4	2
99	22-JUL-86	BJM/BPP	A	32	6210	232	.61		.00	2	5	4		33	95	3	3	5	1
100	22-JUL-86	BPP	A	34	6210	245	1.95	3	.01	1	6	1		36	91	1	3	5	1
87	21-JUL-86	HWT/ERB	A	39	6230	216	5.45	1	.20	2		2		24	104	4	4		5
330	14-AUG-86	BPP/BF	A	47	6210	200	2.75	6	.01	1	6	1		44	83	2	3	5	1
334	14-AUG-86	BJM/HWT	A	50	6210	152	1.05	3	.02	1	6	1		47	79	1	3	5	1
340	14-AUG-86	BPP/BF	A	57	6210	144	2.65	6	.01	1	5	2		54	73	1	4	4	2
342	14-AUG-86	BJM/HWT	A	60	6210	218	1.82	3	.02	1	6	2	1	57	70			4	1
343	14-AUG-86	BPP/BF	A	62	6210	236	2.30	1				3		60	68	3			2
354	15-AUG-86	BJM	A	66	6210	222	1.72	6	.06	1	3	1		63	64	2		2	2
346	14-AUG-86	BPP/BF	A	67	6210	185	.75	6	.01	2	5	1		66	63	2	4	8	1
352	15-AUG-86	BJM/HWT	A	71	6210	223	2.53	1	.04	2	5	1		69	59	4			1
347	14-AUG-86	BJM/HWT	A	73	6210	110	1.55		.00	2	5	1		71	57	3			1
144	28-JUL-86	HWT	F	2	6180	216	1.35	1	.05	1	3	1		46	45	2		8	1
147	28-JUL-86	BJM/BPP	F	4	6180	240	1.20	6	.16	1	6	1		50	42	1			1
152	28-JUL-86	HWT/ERB	F	9	6160	161	-.99	1	1.00	2	1	2		55	37	3		1	1
155	28-JUL-86	BJM	F	12	6170	240	1.18			1		1		57	35	2			2
161	28-JUL-86	BJM	F	15	6170	230	1.80	3	.05	1	1	1		62	31	2			2
159	28-JUL-86	ERB/HWT	F	16	6160	230	-.25	6	.10	2	1	2		63	30	2		8	1
167	28-JUL-86	HWT/ERB	F	23	6160	196	-.15	5	.10	1	4	1	3	68	22	2		1	1
166	28-JUL-86	BJM/BPP	F	27	6160	200	1.30	3	.01	1	6	1	2	68	19	2		5	1
174	29-JUL-86	BJM/ERB	F	31	6160	185	.25	2	.10	1	6	2		77	15	2		4	1
180	29-JUL-86	BJM/ERB	F	35	6160	215	.45			2	5	1		82	11	3		4	1
181	29-JUL-86	HWT/BF	F	37	6170	196	2.70	5	.03	1	1	2		83	9	4		5	1
183	29-JUL-86	BJM/ERB	F	38	6160	233	.09	5	.08	1	6	1		85	8	2		4	1
186	29-JUL-86	BJM/ERB	F	45	6170	220	.00	3		1	6	1		88	1	2		5	1
197	29-JUL-86	BPP/BF	F	56	6140	234	2.90	1	.06	3	1	2	2			3		7	2
200	29-JUL-86	BJM/ERB	F	59	6140	116				3	1	2				3		4	5
108	23-JUL-86	ERB/BJM	I	2	6240	170	2.90	5	.08	2		1		1	36	2		5	2
109	23-JUL-86	BJM/ERB	I	3	6240	195	1.40	3	.04	2	3	1		2	35	2			2
111	23-JUL-86	BJM/ERB	I	5	6250	219	.00	4	.15	2	1	1		4	33	3		4	2
113	23-JUL-86	BJM/ERB	I	7	6250	205	2.40	3	.03	2	4	2		6	31	2			2
144	23-JUL-86	BJM/ERB	I	8	6250	215	1.20		.00	2	5	1		7	30	2		4	1
116	23-JUL-86	HWT/BPP	I	10	6250	240		1	.35			2	1	9	27	3	4		2
117	23-JUL-86	BJM/ERB	I	12	6250	240	.00	3	.18	2	5	1	1	11	26	2		1	1
120	23-JUL-86	BJM/ERB	I	13	6250	230	.00	3	.12	3		1		12	23	3		4	5
123	23-JUL-86	BJM/ERB	I	14	6250	245	1.55		.00	3	5	2		12	23	3		4	2
124	23-JUL-86	BJM/ERB	I	17	6250	250		3	.11	2	1	2		15	19	2		4	1

RC#	DATE	RECORDER	GP	CV#	ELEV	EXP	PGS	FT	FIL DPT	COM	CON	NES	M	UP	DWN	STAB	TUFF	NHUSE	FUNC
122	23-JUL-86	HWT/BPP	I	19	6250	254	1.80		.02	1	6	1		15	19	1		8	3
125	23-JUL-86	ERB/BJM	I	20	6250	245	.00	5	.25	1	5	1		19	16	4		1	1
127	23-JUL-86	BJM/ERB	I	22	6250	245	1.10	3	.04	1	6	1	1	19	15	4		4	1
131	24-JUL-86	BJM/ERB	I	26	6250	245	1.10	3	.02	1	6	1		23	11	1		8	1
132	24-JUL-86	BPP - BF	I	27	6260	245	2.70	1	.03	4	5	3	1	23	11	3	3		2
138	24-JUL-86	BPP BF	I	30	6250	225	.00	3	.09	3	4	2		30	6	2		6	1
135	24-JUL-86	BPP BF	I	31	6250	155	.00	5	.10	1	6	1		29	8	1		6	2
136	24-JUL-86	BPP BF	I	32	6250	222	-.20	3	.30	1	4	1		30	6	1		5	2
137	24-JUL-86	BJM/ERB	I	33	6250	220	.20	1		3	1	2		32	4	3		6	5
500	24-JUL-86	HWT/BPP	I	34	6250	275	-.99	1	.99	1	6	1		32	4	1		6	5
140	24-JUL-86	HWT/BPP	I	37	6250	261	.55	3	.05	2	5			36	1	4		5	1
1	08-JUL-86	HWT/BJM	M	1	6220	231	.02	5	.10	2	2	2			139	2		5	1
2	08-JUL-86	HWT,BPP	M	2	6220	260	.00	5	.20	2	4	2	1	1	138	3	4	5	2
3	08-JUL-86	BJM/BF	M	3	6210		1.00		.00	4		2		3	134	4	4		1
4	08-JUL-86	BJM/BF	M	4	6210	229	1.00	1	.05					3	134		4		2
8	08-JUL-86	HWT	M	8	6210	245	2.90	3	.06	1	5	1		8	130	1	4	7	1
9	08-JUL-86	BPP	M	9	6210	281	2.90	1	.05	2	1	2		10	128	4	4	4	1
10	08-JUL-86	HWT/BPP/BJM	M	10	6210	244	2.90	1	.20	1	3	1		10	128	1	4	4	2
13	09-JUL-86	HWT/BJM	M	13	6205	239	2.20	1	.02	1	1	1		14	120	2	4		3
14	09-JUL-86	BPP	M	14	6200	251	.90	1	.03	4	1	2		19	119	3	4	4	1
65	16-JUL-86	BJM/HWT/BPP	M	15	6215		4.20	1	.02	4	4	2		19	119	4	4		5
64	16-JUL-86	BJM/HWT	M	16	6220		5.50			2		2		16	121	3	4		5
62	16-JUL-86	BJM	M	17	6220		6.00			4		2		14	122	4			5
15	09-JUL-86	BPP	M	18	6200	221	.48	1	.03	4	3	1		22	116	3		4	1
16	09-JUL-86	BJM/HWT	M	19	6205	215	2.30		.00	4	4	2		21	117	3	4		5
17	09-JUL-86	BJM/HWT	M	20	6205	258	2.75	1	.02	2	4	2		22	116	3	4	7	1
18	09-JUL-86	BPP	M	21	6200	255	.86	1	.01	4		1		24	115	4		4	1
29	10-JUL-86	HWT	M	23	6210	203	4.30		.00	4		2		26	113	3	4		5
27	10-JUL-86	HWT	M	24	6210	200	3.40		.00	4		1		27	109	3	1		1
20	09-JUL-86	BPP	M	25	6205	232	1.75	1	.02	4		1		28	109	3	4	4	1
23	09-JUL-86	BJM/BPP	M	29	6210		2.60	3	.01	1	3	1		31	107	1	4	4	2
24	09-JUL-86	BJM/BPP	M	30	6210	274	3.08		.00	1		1		33	105	2	4	4	2
25	09-JUL-86	HWT	M	31	6200		.46	1	.02			2		33	105	2			1
32	10-JUL-86	HWT	M	33	6210	239	.52	1	.01	4	3	1		35	102	3			3
30	10-JUL-86	BPP	M	34	6210	231	3.40		.00	3		2		35	102	1	4		1
28	10-JUL-86	BJM/BF	M	35	6205	216	2.30		.00	2	3	1		38	100	2	4	7	3
33	10-JUL-86	BJM/BF	M	36	6205	240	1.44		.00	3	4	1		39	96	3		7	1
36	11-JUL-86	HWT	M	37	6200	230		5	.12	1	6	1		35	102	1		5	2
34	11-JUL-86	BPP	M	38	6215	200		1	.01	2	4	2		39	96	3	4		1
40	14-JUL-86	HWT	M	40	6215	196	2.85		.00	3	4	2		42	93	3			1
41	14-JUL-86	HWT	M	41	6215	231	2.90		.00	2	1	1		43	93	4		4	1
38	14-JUL-86	BJM	M	42	6205	225	1.10		.00	4		2		42	93	3	4	5	2
39	14-JUL-86	BJM/BPP	M	44	6210	251	1.70		.00	3	4	2		47	92	3		5	1
42	14-JUL-86	BPP	M	46	6205	260	.90	1	.01	4	4	2		48	90	3			1
45	14-JUL-86	BPP	M	48	6210	245	2.80	1	.01	4		2		50	87	3			5
46	14-JUL-86	BPP	M	49	6205	260	2.00	1	.01	4	4	2		53	86	3		4	2
47	14-JUL-86	BPP	M	50	6205	265	4.10	1	.03	4		2		54	85	3	4	4	1
51	15-JUL-86	BPP/BF	M	51	6210		5.80			2	4	2		55	84	2	4	4	2
52	15-JUL-86	BPP/BF	M	52	6205		4.10	1	.01	4	4	2		56	82	3	4	4	1
50	15-JUL-86	HWT/BJM	M	55	6200	242	2.80	3	.01	2	4	1	1	58	81	4			1

RC#	DATE	RECORDER	GP	CV#	ELEV	EXP	PGS	FT	FIL DPT	COM	CON	NES	M	UP	DWN	STAB	TUFF	HUSE	FUNC
53	15-JUL-86	BJM/BF	M	56	6200	255	2.23		.00	4	5	2		59	79	4			1
58	07-JUL-86	BJM	M	57	6200	234	2.10	3	.02	1	2	1		59	79	1		7	2
57	07-JUL-86	HWT/BJM	M	58	6200	227	3.60			1	5	2		62	77	2		4	1
54	15-JUL-86	BPP	M	59	6200	224	5.50	3	.02	2	5	2		64	74	2		4	1
55	15-JUL-86	HWT/BPP	M	60	6200	265	5.50	3	.01	1	5	1	1	65	73	2			1
56	15-JUL-86	BJM	M	61	6200	225	5.50	3	.07	1	3	1		64	74	1		4	2
61	16-JUL-86	BJM	M	64	6230									42	93				
63	16-JUL-86	GREEN/BJM	M	65	6220		6.00	4	.05	1	5	1		14	122	1			2
205	31-JUL-86	BPP/ERB	TS	15	6600	175	.00	6	.10	2	1	1				2	5	1	1
206	31-JUL-86	BJMF	TS	16	6600	117	.00	3	.03	1	1	1				2	5		1
207	21-JUL-86	ERB/BPP	TS	17	6600	162	1.27	3	.05	2		2				2	5	5	1
208	31-JUL-86	BJM/BK	TS	18	6600	137	.00	3	.16	1	6	1				2	5		1
213	31-JUL-86	BJM/BF	TS	19	6610	102	2.28			2	1	2				2	5		5
212	31-JUL-86	BPP/ERB	TS	20	6610	171	1.80	3	.02	1	3	2				1	5		1
218	31-JUL-86	ERB/BPP	TS	21	6600	245	.00	3		3	1	1				2	5	4	1
221	01-AUG-86	BJM	TS	23	6600	210	.00	3	.02	2	1	1				4	5		2
222	01-AUG-86	ERB/HWT	TS	24	6600	210	.00	6	.20	2		2				2	5	5	1
223	01-AUG-86	BPP/BJM	TS	25	6600	205	.00	6	.28	3		2				2	5	5	1
216	31-JUL-86	BJM/BF	TS	26	6590	198	.76	3	.03	2	1	2				2	5		1
235	04-AUG-86	BJM/HWT	TS	27	6600	121		3	.02	1	5	2				2		8	1
237	04-AUG-86	BPP	TS	28	6600	110	.15	3	.05	1	1	1				1	5	4	1
285	07-AUG-86	BJM/BPP	TS	29	6500	170	3.96	6	.03	3	4	1				3	6		1
288	11-AUG-86	BJM/HWT	TS	30	6500	148	.70		1.00	4	1					3	6	4	1
289	11-AUG-86	BPP	TS	31	6500	155	.00	6		1	4	2				2	6	8	2
290	11-AUG-86	BJM/HWT	TS	32	6500	158	.00	5	1.00	1		1				2	6	1	1
291	11-AUG-86	BJM/HWT	TS	33	6500	120	.00	6	.25	1	5	1				2	6	1	1
292	11-AUG-86	BPP	TS	34	6500	105	.00	6	.14	2	1	1				2	6	4	2
293	11-AUG-86	BPP	TS	35	6500	115		6	.75	1	3	1				1	6	5	1
294	11-AUG-86	BJM/HWT	TS	36	6500	100	.00	5	.75	1	5	1	3			3	6	5	1
295	11-AUG-86	BPP	TS	37	6500	113	.22	6	.17	3	1	2				2	6	4	2
296	11-AUG-86	BJM/HWT	TS	38	6500	98	.40	2	.40	1	2	1				2	6	1	1
304	12-AUG-86	BJM	TS	39	6500	85	.38	5	.50	1		1	1	1		4	6	1	1
309	12-AUG-86	BJM/BF	TS	40	6480	95	1.45	1	.05	2		1				2	6		2
313	12-AUG-86	BJM/BF	TS	41	6480	90	1.30	5	.20	1	3	1				2	6	1	1
314	08-AUG-86	BJM/BF	TS	42	6480	72	.00	5	.50	1	2	1				2	6	1	1
315	12-AUG-86	BPP/HWT	TS	43	6480	92	.00	5	.50	1		1					6	5	1
319	12-AUG-86	BJM/BF	TS	44	6500	105	.80	5	.20	2		2				3	6	1	1
320	12-AUG-86	BJM	TS	45	6510	95	2.50	1	.05	2		2				3	6		1
267	07-AUG-86	BJM	TS	50	6540	90	.00	3	.18	1	1	1				3			1
275	07-AUG-86	BPP	TS	51	6540	115	.36	3	.06	1	3	1				2	5		2
274	08-AUG-86	BJM	TS	52	6540	120		6	.20	1	3	1				1		8	2
276	07-AUG-86	HWT/BPP	TS	53	6540	103	.00	6	.15	1	3	1				2		2	3
263	06-AUG-86	HWT/BJM	TS	54	6580	90	.00	6	.05		5	2				3			1
262	06-AUG-86	BPP	TS	55	6580	119	.16	6	.02	2	6	1				2	5	8	1
261	06-AUG-86	BPP	TS	56	6580	153	.25	3	.01	2		2				2	5		1
256	05-AUG-86	BPP	TS	58	6580	141	1.70		.00	2	1	1				1	5		1
259	06-AUG-86	BJM/HWT	TS	59	6580	122	1.70	3	.01	1	6	1				1		7	3
254	05-AUG-86	BJM/HWT	TS	60	6580	105	.25	6	.30	3		2				3		8	
253	05-AUG-86	BJM/HWT	TS	61	6580	153	.00	6	.30	2	5	1				2		4	1
252	05-AUG-86	BJM	TS	63	6580	85	.55	3	.16	2	2	2				2		4	2

RC#	DATE	RECORDER	GP	CV#	ELEV	EXP	PGS	FT	FIL DPT	COM	CON	NES	M	UP	DWN	STAB	TUFF	NHUSE	FUNC
248	04-AUG-86	BPP	TS	64	6580		.00	3	.02	1	6	1				1	5	4	3
242	04-AUG-86	BPP	TS	65	6580	140	.15	3	.30	1	3	1				2	5	5	1
247	04-AUG-86	BJM/HWT	TS	66	6580	115	.00	6	.05	1	6	1				3			3
322	13-AUG-86	BJM	TS	67	6570	125	.00	6	.40	1	6	1				1			2
204	31-JUL-86	BJM/BF	TS	501	6600	222	.00	3	.09	1	1	1				2	5		2
219	31-JUL-86	HWT	TS	507	6610	201	2.10		.00	3		2				3	5		5
217	31-JUL-86	BJM/BF	TS	508	6600	154		5	.28	1	1	1				2	3	1	2
224	31-AUG-86	BJM/BPP	TS	509	6600	210		5	.28	1	2	2				2	5	5	2
232	01-AUG-86	BPP	TS	514	6600	138			.00	4		3				3	5		2
233	01-AUG-86	BJM	TS	515	6600	119	.97	3	.06	3		2				3			2
236	04-AUG-86	BPP	TS	517	6600	100	1.40		.00	2		3				2	5	4	2
239	04-AUG-86	HWT	TS	519	6600	109	2.25	1	.10	2		2				4			2
241	04-AUG-86	BJM	TS	521	6540	213	.00	3	.12	1	6	1				1			2
244	04-AUG-86	BJM/HWT	TS	523	6560	169	.00		.00	3		4				2			5
265	06-AUG-86	BPP	TS	530	6580	137	.00	6	.22	1	5	1				1	5	8	2
264	06-AUG-86	HWT/BJM	TS	531	6580	350	.00	6	.10	1	3	1				1			2
266	07-AUG-86	HWT	TS	533	6570	36	.25	1	.02	2		2							2
270	07-AUG-86	HWT	TS	536	6560	123		1	.02							4			5
287	07-AUG-86	BPP/HWT	TS	548	6480	144	.60		.00	2		1				3	6		5
297	11-AUG-86	BJM/HWT	TS	553	6480	146	.00	3	1.00	1	2	1				2	6		1
316	12-AUG-86	BJM/BF	TS	564	6480	68	.00	5	.75	1		1				1	6		2
503	11-AUG-86	BJM	TS	567	6480	95	.14	6	.24	1		1				1	6		2
305	08-AUG-86	BJM/BF	TS	568	6480	85	.40	5	.50	1		1				1	6	1	2
321	13-AUG-86	BJM/BPP	TS	570	6560	110	5.00	6	.01	2		2				2		2	2

174 records selected.

Notes for Features Considered to Face Major Problems

Cavate Group	Cavate Room Number	Room Notes
A	10	This room is located at the head of a large, narrow drainage that is recessed 40 m into the cliff. Remarkably, the top of the opening is still closed with original masonry in spite of the immediate proximity of what must be a major pour-off in big rains. Some water does pass over the center of the arched masonry remnant, and the mortar is missing. The masonry may collapse soon; there are also some large flakes in the ceiling which look like they may fall soon.
A	20	This room is well up cliff, severe weathering throughout. A column forms one side of door; a large crack indicates imminent collapse of door and structure.
A	22	An extremely carefully shaped room at present ground level. Heavy use by later visitors; there was apparently a low masonry wall across the exterior wall base which then continued up with a tuff wall. While the room is in very good condition, most of the exterior wall is supported only by a small natural pillar.
A	39	Two natural buttresses, both badly cracked and in imminent danger of collapse. Major drainage in front of room.
A	71	A second or possibly third level room which has experienced recent large block falls above to the left and below to the right. The chamber was expanded - the left side is more recent and has fewer coats of plaster and less smoke blackening.
F	37	Door sits in a pour-off. There is a large crack in ceiling that water comes through. Front wall and part of ceiling are thin, threatening collapse.
I	20	Room filled to at least 50% of original height - - only doorway tops are evident. Hole in ceiling goes to I-22, but may only be the result of erosion. Back wall moved back after first occupation; based on differences in plaster and wall angle.
I	22	There are two large, irregularly shaped holes in the floor which are probably the result of a collapsed floor, but a remote possibility exists that at least one was an entry into room I-20, directly below. Natural fissure above door was blocked with a single course of stones. Vent hole also partially closed by masonry. Habitation function based on size and presence of vent and large doorway; very little smoke blackening present.

Cavate Group	Cavate Room Number	Room Notes
I	37	I-36 and 37 are isolated rooms between Groups I, and J, located by the trails to rim. Cavate 37 is presently in good condition but two fissures run through front ceiling. Both fissures were filled and plastered prehistorically, but spalling of smoking suggests some shiftings along fissures.
M	3	
M	9	A large crack is developing in the exterior wall.
M	15	Fill is some kind of tuff, but its pinkish color suggests some burning; the possibility of a thermal feature suggests habitation. About 1 dozen sherds on floor--glazewares of different types, and plain black utility ware. Also 3 obsidian flakes, 2 basalt flakes, 1 mossy chalcedony flake, and one possible piece of groundstone. One redware sherd is worked.
M	17	Room is high on the cliff. It was recorded by Ed Green, who got there by rapelling from above. No plaster anywhere, no evidence of floor. Unidentified redware (possible plain ware) on floor.
M	21	Only back wall remains with remnants of plaster. No exterior wall, no door.
M	41	Plaster on floor is continuous with room 40 but there is a distinct break in smoking. It is likely that room 41 post dates 40 -- 41 is a small expansion. Called habitation since is seems to be an expansion of 40. Front edge may drop off soon.
M	55	Doorway in left wall leading to room 53, filled with masonry blocks. Area filled is in imminent danger of cleaving from the cliff.
M	56	Left and exterior portions of chamber are severely eroded and more collapse is imminent. Piñon shell on floor. This room has two rooms opening off it: room 57 to back and room 58 to left.
TS	23	Although it is smoke blackened, the relatively small size of the chamber suggests that it would have been for storage. There are relatively few interior features, and a few charcoal flecks in fill. There is no apparent floor. Holes are present in the walls, but the high natural porosity of the rock makes determination of which are culturally produced impossible.

Cavate Group	Cavate Room Number	Room Notes
TS	39	The chamber is unstable because of large crack running from its left to right walls. The crack will eventually cause the chamber to collapse, and most of ceiling has already fallen. Habitation function assigned because of relatively large size, smoked walls and ceiling, and the presence of smaller storage-like room in back. Opening has some large masonry elements still in situ. Many blocks on the nearby slope suggest that the opening was entirely filled.
TS	519	A very small chamber near the canyon rim; there is a set of steps going to the rim 3.6 m to the south (marked with trail guide no.16). Located just above TS-518 - both presumably had exterior masonry walls. There is a petroglyph below and 1.2 m to the left.
TS	536	This room probably was once two chambers--there are two floor levels and two openings. A trail passed through the lower of the two before a tuff boulder a meter in diameter became lodged on the former roof area of the lower chamber. The remaining portions are thin, washed, and in danger of collapse.

Breakdown of Cavate Room Stability by Cavate Group

Observation	Record Number	Cavate Number	Stability	Tuff Type	Amount Excavated vs. Amount Natural	Human Damage	Natural Damage
				GROUP A			
Apparently stable							
1	106	4	1	0	1	0	3
2	100	34	1	3	1	1	0
3	334	50	1	3	1	9	9
4	340	57	1	4	2	0	1
Lesser threat							
5	67	1	2	3	1	9	9
6	68	2	2	0	1	9	9
7	80	13	2	0	2	9	9
8	85	18	2	4	2	3	5
9	330	47	2	3	1	2	3
10	345	63	2	0	1	0	5
11	354	66	2	0	1	9	9
12	346	67	2	4	1	2	5
Greater threat							
13	82	15	3	3	2	2	6
14	89	23	3	3	2	0	6
15	104	30	3	0	3	9	9
16	99	32	3	3	4	1	6
17	342	60	3	0	2	9	9
18	343	62	3	0	3	0	6
19	347	73	3	0	1	9	9
Major problem							
20	75	10	4	0	2	9	9
21	86	20	4	4	2	9	9
22	90	22	4	3	1	9	9
23	87	39	4	4	2	9	9
24	352	71	4	0	1	9	9

Observation	Record Number	Cavate Number	Stability	Tuff Type	Amount Excavated vs. Amount Natural	Human Damage	Natural Damage
				GROUP F			
Apparently stable							
25	147	4	1	0	1	9	5
Lesser threat							
26	144	2	2	0	1	9	9
27	155	12	2	0	1	0	5
28	161	15	2	0	1	0	5
29	159	16	2	0	2	9	9
30	167	23	2	0	1	9	9
31	166	27	2	0	1	0	1
32	174	31	2	0	2	0	5
33	183	38	2	0	1	0	5
34	186	45	2	0	1	9	9
Greater threat							
35	152	9	3	0	2	9	9
36	180	35	3	0	1	1	6
37	197	56	3	0	2	9	9
38	200	59	3	0	2	0	6
Major problem							
39	181	37	4	0	2	9	9
				GROUP I			
Apparently stable							
40	122	19	1	0	1	9	9
41	131	26	1	0	1	0	0
42	135	31	1	0	1	6	0
43	136	32	1	0	1	9	9
44	500	34	1	0	1	9	9
Lesser threat							
45	108	2	2	0	1	0	5
46	109	3	2	0	1	0	1

Observation	Record Number	Cavate Number	Stability	Tuff Type	Amount Excavated vs. Amount Natural	Human Damage	Natural Damage
47	113	7	2	0	2	0	6
48	114	8	2	0	1	2	6
49	117	12	2	0	1	0	6
50	124	17	2	0	2	0	6
Greater threat							
51	111	5	3	0	1	9	9
52	116	10	3	4	2	9	9
53	120	13	3	0	1	9	9
54	123	14	3	0	2	9	9
55	132	27	3	3	3	0	6
56	137	33	3	0	2	0	6
Major problem							
57	125	20	4	0	1	9	9
58	127	22	4	0	1	9	9
59	140	37	4	0	2	9	9
				GROUP M			
Apparently stable							
60	8	8	1	4	1	9	9
61	10	10	1	4	1	0	1
62	23	29	1	4	1	9	9
63	30	34	1	4	2	9	9
64	36	37	1	0	1	9	9
65	58	57	1	0	1	0	0
66	56	61	1	0	1	0	3
67	63	65	1	0	1	9	9
Lesser threat							
68	1	1	2	0	2	9	9
69	4	4	2	4	1	0	1
70	13	13	2	4	1	9	9
71	24	30	2	4	1	9	9

Observation	Record Number	Cavate Number	Stability	Tuff Type	Amount Excavated vs. Amount Natural	Human Damage	Natural Damage
72	25	31	2	0	2	9	9
73	28	35	2	4	1	9	9
74	51	51	2	4	2	9	9
75	57	58	2	0	2	0	5
76	54	59	2	0	2	0	5
77	55	60	2	0	1	9	9
78	61	64	2	0	0	0	0
Greater threat							
79	2	2	3	4	2	9	9
80	14	14	3	4	2	9	9
81	64	16	3	4	2	0	6
82	15	18	3	0	1	9	9
83	17	20	3	4	2	9	9
84	29	23	3	4	2	0	6
85	27	24	3	1	1	9	9
86	32	33	3	0	1	0	4
87	33	36	3	0	1	9	9
88	34	38	3	4	2	9	9
89	40	40	3	0	2	9	9
90	39	44	3	0	2	9	9
91	42	46	3	0	2	9	9
92	45	48	3	0	2	9	9
93	46	49	3	0	2	0	6
94	47	50	3	4	2	0	6
95	52	52	3	4	2	0	6
Major problem							
96	3	3	4	4	2	0	4
97	9	9	4	4	2	9	9
98	65	15	4	4	2	0	6
99	62	17	4	0	2	9	9
100	41	41	4	0	1	9	9
101	50	55	4	0	1	9	9

Observation	Record Number	Cavate Number	Stability	Tuff Type	Amount Excavated vs. Amount Natural	Human Damage	Natural Damage
102	53	56	4	0	2	0	6
			TSANKAWI				
Apparently stable							
103	237	28	1	5	1	0	1
104	293	35	1	6	1	0	3
105	274	52	1	0	1	9	9
106	256	58	1	5	1	0	1
107	259	59	1	0	1	9	9
108	248	64	1	5	1	3	0
109	322	67	1	0	1	0	1
110	241	521	1	0	1	9	9
111	265	530	1	5	1	0	0
112	264	531	1	0	1	9	9
113	316	564	1	6	1	0	0
114	503	567	1	6	1	9	9
115	305	568	1	6	1	9	9
Lesser threat							
116	205	15	2	5	1	9	9
117	206	16	2	5	1	0	5
118	207	17	2	5	2	9	9
119	208	18	2	5	1	0	5
120	213	19	2	5	2	5	6
121	218	21	2	5	1	9	9
122	222	24	2	5	2	9	9
123	223	25	2	5	2	0	5
124	216	26	2	0	1	5	6
125	235	27	2	0	2	9	9
126	289	31	2	6	2	0	5
127	290	32	2	6	1	0	5
128	291	33	2	6	1	9	9

Observation	Record Number	Cavate Number	Stability	Tuff Type	Amount Excavated vs. Amount Natural	Human Damage	Natural Damage
129	292	34	2	6	1	0	6
130	295	37	2	6	2	0	6
131	296	38	2	6	1	9	9
132	309	40	2	6	1	9	9
133	313	41	2	6	1	9	9
134	314	42	2	6	1	9	9
135	315	43	2	6	1	9	9
136	275	51	2	5	1	0	0
137	276	53	2	0	1	9	9
138	262	55	2	5	1	1	5
139	261	56	2	0	0	0	1
140	253	61	2	0	1	9	9
141	252	63	2	0	2	9	9
142	242	65	2	5	1	0	3
143	204	501	2	5	1	0	5
144	217	508	2	3	1	0	1
145	224	509	2	5	2	0	3
146	236	517	2	5	3	0	6
147	244	523	2	0	4	9	9
148	266	533	2	0	2	9	9
149	297	553	2	6	1	9	9
150	321	570	2	0	2	9	9
Greater threat							
151	285	29	3	6	1	9	9
152	288	30	3	6	1	9	9
153	294	36	3	6	1	9	9
154	319	44	3	6	2	9	9
155	320	45	3	6	2	9	9
156	267	50	3	0	1	9	9
157	263	54	3	0	2	9	9
158	254	60	3	0	1	9	9
159	247	66	3	0	1	7	0

Observation	Record Number	Cavate Number	Stability	Tuff Type	Amount Excavated vs. Amount Natural	Human Damage	Natural Damage
160	219	507	3	5	2	9	9
161	232	514	3	5	3	0	6
162	233	515	3	0	2	0	6
163	287	548	3	6	1	0	6
Major problem							
164	221	23	4	5	1	5	6
165	304	39	4	6	1	9	9
166	239	519	4	4	2	9	9
167	270	536	4	0	0	9	9

Note: Variable values and definitions can be found in appendix 1.

Noncavate Stability Sorted by Rating, Group, and Number

Record Number	Cavate Number	Stability	Natural Damage	Human Damage
		GROUP A		
Apparently stable				
69	3	1	1	1
71	6	1	4	0
103	36	1	0	0
Lesser threat				
70	5	2	2	6
74	9	2	4	0
95	27	2	6	0
101	33	2	6	0
102	35	2	5	0
325	42	2	5	0
328	45	2	6	0
329	46	2	5	0
336	53	2	6	0
338	55	2	5	0
339	56	2	2	0
350	59	2	6	0
354	74	2	4	0
Greater threat				
83	16	3	6	1
91	21	3	6	0
92	24	3	6	0
93	25	3	6	0
94	26	3	6	0
96	28	3	6	0
98	31	3	6	0
77	37	3	6	0
105	40	3	6	0
326	43	3	6	0
327	44	3	6	0

Record Number	Cavate Number	Stability	Natural Damage	Human Damage
331	48	3	6	0
332	49	3	6	0
333	51	3	6	0
335	52	3	6	0
337	54	3	6	1
341	58	3	6	0
344	61	3	6	0
349	64	3	6	0
348	65	3	6	0
355	68	3	6	0
356	69	3	6	0
353	70	3	6	0
351	72	3	6	0
Major problem				
72	7	4	6	0
73	8	4	6	0
79	12	4	6	7
81	14	4	6	2
88	19	4	6	0
78	38	4	6	0
324	41	4	6	0
84	17	9	9	9
		GROUP F		
Lesser threat				
143	1	2	6	0
148	5	2	6	0
153	10	2	6	0
158	14	2	6	0
163	18	2	5	0
165	19	2	6	0
164	20	2	6	0

Record Number	Cavate Number	Stability	Natural Damage	Human Damage
169	21	2	2	0
172	22	2	6	0
179	26	2	6	1
168	29	2	6	0
171	30	2	6	0
173	32	2	6	0
177	33	2	6	0
178	34	2	6	0
184	39	2	6	0
191	41	2	6	0
187	44	2	2	0
189	46	2	6	0
145	47	2	6	0
193	50	2	6	0
194	52	2	6	0
Greater threat				
146	3	3	6	0
149	6	3	6	0
150	7	3	6	0
151	8	3	6	0
154	11	3	6	0
156	13	3	6	0
162	17	3	1	0
176	24	3	2	0
175	25	3	6	0
170	28	3	2	0
182	36	3	6	0
185	40	3	6	0
190	42	3	2	0
188	43	3	6	0
157	48	3	6	0
203	49	3	6	0
192	51	3	6	0

Record Number	Cavate Number	Stability	Natural Damage	Human Damage
195	53	3	6	0
196	54	3	6	0
198	55	3	6	0
199	57	3	6	0
202	61	3	6	0
Major problem				
201	58	4	6	0
				GROUP I
Apparently stable				
115	9	1	2	0
Lesser threat				
118	16	2	6	0
119	18	2	6	0
126	21	2	6	0
133	28	2	5	0
139	35	2	6	0
141	36	2	6	0
142	38	2	2	0
Greater threat				
107	1	3	6	0
110	4	3	6	0
112	6	3	6	0
121	11	3	6	0
128	23	3	6	0
129	24	3	6	0
130	25	3	6	0
134	29	3	6	0
				GROUP M
Lesser threat				
26	32	2	2	0

Record Number	Cavate Number	Stability	Natural Damage	Human Damage
Greater threat				
5	5	3	2	0
7	7	3	9	9
19	22	3	2	0
21	26	3	6	0
31	27	3	2	0
35	39	3	6	0
43	45	3	6	0
44	47	3	6	0
66	66	3	6	0
Major problem				
6	6	4	2	0
11	11	4	2	0
12	12	4	6	0
22	28	4	4	0
48	53	4	6	1
59	62	4	6	0
60	63	4	6	0

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Stable				
249	525	1	2	0
250	526	1	6	0
251	527	1	6	0
257	528	1	6	0
278	541	1	6	0
302	556	1	5	0
Lesser threat				
220	22	2	6	0
210	503	2	6	0
211	504	2	6	0
215	505	2	6	5
214	506	2	6	5

Record Number	Cavate Number	Stability	Natural Damage	Human Damage
225	510	2	5	0
226	511	2	1	0
227	512	2	5	0
231	513	2	6	0
234	516	2	6	0
238	518	2	6	0
243	522	2	2	0
246	524	2	5	0
265	532	2	6	5
269	535	2	6	0
272	538	2	1	0
273	539	2	2	0
277	540	2	6	0
279	542	2	6	0
280	543	2	6	0
281	544	2	6	0
283	545	2	6	0
282	546	2	6	0
284	547	2	5	0
288	549	2	6	0
298	551	2	5	0
299	552	2	2	0
303	557	2	1	0
306	558	2	5	0
307	559	2	5	0
308	560	2	5	0
310	561	2	5	0
311	562	2	5	0
312	563	2	6	0
317	565	2	5	0
318	566	2	6	0
323	569	2	6	0

Record Number	Cavate Number	Stability	Natural Damage	Human Damage
Greater threat				
255	62	3	6	0
209	502	3	6	0
260	529	3	6	0
268	534	3	6	0
271	537	3	6	0
286	550	3	6	0
300	554	3	6	0
Major problem				
258	57	4	2	4

Note: Variable values and definitions can be found in appendix 1.

Appendix 4: Detailed Listing of Rock Art
June Crowder

Summary of Rock Art Tables by Cavate Group

Group A

Number of cavates in Group A containing the indicated rock art:

Abstracts	8
Cross	1
Geometrics	4
Geometric abstracts	1
Modern graffiti	11
Realistic bird	1
Realistic snake	1
Zig-zags	1
Pictographs	4
Total	32

Contents of the individual cavates:

Petroglyphs:

Cavate 1	modern graffiti
2	abstracts
3	geometric (enclosed hourglass)
5	modern graffiti
10	zig-zags
12	modern graffiti
13	abstracts, geometrics, modern graffiti
14	modern graffiti
15	abstracts, realistic bird
16	abstracts, crosses (2), geometrics
18	modern graffiti
22	abstracts, modern graffiti
32	abstracts, modern graffiti, realistic snake
50	abstracts, geometrics, modern graffiti
60	abstracts, modern graffiti
?	(no number assigned; 2-3 cavates east of #75) abstracts, complex geometric abstract, modern graffiti

Pictographs, or possible remains of pictographs:

Cavate 15	small group of red splotches
50	well executed red circle outlined in black, lower one-quarter and interior missing
?	(1-2 cavates east of #73) 4 small white stripes, lower one-quarter of wall has remnants of a white border and a small vertical stripe with horizontal slashes

?	(2-3 cavates east of #73) small red stripes and red splotches
A73	large white figure, white stars, etc.

Group F

Number of cavates on Group F containing the indicated rock art:

Abstracts	4
Ceremonial figure	2
Geometrics	3
Geometric abstracts	1
Human figure	1
Masks	2
Modern graffiti	3
Realistic snake	1
Stylized bird	1
Stylized insect	1
Terrace	1
Pictographs	1
Total	21

Contents of the individual cavates:

Petroglyphs:

Cavate 2	abstracts, geometrics, complex stylized bird, terraces, ceremonial figure
24	simple mask, stylized mask, stylized insect (?)
25	geometric abstract
26	modern graffiti
27	complex curvilinear abstract, realistic snakes (4), geometrics, abstracts
31	abstracts, modern graffiti
38	ceremonial figure, modern graffiti, abstracts, geometric designs, human figure (armless), masks (4)

Pictograph:

Cavate 38	possible remnants of pictographs composed of red paint splotches with superimposed incised lines

Group I

Number of cavates in Group I containing the indicated rock art:

Abstracts	3
Anthropomorphic figure	1
Ceremonial figure	2
Geometrics	3
Geometric abstracts	2
Mask	1
Modern graffiti	1
Realistic animal	1
Stick figure	1
Stylized parrots	1
Pictograph	1
Total	17

Contents of the individual cavates:

Petroglyphs:

Cavate 8	abstracts, geometrics, ceremonial figures (3), stick figure
12	geometric abstract
19	stylized parrots (7), ceremonial figures (3), abstracts, geometrics, modern graffiti
26	geometrics, abstracts, geometric abstract, squirrel profile, anthropomorph, masks (2)

Pictographs:

Cavate 19	white circle (23 cm diameter), possible white parrot-type beak, two white solid rectangles, tan boxes (2)

Group M

Number of cavates in Group M containing the indicated rock art:

Abstracts	4
Geometrics	3
Human figure	1
Hunter	1
Masks	3
Realistic animal	1
Stylized birds	1
Stick figure	1
Zig-zags	1
Pictograph	3
Total	19

Contents of the individual cavates:

Petroglyphs:

Cavate 13	large zig-zags, abstracts
18	abstracts geometrics
33	geometrics, abstracts, stylized birds (4), mask
40	profile walking-stick figure
41	deer profile, hunter, small masks (9), geometric, outline of human torso (no features)
60	abstracts, geometrics, stylized mask, simple masks (3)

Pictographs:

Cavate 13	white paint outline of right hand
33	several design remnants composed of a partial red headdress, red stripes, yellow stripes, red and yellow paint, yellow paint with red dots, small black and yellow interlocking fret, some superimposition of incised lines
41	red vertical realistic snake with superimposed incised lines

Tsankawi (LA 50976)

Number of cavates in LA 50976 containing the indicated rock art:

Abstracts	7
Anthropomorphic figures	6
Bird, realistic	2
Ceremonial figures	2
Cross	1
Flute player	2
Geometrics	2
Masks	1
Modern graffiti	3
Realistic snake	2
Serpent	1
Serpent motif	2
Serpent, two-horned	2
Snake motif	2
Terrace	1
Pictograph	1
Total	37

Contents of the individual cavates:

Petroglyphs:

Cavate 16	flute player, anthropomorph, abstracts
20	anthropomorph, ceremonial figure, two-horned serpent
26	anthropomorphic figure
33	circle and dots on ceiling, abstracts
40	outside entrance: 2 realistic birds, wavy line
41	abstracts
53	two-horned serpents (2), two-horned anthropomorph, head of two-horned serpent
54	unfinished flute player, modern graffiti, abstracts
59	cross, serpent motifs, abstracts, geometric, concentric circles, realistic bird figures (2), ceremonial figures (4), realistic snake, masks (4), terrace, snake motif
61	ceiling snake motif
64	abstracts, anthropomorph, serpents (one with a rattle), modern graffiti, geometrics
66	geometrics, abstracts, serpent motifs, realistic snake, modern graffiti, anthropomorphic figure

Pictographs:

Cavate 59	five small white stripes

Cliff-face Petroglyphs

Type and location of the various petroglyphs found on the cliff faces at Frijoles canyon and Tsankawi:

Group A	anthropomorphic figure, geometric design, bird, concentric circle, terrace
Group I	birds, snake, quadrupeds
LA 50976	corn symbol, quadrupeds, anthropomorphic figures, birds, abstracts, arrow, snake motif, Kokopelli, sun symbol

Historical Correlation with Chapman

Twenty-three of Chapman's drawings (Hewett 1938) from Frijoles Canyon were matched with the originals during this survey. The table below lists the location of these specific petroglyphs. Also included is a brief description of noticeable changes from the drawings.

Chapman (Hewett 1938)		Location
Plate III	h	I-19 (photo 8)
Plate IV	f	A-13 (photo 2)--slight loss of bottom design due to deterioration of wall plaster
	k	F-2 (photo 4)
	k	F-38 (photo 4)--severe deterioration of middle design area due to loss of wall plaster
Plate V	a	F-2 (photo 4)
	c	A-13 (photo 5)
Plate VII	a	I-19 (photo 9)--head shows severe deterioration due to loss of wall plaster
	b	I-19 (photo 3)--severe deterioration of body design due to loss of wall plaster, head marred with an incised *X*
	e	I-19 (photo 9)
Plate VIII	a	I-19 (photo 6)
	g	I-19 (photo 7)
	h	I-19 (photo 5)
Plate IX	a	M-33 (photo 3)
	c	M-33 (photo 7)
	d	M-33 (photo 4)
	f	M-33 (photo 3)
	h	M-33 (photo 3)--slight deterioration of edge of body design due to loss of wall plaster
Plate X	a	F-2 (photo 3)--slight deterioration of design due to loss of wall plaster
Plate XI	c	I-19 (photo 2)--incised *X* across face
Plate XII	c	F-2 (photo 5)
Plate XIII	d	I-19 (photo 8)
	f	M-60 (photo 2)
	j	F-38 (photo 3A)--incised lines through smallest mask

Appendix 5: Chamber Cluster Membership
Chamber Cluster Analysis Listings

Cluster Analysis Results Sorted by Cluster and Distance from Seed

Cavate		Cluster	Volume	Feature n	Plaster	From Seed
TS	53	1	4.83	39	2	4.3
TS	55	1	6.14	43	1	4.3
TS	50	2	9.77	29	3	3.7
TS	26	2	9.47	20	0	4.0
TS	27	2	13.15	43	2	4.1
TS	64	2	11.75	50	3	4.4
TS	15	2	10.46	27	0	5.1
TS	66	3	17.00	58	4	3.3
TS	20	3	15.50	41	3	6.4
TS	59	3	18.63	64	2	6.9
M	59	4	7.11	36	6	1.9
M	35	4	2.72	28	7	5.1
A	50	4	6.42	32	7	5.2
A	18	4	6.17	36	3	9.4
TS	16	5	4.79	24	3	2.9
F	31	5	6.26	19	5	3.1
F	35	5	3.51	21	4	3.4
A	22	5	5.18	26	3	3.7
M	38	5	5.65	18	2	3.8
TS	30	5	5.93	29	2	3.8
A	13	5	5.33	27	5	4.4
F	45	5	4.05	18	6	4.6
F	23	5	3.56	25	3	4.9
A	32	5	4.07	24	7	5.0

Cavate		Cluster	Volume	Feature n	Plaster	From Seed
A	67	5	7.58	21	7	5.6
A	47	5	7.47	25	8	6.4
F	38	5	4.78	29	9	7.6
I	5	6	.	2	1	0.8
I	20	6	2.22	5	1	0.8
TS	501	6	1.59	3	1	0.9
TS	515	6	2.83	3	.	1.1
I	7	6	1.29	5	1	1.2
M	51	6	1.44	6	1	1.2
TS	19	6	1.82	4	0	1.3
I	3	6	.	2	0	1.4
TS	509	6	.	4	0	1.4
TS	517	6	.	4	0	1.4
M	37	6	1.02	2	1	1.4
A	30	6	0.93	5	1	1.5
TS	521	6	1.32	6	2	1.5
M	2	6	3.43	5	1	1.5
TS	519	6	1.17	4	0	1.6
TS	536	6	3.12	6	0	1.6
F	56	6	1.20	2	0	1.7
A	39	6	2.32	4	0	1.7
I	14	6	3.06	4	0	1.7
F	12	6	0.45	2	1	1.8
M	10	6	0.48	2	1	1.8
A	4	6	0.56	3	1	1.8
TS	508	6	0.60	3	1	1.8
TS	570	6	0.86	2	0	1.8
M	61	6	1.49	5	1	1.8
TS	531	6	0.59	8	1	1.9
A	63	6	0.72	4	0	1.9

Cavate		Cluster	Volume	Feature n	Plaster	From Seed
TS	533	6	0.73	6	0	1.9
TS	37	6	0.83	5	0	1.9
I	17	6	2.76	6	1	1.9
I	32	6	2.85	7	1	1.9
F	15	6	0.35	5	1	2.0
TS	507	6	0.45	6	.	2.0
A	57	6	0.64	4	0	2.0
M	8	6	3.26	4	1	2.1
M	29	6	0.34	5	2	2.2
TS	530	6	1.22	5	0	2.2
TS	40	6	0.85	6	0	2.3
TS	548	6	0.99	6	0	2.3
M	34	6	1.35	19	5	2.3
A	66	6	0.62	7	0	2.4
M	41	6	0.59	9	1	2.5
TS	23	6	2.84	9	0	2.9
TS	523	6	5.11	6	0	2.9
A	10	6	2.65	17	1	3.0
M	57	6	0.51	8	1	3.1
I	33	6	5.23	3	1	3.2
A	2	6	.	14	4	3.4
TS	41	6	4.09	15	1	3.4
I	2	6	.	1	1	3.5
M	1	6	4.76	5	3	3.6
A	73	6	2.27	19	3	4.5
F	4	6	5.11	11	4	4.7
TS	18	6	1.33	12	0	4.8
I	12	6	3.07	8	6	5.3
TS	44	6	8.18	4	3	6.4
TS	25	6	9.25	14	0	7.2
M	31	6	7.38	7	6	7.3

Cavate		Cluster	Volume	Feature n	Plaster	From Seed
TS	24	7	15.15	28	1	2.7
TS	21	7	.	22	1	3.0
M	13	8	3.04	18	1	3.5
I	19	8	4.94	43	5	3.5
TS	34	9	3.21	12	0	1.9
TS	58	9	3.14	10	0	2.6
F	16	9	5.49	16	2	2.7
I	31	9	0.74	10	1	3.0
I	34	9	0.86	8	1	3.0
TS	63	9	1.23	7	0	3.1
TS	33	9	4.00	16	1	3.1
TS	56	9	2.69	24	0	3.2
I	30	9	.	13	2	3.3
A	34	9	4.28	16	4	3.3
A	71	9	2.48	17	2	3.6
A	23	9	4.10	14	4	3.7
TS	52	9	1.32	21	0	3.8
M	36	9	1.48	15	4	3.8
F	27	9	3.17	25	3	3.9
TS	17	9	4.49	16	0	3.9
F	2	9	3.02	20	3	4.0
F	37	9	2.24	16	1	4.6
I	26	9	4.35	22	2	4.6
F	59	9	2.04	10	1	5.2
I	37	9	2.86	14	6	5.2
TS	61	9	3.25	22	0	5.5
TS	51	9	0.94	23	.	5.7
TS	54	9	6.69	25	2	6.1

Cavate		Cluster	Volume	Feature n	Plaster	From Seed
I	13	10	2.86	12	1	2.7
A	60	10	5.25	20	2	3.3
I	22	10	1.52	14	1	3.5
M	55	10	2.69	20	3	3.7
TS	28	10	2.95	29	0	3.7
TS	65	10	5.08	21	1	3.7
M	30	10	1.84	10	1	3.8
M	44	10	1.54	17	3	4.0
M	9	10	6.39	23	1	4.0
M	58	10	2.87	25	1	4.3
M	60	10	5.25	27	2	4.6
M	40	10	3.81	15	6	4.8
M	20	10	6.31	24	3	4.8
TS	45	10	7.02	14	0	4.9
TS	29	10	9.17	19	1	5.2

Cluster Analysis Results Sorted by Group and Cavate

Cavate		Cluster	Volume	Feature n[a]	Plaster	From Seed
A	2	6	.	14	4	3.4
A	4	6	0.56	3	1	1.8
A	10	6	2.65	17	1	3.0
A	13	5	5.33	27	5	4.4
A	18	4	6.17	36	3	9.4
A	22	5	5.18	26	3	3.7
A	23	9	4.10	14	4	3.7
A	30	6	0.93	5	1	1.5
A	32	5	4.07	24	7	5.0
A	34	9	4.28	16	4	3.3
A	39	6	2.32	4	0	1.7
A	47	5	7.47	25	8	6.4
A	50	4	6.42	32	7	5.2
A	57	6	0.64	4	0	2.0
A	60	10	5.25	20	2	3.3
A	63	6	0.72	4	0	1.9
A	66	6	0.62	7	0	2.4
A	67	5	7.58	21	7	5.6
A	71	9	2.48	17	2	3.6
A	73	6	2.27	19	3	4.5
F	2	9	3.02	20	3	4.0
F	4	6	5.11	11	4	4.7
F	12	6	0.45	2	1	1.8
F	15	6	0.35	5	1	2.0
F	16	9	5.49	16	2	2.7
F	23	5	3.56	25	3	4.9
F	27	9	3.17	25	3	3.9
F	31	5	6.26	19	5	3.1
F	35	5	3.51	21	4	3.4

Cavate		Cluster	Volume	Feature n[a]	Plaster	From Seed
F	37	9	2.24	16	1	4.6
F	38	5	4.78	29	9	7.6
F	45	5	4.05	18	6	4.6
F	56	6	1.20	2	0	1.7
F	59	9	2.04	10	1	5.2
I	2	6	.	1	1	3.5
I	3	6	.	2	0	1.4
I	5	6	.	2	1	0.8
I	7	6	1.29	5	1	1.2
I	12	6	3.07	8	6	5.3
I	13	10	2.86	12	1	2.7
I	14	6	3.06	4	0	1.7
I	17	6	2.76	6	1	1.9
I	19	8	4.94	43	5	3.5
I	20	6	2.22	5	1	0.8
I	22	10	1.52	14	1	3.5
I	26	9	4.35	22	2	4.6
I	30	9	.	13	2	3.3
I	31	9	0.74	10	1	3.0
I	32	6	2.85	7	1	1.9
I	33	6	5.23	3	1	3.2
I	34	9	0.86	8	1	3.0
I	37	9	2.86	14	6	5.2
M	1	6	4.76	5	3	3.6
M	2	6	3.43	5	1	1.5
M	8	6	3.26	4	1	2.1
M	9	10	6.39	23	1	4.0
M	10	6	0.48	2	1	1.8
M	13	8	3.04	18	1	3.5

Cavate		Cluster	Volume	Feature n[a]	Plaster	From Seed
M	20	10	6.31	24	3	4.8
M	29	6	0.34	5	2	2.2
M	30	10	1.84	10	1	3.8
M	31	6	7.38	7	6	7.3
M	34	6	1.35	19	5	2.3
M	35	4	2.72	28	7	5.1
M	36	9	1.48	15	4	3.8
M	37	6	1.02	2	1	1.4
M	38	5	5.65	18	2	3.8
M	40	10	3.81	15	6	4.8
M	41	6	0.59	9	1	2.5
M	44	10	1.54	17	3	4.0
M	51	6	1.44	6	1	1.2
M	55	10	2.69	20	3	3.7
M	57	6	0.51	8	1	3.1
M	58	10	2.87	25	1	4.3
M	59	4	7.11	36	6	1.9
M	60	10	5.25	27	2	4.6
M	61	6	1.49	5	1	1.8
TS	15	2	10.46	27	0	5.1
TS	16	5	4.79	24	3	2.9
TS	17	9	4.49	16	0	3.9
TS	18	6	1.33	12	0	4.8
TS	19	6	1.82	4	0	1.3
TS	20	3	15.50	41	3	6.4
TS	21	7	.	22	1	3.0
TS	23	6	2.84	9	0	2.9
TS	24	7	15.15	28	1	2.7
TS	25	6	9.25	14	0	7.2
TS	26	2	9.47	20	0	4.0

Cavate		Cluster	Volume	Feature n[a]	Plaster	From Seed
TS	27	2	13.15	43	2	4.1
TS	28	10	2.95	29	0	3.7
TS	29	10	9.17	19	1	5.2
TS	30	5	5.93	29	2	3.8
TS	33	9	4.00	16	1	3.1
TS	34	9	3.21	12	0	1.9
TS	37	6	0.83	5	0	1.9
TS	40	6	0.85	6	0	2.3
TS	41	6	4.09	15	1	3.4
TS	44	6	8.18	4	3	6.4
TS	45	10	7.02	14	0	4.9
TS	50	2	9.77	29	3	3.7
TS	51	9	0.94	23	.	5.7
TS	52	9	1.32	21	0	3.8
TS	53	1	4.83	39	2	4.3
TS	54	9	6.69	25	2	6.1
TS	55	1	6.14	43	1	4.3
TS	56	9	2.69	24	0	3.2
TS	58	9	3.14	10	0	2.6
TS	59	3	18.63	64	2	6.9
TS	61	9	3.25	22	0	5.5
TS	63	9	1.23	7	0	3.1
TS	64	2	11.75	50	3	4.4
TS	65	10	5.08	21	1	3.7
TS	66	3	17.00	58	4	3.3
TS	501	6	1.59	3	1	0.9
TS	507	6	0.45	6	.	2.0
TS	508	6	0.60	3	1	1.8
TS	509	6	.	4	0	1.4
TS	515	6	2.83	3	.	1.1
TS	517	6	.	4	0	1.4

Cavate		Cluster	Volume	Feature n[a]	Plaster	From Seed
TS	519	6	1.17	4	0	1.6
TS	521	6	1.32	6	2	1.5
TS	523	6	5.11	6	0	2.9
TS	530	6	1.22	5	0	2.2
TS	531	6	0.59	8	1	1.9
TS	533	6	0.73	6	0	1.9
TS	536	6	3.12	6	0	1.6
TS	548	6	0.99	6	0	2.3
TS	570	6	0.86	2	0	1.8

[a]Feature n is all features except walls. Not all of the features in the count were included in the cluster analysis.

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