HIGHLAND INCA ARCHITECTURE IN ADOBE

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Editor's note. This study is based on research conducted in July and August, 1975, to complement the work of the PER 39 Project, a program sponsored jointly by the Peruvian government and the United Nations for the conservation and study of a selection of archaeological sites and colonial monuments. I was serving as archaeological consultant to the Project at the time and was concerned with the fact that no one had made a study of Inca construction in adobe, although the Project proposed to work at a number of sites where there was adobe architecture.

The distinguished historian of architecture, Graziano Gasparini, gave a series of lectures in Cuzco in 1975 as part of the PER 39 program. Elisabeth Moorehead attended these lectures and incorporated a number of references to them in the first draft of this study. Gasparini has subsequently published a book on Inca architecture in collaboration with Luise Margolies (1977); the book includes the material presented in Gasparini's 1975 lectures, and the editors have substituted references to the book where appropriate. We have also omitted some detail in the section on the Temple of Viracocha which is adequately covered in the book. There was, however, surprisingly little overlap between the Gasparini and Margolies discussion and the material in this study.

This article is the first published research contribution resulting from the archaeological segment of the PER 39 Project. — JHR

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Introduction

As a subject of study, Inca construction methods have not received the attention they deserve and need. There is little written on construction in stone, and even less on adobe architecture in the highlands. The craftsmanship of Inca stonework has been glorified to such an extent as to give the general public the impression that the Incas built only in stone. Adobe buildings in the highlands have been so neglected that they have been omitted from maps of Inca sites, Pisac for example.

The fact is that the Incas did use adobe as a building medium in the highlands. Moreover, they used it in some of their finest buildings (Amarucancha, presumed to be the palace of Huascar; the Palace of Sayri Thupa; the Temple of Viracocha) as well as in common dwellings, indicating a broad range of social importance of buildings in which adobe was used. The material that follows describes about twenty-two adobe buildings distributed among four sites in the Cuzco area and south.[1] Two of the sites, the Temple of Viracocha and the Palace of Sayri Thupa, were highly prestigious and important

government buildings, one religious in function and the other probably a civil structure. At the other two sites, the adobe buildings do not appear to have had such high status and more likely fall into the category of dwellings for a lower class of people; these structures are at the sites of Pisac and San Sebastian.[2] Although precise dates for construction and occupation of the buildings are unknown, they are all in some sense Late Inca and will be established as such in the individual treatment of sites which constitutes the body of this paper.

Before proceeding with the description and analysis of the sites, however, there are two aspects of adobe construction which should be discussed, and a few features common to these adobe buildings which should be introduced.

As a basis for comparison, let us look first at the modern adobe-making process. In the Cuzco area, in a typical method, water is added to an area of loosened, turned-under and sometimes sifted earth until the desired consistency is attained, whereupon the mud is thoroughly mixed by the workers who tread it with their bare feet. Straw is added and mixed in to give strength and cohesion to the brick, and the mixture is then poured into rectangular molds and allowed to dry. The most obvious differences we have found between this method and the Inca method are: (1) the modern use of the rectangular mold, and (2) the modern feature of sifting the earth to remove small stones. As we examine individual sites, we shall make further observations regarding Inca adobe-making methods and variations from site to site.

The second element of construction in adobe that needs prior explanation is the requirement of a stone foundation. The earliest communities to experiment with adobe probably learned to provide stone bases for their walls after the first rainy season, when the runoff and standing water were absorbed by the adobe and the walls began to deteriorate at ground level. Stone foundations eliminate this problem.

The following features of Inca adobe buildings are typically Inca; they are pertinent to all the structures included in this study, but do not necessarily continue beyond the Inca tradition, as do the characteristics mentioned above. The first of these features is the hand shaping of adobes, a technique which contrasts to Inca construction on the central coast where <u>tapia</u> predominated (i.e., mud fill between two vertical planes), and to mold made adobes which appeared in a local north coast tradition and in much of the post-conquest production in the highlands. The practice of using molds insured consistency in size from brick to brick, and from batch to batch. Inca adobes, on the other hand, are very irregular in size. Furthermore, it is common to observe that an adobe may be plano-convex; that is, have one side flat with angular corners, while the other side is convex with curved edges and corners. The curved edges and corners were probably a result of the hand shaping process; the flat side is flat because it was against the working surface while the brick was being shaped, whereas the curved parts were the top of the adobe, being shaped by the hands. The process would be similar to shaping bread dough into loaf form without a loaf pan. Although the adobe was hand shaped with the flat side down, it was placed in the wall with the

flat side up.

The second feature is the nearly predictable presence of niches on the interior surfaces of the walls. Niches are typical of Inca stone buildings as well, and I think it is worth pointing out that they are included in Inca buildings regardless of construction medium. Generally the niches are trapezoidal in shape and appear in a horizontal sequence set just above the stone foundation, which typically ends 1.5 m. above floor level.

Third, a layer of clay plaster over the interior of finished walls is apparent on almost all remaining adobe buildings. Very often the clay contained the Andean high altitude bunch-grass, ichu, and was applied in two coats. The plaster coating served a stylistic purpose, in that it covered the bricks, mortar and lintels above, and the stone below in the wall, giving the building a relatively smooth finish. Since the plaster would hide the interface between the stone base and adobe upper wall, consistency in the height of the foundations was not always observed; generally, however, the stone occupies a substantial portion of the total wall. Also, the type of stone varies according to the location and/or status of the building, while the degree to which the stone is dressed is a function only of status. In the discussion of the Temple of Viracocha, we shall consider an exceptional case in the use of plaster, which was applied in a decorative pattern (see fig. 35). This case is unique in that some elaborately dressed stone was covered by the plaster and in that the stone was partially covered rather than being fully covered or fully exposed.

If plaster coated the outside surfaces of the buildings, there is no evidence of it now remaining. However, there is no reason to believe that the walls were not plastered on the outside. In the façade of the Palace of Sayri Thupa (fig. 28), for instance, a series of lintels was no doubt unsightly to the royal sense of finery, and the stepped niches in the façade probably required a careful plaster finish to make them individually symmetrical, and uniform. Aside from serving an aesthetic purpose, external plastering may have functioned as protection. It would be as vulnerable to the driving rains as the adobes, but plaster is easily reapplied whereas bricks are not.

Other architectural features will be discussed as they appear in the course of the descriptions that follow.

San Sebastian

The city of Cuzco is located at the head of the valley of the Huatanay River in the Department of Cuzco. The city was the Inca capital, from which the powerful empire expanded to conquer much of the Andean region of South America. The terracing and construction projects found throughout the Huatanay Valley are simply extensions of building projects in the capital.

The site I am calling San Sebastian, because of its proximity

to the town of that name, is located on the northern slopes of the valley, a short distance from Cuzco and Sacsahuaman. The western edge of the site (i.e., those ruins upon which more recent construction has not been superimposed) is marked by a canyon down which flows a small river the Cachimayo, whose name means "salt river" (cachi, salt; mayo, river). Where the canyon opens up, there are basins for evaporating salt in use today. The origins of these basins are uncertain, but they date back at least to the early colonial period, since they are mentioned as landmarks in land documents of that time. Rowe suggests that they were probably used during Inca times and may even be pre-Inca in origin (Rowe, personal communication).

As one climbs the hillside from the salt flats, in a roughly northeast direction, one encounters the foundation of a fieldstone building or terrace here and there, and sometimes even a wall with a niche or two in it. Where the land begins to flatten out toward the top of the slope, such stonework appears to increase in density (see fig. 1), and on the first open, flat area is a large rectangular building with brickwork remaining at one end (fig. 3). This building will be referred to as Structure 2.

Turning and proceeding in a northwesterly direction, one sees with even greater frequency the remains of Inca stone walls, and also a road that runs approximately north-south. Eventually, as the evidence of stonework becomes more sparse, a limestone quarry is encountered. Continuing from there in a more westerly direction, the density of stone foundations and terraces again increases until one encounters San Sebastian Structure 1, an adobe building not far from the edge of the Cachimayo canyon (fig. 2). Very nearby is a small area of apparently greater ceremonial significance, to judge by the appearance of stone masonry of the finest quality in unusual forms and places.

Upriver along the canyon edge is a place where the slope lessens and the valley widens, and a modern bridge spans the river. From the other side of the river looking back across, one sees that the Incas had canalized the river. The path that continues towards Cuzco from this point appears to be an Inca road and is intermittently accompanied by a small, meandering canal.

From remains such as these I can only conjecture that this large tract of land was used for agriculture and the production of salt. Each of the large adobe buildings is surrounded by a group of fieldstone buildings. Since the fieldstone buildings are more common and are scattered throughout the terraces, they were probably constructed as storehouses or dwellings for those who worked the fields. The larger size of the adobe buildings suggests some special or different use, a conclusion which is reinforced by the presence of finely worked stone in association with Structure 1.

Structure 2

This building has two entrances, both in the south wall, giving it a southward orientation, facing out over the descending slopes to the

Huatanay. The stone foundation of the building is for the most part intact; it was made of limestone set with a clay mortar and probably rose about 1.50 m. above the original floor level. The stones were lightly worked to smooth the face somewhat after placement in the wall.

The only remaining brickwork is in the west wall and is incomplete. Four niches remain, and based on their spacing and the erosion of the wall, we can infer that there were originally five niches. The niches were approximately 97 cm. in height and 65 cm. in basal width. Each niche had one wooden lintel which was wrapped with loose ichu and clay to provide better adhesion to the subsequent adobe work. The lintel was set in from the wall face slightly, to give more centralized support for the bricks above the niche opening. Perhaps a stretcher was set in the space between the front of the lintel and the surface of the wall, evening out the surface and completing the ceiling of the niche. The wood used for the lintels was not cut to any particular shape. Apparently branches were simply cut, trimmed and placed in the wall. The impression of the wood grain and gnarl can be seen in some of the niches. The branches used were 7-10 cm. in diameter.

The adobe is weathered to the point that no plaster is evident, and only between the niches can individual bricks be clearly distinguished. The bricks are laid in alternate courses of headers and stretchers, or English bond. The niches are separated from one another by one stretcher, or in alternate courses, four headers. Stretchers have a mean of 82 cm. in length (with a range of 74-90 cm.) and headers have a mean of 19 cm. in width (ranging from 16.5-21 cm.). These proportions are appropriate for English bond since, for the courses to work out regularly, the bricks should be proportioned so that the width equals one half, one third or one fourth the length. Since the niches are trapezoidal, the intervening section of brickwork between them is ideally a reverse trapezoid. Thus, the longer stretchers are usually placed towards the top between niches, and the shorter ones are placed toward the bottom where the gap is narrowest. Sometimes if a stretcher is not long enough to span the area between niches (especially towards the top), a header is fitted in beside it to complete the course to the niche wall. Presumably plaster was used freely to fill out the walls to produce the desired effect. The average thickness of the bricks is 7 cm. and the mortar between bricks is generally 1.5 cm. thick.

Looking at the profile of the west wall, one sees that the adobe section is narrower at the base than is the stone wall on which it rests. This narrowing is entirely the result of weathering since construction, however. The fact that the stone wall measures 85.5 cm. in thickness and the stretchers measure approximately 83 cm. is evidence that the adobe section and its stone base were originally of essentially the same thickness, forming a smoothly surfaced wall when plastered.

The adobe contains much ichu, primarily the base portion

of the bunch, perhaps as much as 40% of the volume of the brick. Where visible, the grass usually lies lengthwise in the bricks and may have been intended to strengthen the brick along its most vulnerable lines. The earth used to make the adobes has a high sand and silt content, plus some clay, as well as a fair amount of gravel. The earth was not sifted or processed in any way; it was apparently prepared on the spot since it closely matches the surrounding land in color (pink) and stone content.

The outline of the remaining adobe wall shows above all how badly eroded it is. Nevertheless, a potential gable is implied by a downward inclination of the wall on the south end. This observation acquires a degree of arbitrariness, though, when one observes two similar inclinations forming a V towards the center of the wall, and it is highly unlikely that the roof was twin-gabled. Any type of roof over such a large building would require ample support from within, and a gabled roof would be no less feasible than any other type, perhaps; but the weathering of five hundred years has taken us beyond the point of being able to determine the roof style, rendering the discussion moot.

Structure 1 (fig. 2)

This building is in a miserable state of disrepair, and so overgrown that it is not easily recognizable. Little remains but the stone portion of the walls which varies in height considerably from one part of the building to the next. This irregularity would have been concealed beneath the plaster which originally covered the walls. The stone is limestone set in clay mortar and lightly finished.

As in Structure 2, the length of this building is over twice the width. There were originally three entrances, two in the north wall and one in the center of the south wall, but the two north wall entrances were filled in with fieldstones at some later date.

The adobe here is very pink, as is the surrounding soil, and contains no stone or straw, a fact which could explain why it is in such poor condition now and why there is so much vegetation growing out of it. The mortar used was evidently the same silty mud as that seen in the adobes; only upon close examination can the bricks and mortar be distinguished from one another.

There are no niches remaining in this structure. Behind the north wall, however, are the partial remains of other rooms, one of which has a small section of adobe containing the ghost of a niche. It is reasonable to assume that Structure 1 did have niches, but that they disappeared under the erosive forces which defaced the walls and washed away much of the adobe.

Pisac

Pisac is a colonial town in the Urubamba Valley, situated on the Inca road between Cuzco and Paucartambo. The town was built

at the site of an elaborate Inca system of terraces which extends around the mountain behind the present town, and across the river from it. The sector across the river can no longer be cultivated, because the modern highway has broken the irrigation system. The best preserved section of the ancient site is located on the mountain behind the modern town of Pisac and includes the remains of a ceremonial center, various buildings, towers, stairways, gates, resting places, retention walls, terraces, bridges and tombs.

The areas of construction with which we are concerned are the major groups of buildings which I shall refer to as clusters. Five such clusters can be distinguished: Hospitalniyoc, Pisacllacta, Callacasa, Cantocracay and Intihuatana.[3] Only the first four of these clusters contain adobe buildings, which are usually found in conjunction with fieldstone structures. In contrast, Intihuatana, the ceremonial center, is characterized by being composed almost entirely of Imperial Cuzco style stonework, the one exception being a small fieldstone structure. There are also some isolated structures which had adobe, such as the Mirador.

There were many adobe buildings at Pisac including some which, although they show no remaining adobe today, presumably did have adobe walls originally. The buildings described here constitute merely a portion of the unknown total. The information presented in this section results from the study of eighteen buildings with adobe walls, some in good and some in poor condition, not all of which will be treated individually. The eighteen were selected on the basis of the information they provide on Inca architectural methods and standards.

Hospitalniyoc (fig. 4)

Ascending the footpath from the present town to the ruins, Hospitalniyoc is likely to be the first cluster encountered. Set into a steep hillside on the southeast side of the mountain are six very similar adobe structures which constitute most of this cluster. There are two stone towers below the six buildings, while just above them are two more towers, and above them on the flat ridge of the mountain is the area referred to as Corihuayrachina which consists mainly of a lookout point lined with a stone retaining wall. The view from this point is nearly 360°. Between the lookout and the Intihuatana, on the same ridge, is a circular structure which shows the remains of adobe upper walls. To the north of Hospitalniyoc and to the east of the circular building is a series of terraces.

The six main buildings of Hospitalniyoc are divided by a path and the terrain into two groups: two buildings to the west and four to the east. Nevertheless, they were clearly designed and constructed as a single unit. The separation of the buildings by a path and the fact that the western buildings are longer and narrower than the eastern ones derive from the necessity to make the best use of available land.

Due to the slope upon which the buildings were constructed, the downhill (NE) wall of each is built as a retaining wall. It extends far below the floor level of the building, and serves simultaneously as one wall of the entry yard of the next lower building. On the other hand, the uphill (SW) wall shows very little stone when viewed from outside its own entry yard since the yard is usually two or three steps above the floor level of the building. Entrances are consistently in the uphill wall. Structures 1, 2 and 5 (see pl. XV) have or had two entrances in this wall, while the other three buildings have only one entrance.

The standard floorplan of the buildings was intended to be basically quadrilateral, and where mechanical difficulties of the terrain interfere, modifications occur. One such difficulty was presented by the limited amount of building space, causing the workers to build into the hillside as close to the path and cliff as possible; in so doing, they compromised a normal angle on the west corner of some buildings. Frequently, the outside wall is curved and the inside wall retains an angle. However, in Structure 2 (and, to a lesser extent, 3), the corner is rounded inside and out (figs. 6-7). The inside curve is nearly a perfect arc, 2 m. long with a radius of 1.38 m.; a chord spanning the arc from end to end is 1.83 m. The west niche of the NW wall is located just within the curve. In the west corner of Structure 4 (fig. 8), the outside wall is also curved, but the inside wall has a double corner rather than being curved as in Structure 2, or a single angle as in the other buildings. Both variations, the curved inner wall and the double corner, may have been designed to provide extra thickness for topographical reasons or just for aesthetic variation.

The buildings are gabled, and generally each gable has a window, below which are two niches in the interior surface of the wall (fig. 23). A variation on this plan is seen in the above mentioned double corner in Structure 4, where the west niche is set into the double corner instead of sharing the same plane with the other niche and the window. Between the two niches, in the other wall of the double corner, is another niche which is smaller than most.

The gables, although very eroded in some cases, still retain the basic outline of the original. They are, however, not common, symmetrically pitched gables. Rather, the architecture is adapted to hillside construction. The uphill wall of each building is higher than the downhill wall, as described above, reaching approximately the level of the top of the gable window on the uphill wall, while the downhill wall reaches only to the level of the base of the gable windows. As can be clearly seen in fig. 23, the pitch of the gable from the apex to the uphill wall is, therefore, flatter and shorter, while the pitch to the downhill wall is steeper and longer.

Within several of the structures, the base level of the niches varies from wall to wall or even within a single wall. For example, in Structure 3 (fig. 7), the two niches in the NW gable wall are not level with each other. The north (right) niche is lower; it is also nearest the downhill (NE) wall in which the niches are set at a lower level than those in the uphill (SW) wall. The unevenness of the niches

in the end wall might be considered a stylistic feature providing a transition of sorts between the different niche levels of the SW and NE walls. An examination of the SE wall, however, suggests that this explanation is not valid, since this wall lacks the descending arrangement of niches and is, moreover, unique in having three niches below the window. The niches and window are relatively widely spaced on this wall compared to the arrangement on the opposite wall, and in spite of the inclusion of an extra niche.

In addition to the niches and windows on the gable walls, the side walls (SW, NE) are invariably embellished by niches usually spaced fairly symmetrically along the wall. A variation is seen in the NE wall of Structure 3, which has a window with two niches on either side. The window is the same size and is spaced the same as the accompanying niches. This variation is perhaps based on a desire for additional light.

Where lintels are visible, they are always of stone in the niches and doorways, and usually of stone in the windows as well. However, Structures 4 and 6 (fig. 10) have or had wooden lintels in the windows. No lintel remains in the NW window of Structure 4, but the impressions indicate that it also had a wooden lintel. The lintel of the SE window of Structure 4 is wrapped with a two-strand twisted rope (fig. 24).

Some structures also have or had wooden braces diagonally spanning some of the interior corners, presumably to provide reinforcement. The east and south corners of Structure 2 had them, but only the ends are visible now, and they barely protrude from the walls. In the east corner, the brace is 9 cm. in diameter and its span was about 79 cm. Unfortunately, the length that each end extended into the wall is impossible to determine without taking the wall apart. In the south corner the lintel of the south niche of the SE wall may have been used to support the end of the brace in that corner during construction. In Structure 5 (fig. 9), again the corners with wooden braces are the east and south corners. The east corner brace was 6 cm. in diameter and had a span of 36 cm. In the south corner only one end remains, barely visible; likewise in the north and west corners the holes for corner braces are visible but only for one end of the beam. The beams were about the same in diameter as others, 7-10 cm.

Though varying from barely perceptible to very clear, the bond in these buildings is generally English. Within each building there is a range of color in the adobes used; gray, yellow, brown, and red-pink tones are typical. We can infer, then, that the adobes were prepared in different locations. Perhaps the leftover bricks from four or five different construction sites were pooled to use in this cluster. The mortar with which the bricks are set is used abundantly, sometimes serving as filler. In some buildings the mortar remains intact while the adobes in between have suffered considerably from weathering; this mortar evidently was of different composition than the adobe. Plaster was usually applied to these

structures in two layers, and the different colors may have been deliberate. The plaster contains grass.

On the outside surface of several of the gables can be seen cylindrical stone pegs (see fig. 25). These devices are found in stone as well as adobe architecture and were used for tying down the thatched roof. They therefore were placed just within the edges of the gables at appropriate intervals.

Another feature of note is the handhold. On the outside surface of the NW wall of each building there may be from three to eight squarish holes in the wall which were apparently intended to be used for assistance in climbing the steep path (fig. 25). In most of these holes, the bottom is somewhat scooped out, forming a ridge at the front that aids in grasping. In some instances the handholds are set with the base in stone and the hole cut out of the adobe, and in other instances they are entirely cut into adobe. The placement of the handholds is determined by where they would be most helpful to people ascending the path, with little or no regard to the material they are cut into. Yet a stylistic element seems to enter into the placement, since some handholds are placed where they are useless in climbing but serve to complete the continuity of the line of perforations.

While the presence of such features as niches and windows in these small, unpretentious structures suggests that the buildings were dwellings, Angles Vargas (1970, p. 49) argues that the proximity of the several towers above and below the cluster, presumably guard stations, implies that supplies were being protected from foreign or even internal theft. The many terraces at Pisac were certainly used for agriculture, and the number of terraces is high in proportion to the number of buildings; therefore, the government was probably using this area to provide a surplus of some crop for its own purposes, and storage space would indeed be necessary. I feel, however, that the stylistic elements in these structures poses a strong argument against Angles' theory. Rowe (personal communication) points out that storage buildings at other sites do not have windows or niches. For a development such as Pisac, dwellings would be needed for the people involved in maintenance of the crops, accounts and guarding. Furthermore, the guard stations which Angles interprets as protection for the stored goods at Hospitalniyoc did not necessarily serve such a limited purpose, but rather probably functioned as defenses and lookouts for the general area. If these six structures were indeed dwellings, then Hospitalniyoc was a "housing development," of sorts, built as a unit in contrast to Callacasa, for instance, where each structure has its own plan and unique identity.

Pisacllacta (fig. 11)

Walking north along the path from Hospitalniyoc, through the terraces, one ascends to a solitary adobe building that rests above and next to another set of terraces. This structure is referred to by Rowe as a mirador (Rowe, 1946 field notes) because of the large openings it apparently had in its south wall, providing a spectacular view of the valley below. The building cluster of Pisacllacta is a short distance

to the northeast, and although the Mirador is not part of the main area of Pisacllacta, it can be considered part of the cluster, since the terraces and path integrate it with the rest.

The Mirador (fig. 13)

As the path approaches the building, it passes through an opening in a presently low Imperial Cuzco stone wall, and then jogs to the left and uphill just before reaching the steps to the west entrance of the Mirador. Another entrance exists directly opposite in the east wall; passing through it, one finds oneself on a terrace with a staircase leading down immediately to the right. The foundation of the south wall of the building is actually a fieldstone terrace wall; from inside the building the stone would have reached just above floor level, but it has fallen away somewhat, while the floor level has risen slightly due to deposition of eroded material. In contrast, the stone foundation of the north wall is much higher. The stone portions of the east and west walls are the same height at their north ends as the stone section of the north wall, and the same height at the south end as the south wall stone foundation; thus, the stone portion of the east and west walls decreases in height from north to south (see fig. 26). As usual, the niches are placed at the top level of stone.

There is one niche to the north of each entrance, while six niches adorn the north wall. Apart from lacking their wooden lintels, most of the niches are in perfect condition (see fig. 26). They are approximately 42.5 cm. wide across the top, 44 cm. across the base, and 62 cm. high. In four of the niches in the north wall, two wooden sticks horizontally juxtaposed formed the lintels, while in one there was a single stick. In one of these niches the impression of braided rope that was wrapped around the wooden lintel is still visible. In the east and west wall niches, it is difficult to determine how many sticks were used as lintels. Niche lintels generally extended 25 cm. into the wall beyond each side of the niche, making the lintels about 50 cm. longer than the space over which they were to function as support for the brick above. The entrance lintels probably had four sticks each arranged in two pairs, one toward each face of the wall. The sticks for the west entrance extended 53 cm. into the wall beside the entrance, indicating that at entrances the sticks themselves got twice the support of the niche lintels from the walls flanking the opening, probably because the opening was much larger.

The south side of the building consists of a single, quadrilateral pillar of adobes with a large opening on either side of it. Apparently there was a marginal section of adobe wall at each end of the south side, albeit minimal, for where the east wall reaches its southern limit, there is evidence of a perpendicular extension westward. There is no way of knowing if the large openings on either side of the central pillar extended from floor to eaves. In any case, the primary concern in this design was probably that the view be as full as possible. The pillar is entirely utilitarian, serving only to support the roof frame. Perhaps, then, this building

was used only in dry weather as a veranda, of sorts, for the nobility. Its meticulous construction definitely associates it with the upper class, while its unusual exposure limits its use both functionally and temporally.

The east and west walls are not gabled, but rather have a unidirectional slope. The tops of the walls, although somewhat eroded, retain a slope of approximately 27° which is probably very close to the original. The type of roof used, then, would have been a lean-to type.

Wooden corner braces supported the NE and NW corners about 3 m. above floor level. They were 10-12 cm. in diameter and would have had a span of 60 cm. (NW) and 50 cm. (NE). The closest we can come to determining the standards (if any) for placing these braces is in this building where the brickwork is clearest. The north and east ends of the NE brace were set in a course of stretchers, but since another stretcher did not fit between the inside of the beam and the corner, a header was placed there instead. A horizontal, cross-sectional view of the wall would probably reveal some cutting of the corners of the bricks plus abundant use of mortar as fill in order to facilitate the diagonal placement of the braces. In the NW corner, only the north end is at all intelligible. There it appears that the beam was set between a course of stretchers above and headers below, but resting more in the headers. The adobes may have been shaped to contain the beam, or mortar may have been the sole matrix for it. The latter possibility is likely, since the area surrounding the brace is more weathered than most of the brick and similar to the mortar elsewhere in the walls.

Of all the adobe buildings I examined at Pisac, this one was the most carefully constructed and is the best preserved. The adobes are a pale shade of brown, while the mortar is a bit darker and grayer; the bond is clearly English and the bricks were relatively evenly placed. The bricks have a mean length of 75 cm. (ranging from 68-82 cm.), a mean width of 25 cm. (ranging from 19-31 cm.), and a mean thickness of 11 cm. (ranging from 9-13 cm.). A single stretcher spans the distance separating the niches of the north wall. There is not a marked increase in size from the lower stretchers between niches to those higher up, as is typically expected for shaping the trapezoidal niches. The courses of headers between niches are a bit irregular since the widths of the adobes have no fixed proportion to the lengths. In four places it looks as if two and a half headers were used, and in other places two very wide headers were used and supplemented with a heavy application of mortar; in yet other rows, three narrow headers cover the distance.

The plaster is also a light brown, probably even prepared in the same area. It contains much grass.

Structures 1-4 (figs. 12, 14)

The four other buildings at Pisacllacta differ from the rest of the structures at Pisac in being less well preserved. Three of them also have unusual designs, in that they are divided into two rooms by a wall. Structures 1, 2 and 3 (fig. 12) form a separate group, while Structure 4 (fig. 14) appears to be part of a compound and related by

orientation to another building with the more typical Pisac one room plan. The difference in plan of these buildings suggests the possibility that they are not Inca. However, although it is difficult to prove without excavating, they probably are Inca in origin. For example, Structure 4 is clearly related to a typical Inca building, and Structures 1, 2 and 3 are related to a system of terraces with 3 utilizing the lowest terrace wall as one of its walls; any attempt to disprove the Inca origin of these buildings would have to account for this relationship to the terraces. Furthermore, the niches in Structure 1 resemble typical Inca niches.

Structure 1 is rectangular with the entrance in the west wall. A north-south wall, parallel to the front wall, divided the building into two rooms, with a doorway connecting them. The stone foundation is all that remains of this wall, and it is unclear whether it was an older front wall or a partition inside the building. There is no evidence of adobe construction built on it, whereas from inside the building the perimeter walls show only adobes; their stone foundations are apparently lower than those of the partition wall.

The east wall is the best preserved, and in it can be seen the vague outlines of niches which at some point have been filled in or simply washed over with erosive debris. There were six such niches which were about 45 cm. wide at the base and maybe 30 cm. deep; but only the one closest to the north end of the wall is sufficiently well preserved for detailed observations. In the base of this niche are the remains of four sticks, or possibly canes, placed vertically in the wall so that only their tops show. Two are in the rear corners of the niche while the other two are 6 cm. apart, in between and slightly in front of the first two. The back two look somewhat slanted forward and to the center, while the other two look more vertical. In no other building in this study did I encounter a similar phenomenon.

Structures 2 and 4 preserve portions of the stone foundations of what appear to be partition walls dividing the buildings into two rooms, as in Structure 1.

The adobes of these buildings contain a very high percentage of stones, most of which are about 3 cm. and smaller. Also seen in the adobes are pottery sherds and bits of fired earth, implying that the adobes were prepared in an area that contained habitation refuse or was formerly a hearth for making ceramics. The earth was obviously not processed in any way for the preparation of adobes except by the addition of water and ichu, after which the mixture was hand shaped into bricks. The ichu used is usually the base portion of the bunch from which most of the grass had been cut, as was the case at San Sebastian in Structure 2. The adobes are of a red tone and the mortar is a purple-gray

The bond of the adobes in Structure 1 is English, and their dimensions are approximately 22 cm. by 70 cm. As far as can be determined by observation, this information applies to Structures 2 and 3 also, however, such observation is even more limited in these

buildings than the first, while Structure 4 is totally unintelligible. All that remains to be described of the last three buildings may be seen in the floor plans.

Callacasa (fig. 15)

Whether one ascends the path from Pisacllacta to Intihuatana and heads north from there, or simply follows the more level path leading northward directly out of Pisacllacta, the cluster of Callacasa will eventually be found up to the left of the footpath and can be reached by any of the steep paths connecting it to the main one.

In this steep, intricate village, there are five out of about twenty-four buildings that still retain a substantial amount of brickwork, while others show evidence that they once had adobe gables. Since all the remains have fieldstone walls to some extent, and many have adobes on top of that, it is possible that all originally had adobe walls to a greater or lesser degree. Unfortunately, time did not allow a close inspection of the cluster as a whole to check further into this possibility.

In contrast to the general uniformity of the adobe buildings at Hospitalniyoc or even Pisacllacta, the architecture in this cluster is highly varied. The steepness of the hillside crowds the buildings together, while a labyrinth of narrow paths connects them.

Structure 1 (fig. 16)

This small rectangular building has an entrance in the center of its northwest wall, and reveals upon closer observation the threshold of a second story entrance in the southeast wall. The intervening floor/ceiling does not remain. The lower level is entirely of fieldstone, with a niche on either side of the entrance, two each in the north, east and southwest walls, and four niches in the southeast wall. The stone lintels of the first floor niches help form the 14 cm. wide ledge in the southeast and northwest walls that supported some type of flooring, in which the supportive framework ran northeast-southwest and merely rested on the ledge and was not fastened to the walls in any way. The stone walls of the first floor are 80-82 cm. thick, which is fairly standard in Inca buildings, but they seem unusually thick for this small structure. The reason for the thick walls appears to be that the 14 cm. ledge had to be accounted for in the bulk of the lower walls, and added support was needed to sustain the extra weight of a second level.

The adobe walls begin about 35 cm. above the ledge; this distance removed the adobe from any abrasion by loose flooring against the walls, and also set the adobes beyond the level of runoff water from rain. The adobe walls are not in good condition; only one niche, in the southeast wall, remains just to the northeast of the entrance to the second story. The fact that it is not symmetrically aligned in any way with the niches below is, of course, attributable to the fact that they were not seen as a unity but rather as elements of separate rooms. The northeast wall is badly eroded, but the remaining profile

indicates that there were windows rather than niches in the second story.

The adobes themselves contain ichu (mostly the chopped off bases of the bunch) and much stone; in short, the material resembles most of the other adobe at Pisac and San Sebastian in terms of the content and the implications thereof for the Inca adobe-making process. English bond is combined with a seemingly random placement of bricks. The color is reddish brown. The mortar is a beige tone, and is more durable than the adobes. No plaster remains.

Structure 2 (fig. 17)

Except for one unique feature, a description of this building would be needless repetition. In fact, the amount of adobe construction remaining here would not ordinarily merit a description. The building is basically similar in plan to Structure 1. However, in the southeast wall there is an anomalous combination of adobe and stone (fig. 38). The lower walls of the building and the niches are built of fieldstone, upon which 93 cm. of irregular adobe courses were set, and on top of the adobes rests about 95 cm. of fieldstone. Nowhere else in Pisac does this sandwiching of adobe between stone exist, and I have no explanation for it.[4] The way this construction technique was used in the entire building is suggested by observation of the northwest wall corners. At these points, the upper stone portion rests on only two (west corner) and three (north corner) courses of adobe. Thus, it appears that the adobe section (and with it, the roofline formed by the superincumbent stone) decreased in height from southeast to northwest, so that the roof would have been of a lean-to type like the Mirador.

Structure 3 (fig. 18)

Another two story building is also the smallest structure discussed in this study. As the plan shows, the west corner forms an obtuse angle and the north one an acute angle. The lower entrance is in the southeast wall wherein there are no accompanying niches. Each of the other walls has two niches, five of which are in fieldstone, while the sixth (northwest wall) is in the adobe part and belongs to the upper level. A ledge along the northwest and southeast walls, partly formed by the stone lintel of the lower entrance, supported the upstairs floor 2.35 m. above the floor of the lower level. The upper entrance would have been in the southwest wall.

The adobes, light brown in tone, are in bad condition. In them can be seen sherds, fired scrap clay, bone and wood chips, in addition to the usual grass and gravel.

Structure 4 (fig. 19)

This building displays a variation on the two story plan. Apparently a geographical factor precluded cutting into the hillside to attain the desired width of the lower story, therefore,

instead of having two stories the same size, the lower one is only about half the width of the upper one. The southwest wall of the lower level is like the vertical wall of a terrace on which half the upper level rests. A ledge in the northeast wall, plus the top of the southwest wall of the lower level, supported the flooring for the second story. As in the other two story buildings, there is no apparent access between the levels; if there ever was, a simple ladder was probably the apparatus used. No steps, such as those set into terrace walls, are seen in the stone walls of these buildings. The two entrances to the lower room are in the northeast wall, while the entrance to the upper room is in its southwest wall. According to Rowe (personal communication), there is no evidence in any Inca two story building of any kind of interior access between floors.

Although no trace of adobe construction shows in the northeast wall, and the stone is evenly finished along the top, it is likely that a wall of adobes did top the stone, for the following reason. The pitch of the gables from the approximated apex to the present northeast wall would be so steep it would cut across the niches at that end of the gables; raising the height of the northeast wall would reduce the pitch and also give more usable space in the upper room.

The gables manifest the same asymmetrical hillside construction as those of the Hospitalniyoc buildings. Rather than having one window and two niches, however, here there are three niches below a single window. The window is not symmetrically aligned with the three niches but reflects the asymmetry of the gable itself by indicating approximately where the apex was. At some point since construction, the northwest gable window has been halfway, and very crudely, filled in with stones. The lintels of all windows and niches are of stone.

Structure 5 (fig. 20)

The only entrance is at the south end of this one story building, as is one niche immediately to the left as one enters. There may have been another niche, but the wall is too badly damaged to tell. The window is centered between and above the entrance and the remaining niche. The north wall, also a gable wall, contains three niches and a window which is much higher than the south one, about 2 m. above the niche lintels (see fig. 39). The window is over the innermost niche, indicating as with the other gable window that the gable was not symmetrical; rather, the apex was displaced towards the uphill side in the same sort of hillside architecture described for Hospitalniyoc.

The west wall has six niches, and the east wall five windows. The west and east walls of the building (uphill and downhill respectively) were constructed as part of the building but serve simultaneously as retaining walls as a consequence of the steep terrain. Each, therefore, has a slight westward inclination reflecting this function.

The corners of the building do not form right angles. One wonders if deviation from rectangularity presented any difficulty in

roofing the structure.

The height of the stone in the west wall is considerably greater than in the east wall, where no stone is now visible from the inside. Consequently, the west wall niches are set in stone and the east wall windows in adobe. The level of stone is very uneven in the north and south walls to compensate for the discrepancy in height from east to west. Their niches are set in stone.

Two stone pegs, identical to those used on the outside to tie down roofs, are set between the niches of the north wall. Similar pegs are present in some of the buildings at Machu Picchu. Such pegs are probably skeuomorphs of wooden pegs used in dwellings for hanging up clothing (Guaman Poma de Ayala, 1936, pp. 145, 871 [885]).

The adobe of the west wall extended quite high with respect to the gables, implying that the slope of the roof from there to the apex was quite short and shallow, while the slope to the east was longer and steeper.

Cantocracay (fig. 21)

The main path between Pisacllacta and Callacasa continues north and terminates in the 1975 parking area; another path begins there and travels uphill in a northerly direction to Cantocracay, the building cluster visible from the parking area. This group contains a diversity of Inca architectural styles, including some unusual variations. For example, one chamber of Imperial Cuzco stonework is found there, but most are built with simple fieldstone and possibly all of the buildings had adobe walls on top of the stone. Adobe was a major element in the architecture of this cluster.

Only the buildings labeled 1 to 3 on fig. 21 have a major portion of the wall space of brick, and only Structure 1 was chosen for a full description. Useful information or unusual features from Structures 2 and 3 as well as others will amplify the discussion of adobe construction at Cantocracay. The observation that Structures 1-3 are similar in their use of adobe may be traced to another observation: they are grouped in a cluster and apparently intended to form a unit similar to the Inca cancha. A cancha is an enclosure or an enclosed group of buildings which open onto a common courtyard, but in this case no enclosure wall is evident. Thus this grouping may be considered a modification of the cancha concept. Shared features are explained by the presumption that these three structures were designed as an architectural unit.

Structure 1 (fig. 22)

The two remaining adobe walls of this building are on the south and north; each has a window centered above two niches, typical features of previously discussed gables. Since buildings 2 and 3 are entered from the courtyard, it is logical to assume that

the entrance to Structure 1 was located in its west wall. Whether or not the east wall had an entrance as well is impossible to tell, although I suspect not, since most one room structures at Pisac, whether of adobe or just stone, have a single entrance.

The niches in the north wall (as I referred to them earlier) are no longer niches but have become windows looking out over the valley of the Riachuelo Chongo. Originally, however, they were niches. Wind and rain have eroded the wall over the years and gradually worn through at the points where the wall was thinned to form niches. The small amount of adobe remaining at the rear bases of the openings appears to be the last trace of what once were the back walls of the niches. Further justification for this interpretation is provided by comparing the window above to the two "windows" below; while the remaining sides of the upper window are badly weathered, those of the openings below are perfectly intact, implying that they have not been exposed to the elements until recently.

The niches in this building are unique in having rounded rather than sharp corners such as are found elsewhere. The south window also shows definite rounding in the lower corners. The niches and windows have stone lintels. The mean width of the niches at the top is 36 cm. (range 33-39 cm.); that of the base is 42 cm. (range 37-47 cm.). The mean height is 84 cm. (range 80-88 cm.), and the mean depth is 35.5 cm. (range 34-37 cm.).

The adobes here are rather pale in color, gray and beige tones with red mortar. The bond is a semi-successful attempt at English; the dimensions of the individual adobes were not designed to conform to formal English bond. Because of this fact, the stretchers often do not span the width of the wall as determined by the courses of headers, and to compensate, fragments of broken adobes were embedded in abundant mortar between the stretchers. This view of the internal bond is provided by the south wall of Structure 3, where stretchers 25 cm. and 27 cm. wide were separated by 13 cm. of mortar, plus fragments of adobes (fig. 40). A little farther along, a very wide stretcher is placed beside an average size stretcher. Then at the corner, the internal bond for a course of headers can be seen; the headers continue all the way to the corner where the last one serves as a header for the same wall as well as a stretcher for the adjoining perpendicular wall. From there, bricks are placed perpendicular to those of the first wall, resuming the row again as headers although the one stretcher initiated the course.

One more phenomenon that deserves mention appears in Structure 4 (fig. 21). In the vertical portion that remains of the east wall of the structure, an arbitrary mixture of stones with bricks is seen; there are no set boundaries for sections of one or the other except for the all stone foundation. I find it difficult to imagine any structural advantage in the combination of stone with adobe and, on the contrary, I would expect the bonding between stone and adobe throughout a wall to be less stable than a wall which is composed of one or more materials wherein each type is purely and consistently

concentrated in one part of the wall, rather than being mixed throughout. This phenomenon is even more anomalous in Inca architecture than the "adobe sandwich" observed in Structure 2 at Callacasa.

Summary

Pisac has taught us a great deal about Inca construction in adobe. We have observed the use of a special hillside architecture which involves differing heights for uphill and downhill walls, and within the walls different proportions of stone to adobe, which in turn sometimes determines the level at which the niches will be placed. Furthermore, gables are necessarily asymmetrical and their stone foundations often sloped due to the differing heights of the uphill and downhill walls.

Adobe construction appears here in two unconventional combinations with stone: (1) as a horizontal section vertically sandwiched between two sections of stone, (2) in a random mixture with stone throughout most of one wall.

At Callacasa, the use of limited and difficult terrain was maximized by building two story structures. Unless there was a form of access in perishable material between levels, the upper and lower levels may have been regarded as independent of one another, since each had its own entrance(s) on opposite sides of the building opening onto different sections of the cluster. Going "downstairs" in this type of structure with no internal communication between levels would be similar to going around the block and up or down a steep hill. The possibility that the levels were relatively independent of one another suggests some interesting implications for urban settlement and planning which are beyond the scope of this study. Adobe upper stories appear to be common in areas where there are both one and two story structures built of both stone and adobe. Also, adobe gables seem to be very common in predominantly stone structures.

Palace of Sayri Thupa

The structure known as the Palace of Sayri Thupa or Incahuasi (fig. 27) is located down the Urubamba Valley from Pisac, in the town of Yucay on the northwest side of the spacious Plaza Manco II.

Although the Palace was probably constructed during the colonial period, it is nevertheless Inca in style. In 1975 the Palace formed part of a colonial house and served as corral, outhouse, and occasional dumping grounds for the middle class Peruvian family occupying the house. It was originally a one room structure and very likely only part of a much larger edifice of which nothing else remains above ground.

Unlike the buildings already described, this structure

originally had a striking façade (fig. 28). The great entranceway (now filled in) is flanked on each side by a very tall, trapezoidal, double-jamb niche. The niches are bordered on each side by a column of seven small, stepped niches which are barely distinguishable now, except for the lower three of each column which are set in stone. Thus there was an alternation of the columns of small niches with the large niches and the entrance. The stone foundation of the façade is a mixture of river stone and worked andesite, none of which is perfectly fitted. The upper portion of the wall is adobe, and the entire façade was plastered.

The main entrance is about 3 m. wide and is one of the largest entrances to an Inca building built in adobe, with perhaps the largest lintels set in adobe. It had two parallel wooden lintels which were logs at least 5 m. long by rough estimate. Rowe observed the outer lintel to be round, with a diameter of 30 cm. and wrapped in a layer of grass 1 cm. thick. The inner beam was squared, measuring 23 cm. on a side. Both lintels were wrapped with a five strand braided rope (Rowe, field notes, 1946).

Each of the large, double jamb niches also had large wooden lintels which underlapped the entrance lintels. According to Rowe, these lintels were about 20 cm. in diameter with 5-10 mm. of grass padding secured by braided grass rope (Rowe, field notes, 1946).

The lintels of the small stepped niches varied depending on their horizontal and vertical location. The bottom three of each column, which were set in stone, had stone lintels. The fourth from the bottom in each column had a wooden lintel, with the face smoothed off flush with the wall surface, while the fifth set has stone lintels. The lintels of the large niches are long enough to serve as lintels for the sixth set of small niches, while the seventh (and last) set on the innermost two columns is similarly provided with lintels by the extension of the exterior entrance lintel, but the outermost pair at the same level have stone lintels. The only generalization that can be made about this arrangement is that wooden lintels were not used in the stone portion of the wall.

The northeast wall has been removed, some colonial walls have been added inside the building, a few of the stone lintels from niches and entrances are strewn about on the ground, and some interior niches and entrances have been filled in (fig. 29).

The inside of the main entrance has a double jamb which is shallower and wider than typical double jambs. From the filled in entrance, later occupants extended a wall of river cobbles that has an opening in it with a colonial stone lintel (fig. 29).

The east and south corners were each reinforced with a series of eight wooden braces about 10 cm. in diameter. At the top of these corners was a brace of a different type, an L-shaped stone key that was entirely set into the wall in contrast to the wooden braces. In the south corner, the series of braces begins 13 cm. below the stone

key, and thereafter they are spaced at 48–50 cm. intervals. The braces had a span of 88 cm. and were wound with a five-strand braided grass rope, 1.5 cm. wide (Rowe, field notes, 1946). These braces were really more of an aesthetic extravagance than a structural necessity; nowhere else are so many used for one corner, nor are they all essential to the stability of the walls, as testified by the lack of any such mechanism in the west and north corners (the west corner does have one stone key). The quantity of braces, then, is merely a way of adding grandeur to the Inca palace.

The southwest wall had four stepped niches of larger proportions than those in the façade, each with a large, carefully finished stone lintel (fig. 30). Below each of these niches is either a trapezoidal niche or an entrance (fig. 31). I have numbered these sets of niches 1 to 4 from southeast to northwest.

Stepped niche 1 is larger than 2 and 3 (see fig. 29), and 4 has been filled in, concealing its original size and shape (see fig. 31); possibly it corresponded to number 1 in size, thus balancing what otherwise looks like a lack of symmetry. Below stepped niche 1 is a trapezoidal niche measuring 82 cm. wide at the base, 66 cm. across the top, 63 cm. deep and 133 cm. high; much larger than those observed in buildings at Pisac and San Sebastian, another element of grandeur for the Inca. The stone lintel was wrapped with a braided grass rope.

Stepped niche 2 (fig. 30) is placed about 10 cm. lower than the first and, as previously mentioned, is smaller. Below it was an entrance which is now filled in. The clearest outline of the entrance shows that at a point towards the top it narrows by about 10 cm.; however, a faint line continuing to the top with no such break is also visible. Thus, the original shape of the entrance is uncertain.

Stepped niche 3 is identical to 2, while the trapezoidal niche below it resembles that of set 1. Stepped niche 4, the one which has been filled in, has below it a trapezoidal niche as in sets 1 and 3.

On the back walls of the stepped niches are multicolor paintings that Rowe, in 1946, observed to represent red feathered Inca helmets; the paintings are colonial. The tops of these niches appear somewhat blackened, possibly from holding torches or, in a later period, candles. The trapezoidal niches were plastered with some mixture high in sand content (sand is readily available from the nearby Urubamba River), a feature which is, to my knowledge, unique to this building.

The northwest wall contains two large, double-jamb niches of which the right one was originally an entrance, later filled in to match the left one (fig. 32). Possibly another room existed behind this one, to which the entrance provided access. The lintels still in place over these niches serve only the inner jambs, while the stone lintels strewn on the ground belong over the outer jambs. To the left of the large niche and entrance is a single trapezoidal

niche corresponding to the series seen in the southwest wall. The area above it is badly eroded, but a stepped niche did exist there originally. This pattern does not continue to the right side of the large niche and entrance.

Although most of the adobe construction still remains and has been little damaged by weathering, it is very difficult to examine due to the quantity of preserved plaster and a massive concentration of insect borings. Thus, the observations that follow may not be entirely representative. The bond is English, and a careful and even placement of courses was facilitated by the uniformity of dimensions among the bricks and even distribution of mortar. Such fine work is rarely seen at Pisac or San Sebastian; only the Mirador at Pisac approaches this standard. The mean dimensions for an individual brick are 21.5 cm. wide by 59 cm. long by 13 cm. thick, smaller on the whole than at the other sites. There is much ichu in the adobes while stone and other addenda constitute a very small part of the volume, suggesting that the earth was either sifted or carefully selected. The bricks are a light brown color. Mortar is made from the same matrix and also contains ichu; it is usually 2 cm. thick.

All the walls of the Palace are the same height, suggesting that it had a hip roof.

Most of the differences between the Palace and the other structures studied may be attributable to status. We see many of the same basic mechanical and stylistic features exaggerated in number, size, and/or quality. Even the huge, double-jamb niches are an exaggerated form of the common niche, made more elaborate by an additional jamb.

Temple of Viracocha

About 130 km. south of Cuzco, in Raqch'i ayllu of San Pedro de Cacha near Sicuani, stands the impressive skeleton of the Temple of Viracocha (figs. 33-34). Viracocha was the Inca creator god. The Temple is of such scale and quality as to humble one with awe, the same effect that prevails in the architecture of many Gothic cathedrals.

The exterior walls of the building formed a long rectangle divided lengthwise by a center wall into two narrower rectangular halls. Each hall was 88.40 m. by 10.85 m. The central wall has ten doorways dividing it into eleven sections, or piers. Each pier was flanked by two columns, one in each hall set midway between the central and lateral walls; thus there was a total of twenty-two columns in the structure. It must have been an impressive building.

The south end wall has two entrances, one on each side of the central wall; nowhere else in the perimeter walls are the remains sufficient to indicate other possible entrances. Also in the south wall are four niches set in the stone base wall, two between each entrance and the central wall.[5]

The surviving stone base walls of the building are andesite dressed in the Imperial Cuzco style. The height of the stone varies throughout the building but is usually about 3 m. high in the center wall. It did not matter that the top of the stone is uneven, since that was originally concealed by plaster.

In the stone part of each of the center wall piers is a window (fig. 35). As windows go, these do not offer much view of one hall from the other, for they are no larger than the common niche at Hospitalniyoc yet they perforate a wall 1.70 m. thick. Therefore, unless they served some unknown ceremonial purpose, they are primarily a decorative feature giving strength to a hypothetical pattern of niches and/or windows in the no longer extant east, west and north perimeter walls. Toward the top of the stone portion of the piers, there are small, square holes visible from within the doorways between piers (fig. 34). One possibility is that these holes held a pole across the doorway which perhaps supported some kind of curtain.

The ten doorways between the halls were 2.70 m. wide (Rowe, field notes, 1954 and 1968), almost as wide as (and perhaps higher than) the entrance to the Palace of Sayri Thupa. The lintels of the doorways were set in adobe, and in the north end of the third pier, counting south to north, there are traces of at least five wooden poles that spanned the opening. Probably two more existed but their remains have been obliterated by weathering, providing a total of seven wooden lintels which Rowe estimates at 10–15 cm. in diameter (1954 field notes). Above each doorway was a large, squarish window which continued in the lines and inclination set by the trapezoidal doorway, and above it yet another, much smaller window, close in size to those in the gables at Hospitalniyoc (fig. 36). These vertical sets of three openings have led some observers to believe that the building had three stories. Gasparini's analysis of the architectural mechanics of the Temple makes a convincing case for the structure being only one story by suggesting that the openings above the doors do not indicate second and third stories but rather served to lighten the weight of the massive wall on the wooden lintels of the doorways. Each pier does have, at the level of the top of the columns, the remains of one or two thin wooden poles, 10–20 cm. in diameter, preserved in the adobe. Poles of this size set so far apart would not support a second floor [see Gasparini and Margolies, 1977, pp. 243–263].

Gasparini proposes that the north and south walls were gabled, and the east and west walls were the height necessary to support the roof at the slope which may be inferred from the height of the center wall and the height of the columns. It is possible that the east and west walls had no adobe superstructure, for the slope of the roof may have been so steep as to limit the height of those walls.

The columns, of which a single one is preserved, are consistent with the rest of the building, constructed in stone for a few meters, with adobe construction completing the height. The manner in which the brickwork was arranged to form a solid circular

structure is concealed from view by modern clay plaster in the only remaining column. In order to reconstruct the others accurately, a special inspection of the column would have to be undertaken.

Rowe observes that in the profile of the center wall, the west face is very straight, almost perpendicular to the ground, whereas the east face has an inclination that narrows the wall in thickness toward the top. The narrowing is not entirely gradual either, for just at the base level of the small, uppermost windows, there is a noticeable reduction in wall thickness within a very short vertical distance (Rowe, personal communication, 1975). Perhaps this was the easy way to narrow a brick wall, by simply choosing one course at which to begin using fewer bricks than the number used in lower courses.

It is difficult to generalize about the bond of the bricks since the pattern is not very regular. Externally it appears as primarily English bond, but the internal structure is somewhat more complex (fig. 37). It looks as if courses of stretchers were achieved by simply laying four bricks side by side through the wall, yielding the desired thickness. Headers presented more of a problem, since the bricks were usually not long enough to span the thickness of the wall, a function of inappropriate length/width proportions in the bricks. Therefore, stretchers completed the distance, producing a course which on one face of the wall is composed of headers and on the other of stretchers. In the thickest part of the wall, two headers end to end sometimes fit across. Mortar was used more abundantly internally than in the façades, and was important in the somewhat difficult joining of the internal bond.

Since the lower courses of brickwork of each pier are independent of the adjoining piers, and the stone foundations vary in height, there must have been a problem in the first courses that span the doorways above the lintels and meet the courses of adjoining piers. The resolution of this problem can only be observed from a distance in one place where two piers are still attached, above the eighth doorway and window, and definite adjustments were made in order to establish some degree of continuity between the courses.

Unfortunately, no portion of the adobe walls is accessible for taking measurements of individual adobes without a ladder. They vary considerably in size, however, and appear to be larger than those at any other site. While the Temple of Viracocha humbles the grandeur of the Palace of Sayri Thupa, the latter can be said to excel in the quality of its brickwork.

Both the mortar and the adobes of the Temple are beige in color, and the plaster used was very red, where traces of it remain on some of the stone. Rowe observed in 1942 (field notes, 1954) that the stone portions of the piers show discoloration from plaster in a definitely stepped pattern (see fig. 35) reminiscent of that of the stepped niches at the Palace of Sayri Thupa. Probably the plaster was applied in that pattern for decorative purposes, and the rest of the stone below was left exposed.

A structure of this status would certainly be constructed with only the finest quality workmanship in the stone foundations; nevertheless, a structural consideration may have been more important than aesthetic appeal in choosing Imperial Cuzco masonry for the stone wall bases. In such a thick and high wall as the center wall, basal stability is essential. A fieldstone wall set with mortar would be considerably less stable under the superincumbent weight, than is the jigsaw puzzlelike fit of the stones in the Imperial Cuzco style.

Conclusions

In comparing the more prestigious buildings, the Palace of Sayri Thupa and the Temple of Viracocha, to the structures at Pisac and San Sebastian, general differences between them are based for the most part on size, repetition, quality and complexity. In architecture, a common means of increasing the status of a feature to fit the status of a building is to enlarge that feature. Size creates a literal relationship between the building and its visitors, which has symbolic application to social relationships, particularly in the case of highly prestigious religious-governmental structures. In the Palace of Sayri Thupa, we see many of the basic features of common buildings exaggerated for the purpose of expressing the theme of greatness, to represent the occupant and thereby humble all others. For instance, the common niche is elaborated by size in two variations: the larger trapezoidal niche (seen in the southwest wall) and the door-sized, double-jamb, trapezoidal niche. Similarly, the entrance is enormous. Each of these openings requires a larger than ordinary lintel. At the Temple of Viracocha, the entire building was constructed on an unprecedented scale for the purpose of expressing the greatness of Viracocha. The ceiling was high and the doorways are very large. Furthermore, features that complied with the aesthetic objectives of the grandiose architecture were introduced as a direct function of the structure's size: columns were needed to support the roofing; openings above the center wall doorways were required to lighten the load over the lintels; and very thick and carefully set stone base walls were required, also to support the great walls and roof.

Repetition of a feature also has implications for prestige by requiring the use of much labor. In going beyond structural necessities, the repeated element becomes a luxury item, so to speak, serving only to perpetuate the idea of elegance and expense. We see this at the Palace of Sayri Thupa in the series of braces in the south and east corners and in the columns of stepped niches on the façade.

The goal of making something with greater precision and/or complexity than normal is fundamental to the concept of quality, and again derives its prestige from the labor involved and the aesthetic appeal of the finished product. For the most part, Pisac and San Sebastian structures evince minimal quality in the elements of construction, with the single exception of the Mirador. The latter's relatively careful brickwork and symmetrical fenestration definitely

set it apart from other adobe structures at either of the two sites. The brickwork of the walls, and stone and woodwork of the lintels at the Palace of Sayri Thupa are also of uncommonly high quality. And at the Temple of Viracocha, the Imperial Cuzco stone masonry far exceeds the quality of the foundations of other adobe buildings, while the meticulous engineering involved in the structure reinforces its importance.

Elaboration in the form of complexity or intricacy is also an effective way of increasing the aura of a building. Again the niche is a good example. As a decorative element in common structures, it is simply four sided and slightly trapezoidal. At the Palace, elaborations on the theme occur in the form of stepped niches in a complex arrangement and of double jamb niches. The element that transforms the niche from common to high status lies in the transformation from simple to complex, which again points to an increase in labor to achieve an aesthetic objective.

We have examined numerous adobe structures in an attempt to determine the basic architectural standards and motifs employed by the Incas in this type of construction, the degree of variation and the rationale behind both variations and consistencies. In reviewing the observations made in this study, we can conclude that adobes were made by a process in which ichu was added to a mixture of water and unsifted earth. In two cases, the process appears to have varied: in the Palace of Sayri Thupa, the earth may have been sifted, and in Structure 1 at San Sebastian, grass is not present in the bricks, resulting in a relatively weaker brick. The Inca method differs from the modern adobe-making process in general use around Cuzco on two counts: first, the earth was not generally sifted as it commonly is today; and second, the bricks were shaped by hand rather than in molds. When completed, the adobes were placed on a stone foundation in the predominant pattern of English bond, although irregularities in the bond are not unusual in the common buildings or even in the prestigious Temple of Viracocha. The irregularity of bond pattern can apparently be attributed to carelessness as well as to the irregularity of Inca stone foundations and of hand shaped bricks. The plaster used by builders in Inca times was apparently sifted (the larger pebbles, at least, were extracted from the earth used). Ichu was added and the plaster was applied, usually in two coats, to the interior and probably to the exterior surfaces of the buildings.

Niches were the most typical interior feature of Inca adobe architecture, generally occurring in horizontal series. They probably served as storage space in most dwellings, while in the most prestigious structures they may have been purely decorative elements in their various forms. Niches, windows and doorways always had stone or wooden lintels. However, the criteria used to determine which material would be used for a lintel was apparently arbitrary, as I can observe no overall pattern. Wooden lintels were usually wrapped in grass to increase adhesion to the superimposed adobes and mortar and to the clay plaster which covered them on the under side.

Two adaptations to mountainous terrain were observed. The first is the asymmetrically gabled structure in which we observe the basic concept employed in the agricultural terraces of the Incas: parallel retaining walls set into the hillside enable a level land surface to be established, providing a workable crop area or the floor of a building. By virtue of its fundamental function as a retaining wall, the uphill wall of a terrace structure is necessarily higher than the downhill wall, and the downhill wall, when viewed from outside, extends below the floor level of the building. Consequently gables are asymmetrically pitched and a difference between the height of the stone bases of the uphill and downhill walls requires that the top of the stone portion of the gable walls of the building be sloped rather than level, sometimes occasioning a discrepancy in the levels of the niches within a building.

The second architectural adaptation to mountainous terrain is the two story building. Ledges in the walls supported flooring of some kind, and the upper and lower levels always had separate entrances. No evidence of internal access between levels is preserved.

The different roof styles that may be inferred to have existed on the buildings observed are the lean-to, hip and gabled roofs. In gabled structures, a window was always placed in the gable, above the level of all niches, for the purpose of lighting the interior.

Corner braces were used in several of the buildings presumably to reinforce the corner joint. Such small wooden members probably do not offer much in the way of reinforcement, however; and the use of such braces seems to have been arbitrary, since no regular pattern is apparent. Also, many walls without corner braces have remained standing.

Another previously unmentioned generalization is that entrances are usually about one meter wide and walls of normal size structures are consistently about 80 cm. thick. Similarly, common measurements of niches and windows and/or their distance from one another are about 40 and 50 cm. Very likely the standard units of measurement were approximately 40 and 50 cm. which were simply doubled for larger elements such as walls and entrances.

At many of these sites, it appears that adobe and fieldstone are used almost interchangeably for constructing lower status buildings. At Pisac, for example, there is no clear status difference between adobe and fieldstone structures. Adobe is used as a construction medium to a greater or lesser extent at virtually every site, and the Temple of Viracocha is a particularly good example of the fact that adobe is not strictly a low status material; it is used in all classes of structures.

Time did not permit the inclusion in this project of many topics that would considerably amplify our understanding of Inca adobe architecture in the highlands. A comparison of Inca adobe

construction in the highlands to precolonial adobe architecture on the coast would be very instructive. A comparison of highland Inca architecture in adobe to modern adobe architecture in the same area would help determine which Inca elements proved so effective they were preserved through the centuries, and the amount of Spanish influence in post-conquest adobe architecture. For example, the introduction of the adobe mold revolutionized the production and bonding regularity of adobes in the highlands. A study of how the space within modern adobe buildings in the Cuzco area is typically used, and what terms are used in Runasimi to refer to parts of the buildings, could provide an additional dimension to the reconstruction of Inca adobe buildings.

Acknowledgements

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April 16, 1976
revised May 11, 1978

NOTES

[1]These approximately twenty-two buildings represent merely a sampling of the surviving Inca buildings in the Cuzco area that show remains of adobe walls or evidence of having had them originally.

[2]One exception, the Mirador at Pisacllacta, Pisac, appears to have had a higher status than most of the Pisac and San Sebastian structures.

[3]The orthography used for the place names in this section is that of the map made for the PER 39 Project, with the exception of "Pisacllacta." This cluster is designated "Pisaca" on the map and "P'isaqa" by Angles Vargas (1970, diagram opposite p. 17). The author was informed by Percy Paz, himself a native of Pisac, that the traditional name of the cluster was Pisacllacta. Paz explained "Pisaca" as a popular etymology of relatively recent origin.

[4]One building in the complex just to the southeast of the Temple of Viracocha exhibits the same "adobe sandwich" phenomenon, but time did not permit a study of this structure or the others associated with it, except the Temple itself. The placement of the stone on top

of adobe in this wall is definitely not modern, because Squier recorded it as early as the 1860's (Squier, 1877, pp. 410-411).

[5]Other niches have been "reconstructed" between the entrance and the outer corner, but in this area the wall foundations were not preserved to niche height; in consequence, these niches are justified only by an argument from symmetry.

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KEY TO ILLUSTRATIONS

The maps of the building clusters in figs. 4, 11, 15 and 21 are based on survey maps of Pisac made by the Instituto Nacional de Cultura/Proyecto PER 39.

The plans of individual structures in figs. 2-3, 5-10, 12-14, 16-20, 22 and 27 were made by the author on the basis of her measurements. Exact corner angles were not measured, so they must be considered approximate as they appear in the plans. The sections of remaining adobe were also not measured and have been approximated in the plans on the basis of photographs.

Unless otherwise noted, all photographs are by the author.

Plate XXI

Fig. 23. Northwest gable wall, Structure 1, Hospitalniyoc.
Fig. 24. Window with wooden lintel wrapped with grass rope, Structure 4, Hospitalniyoc.
Fig. 25. Handholds and cylindrical stone pegs in gable

walls along a path, Hospitalniyoc.

Fig. 26. Interior of northwest corner, Mirador, Pisacllacta, showing drop in height of stone foundations, preserved plaster, and bond of brickwork.

Plate XXIII

Fig. 29. Inside of main entrance on southeast wall, stone key reinforcing south corner, stone lintels of stepped niches 1 and 2 on southwest wall.

Fig. 30. Stepped niche 2 over filled in "entrance."

Fig. 31. Stepped niche 3 next to filled in niche 4.

Fig. 32. Large double jamb niches.

Plate XXIV

Plan of Temple of Viracocha drawn by John H. Rowe based on his measurements and notes made in 1954 and 1975. Note that only the central part of the south end of the perimeter wall is sufficiently well preserved to permit accurate measurement; the rest has been obscured by modern reconstruction.

Plate XXV

Fig. 34. General view of Temple of Viracocha taken from northeast corner. The two niches visible in the south wall are reconstructed.

Fig. 35. Stone base of central pier showing window through the wall and remains of stepped pattern in red clay plaster on the stone.

Fig. 36. Doorway in central wall between ninth and tenth piers counting from the south end. Above the door are the remains of a large and a much smaller opening in the wall, apparently to reduce the weight on the door lintel. Photo courtesy of John H. Rowe.

Fig. 37. Profile view of east end of north wall, showing detail of internal bonding of adobe bricks as well as their rounded edges. Wall visible on the left is the first pier of the central wall. Photo courtesy of John H. Rowe.

Plate XXVI

Fig. 38. Rare construction technique of adobes sandwiched horizontally between fieldstone segments, northeast wall, Structure 2.

Fig. 39. Two story high northwest gable wall; on left is retaining wall; entrances are on the right.

Fig. 40. South wall showing internal bonding of adobe wall and extensive use of mortar and broken bricks in the center of the wall thickness.

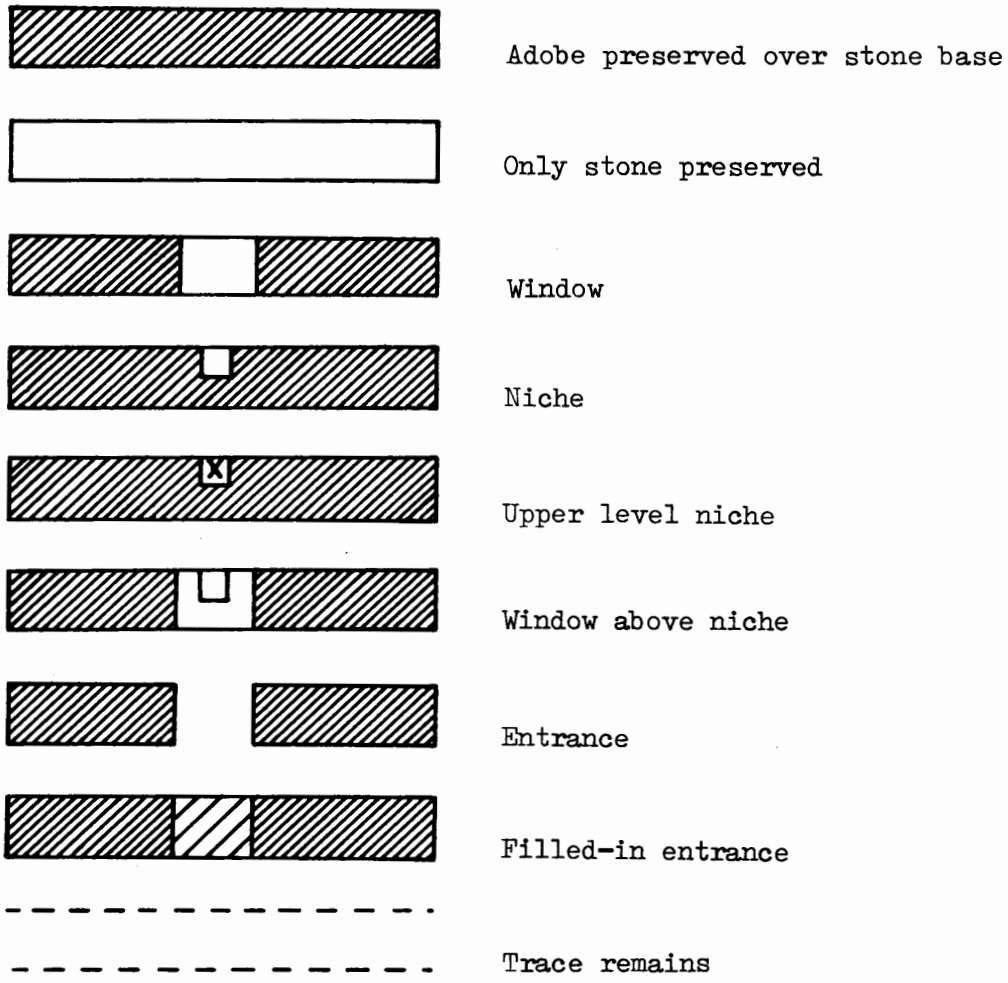


Plate XI. Key to conventional symbols used in individual building plans.

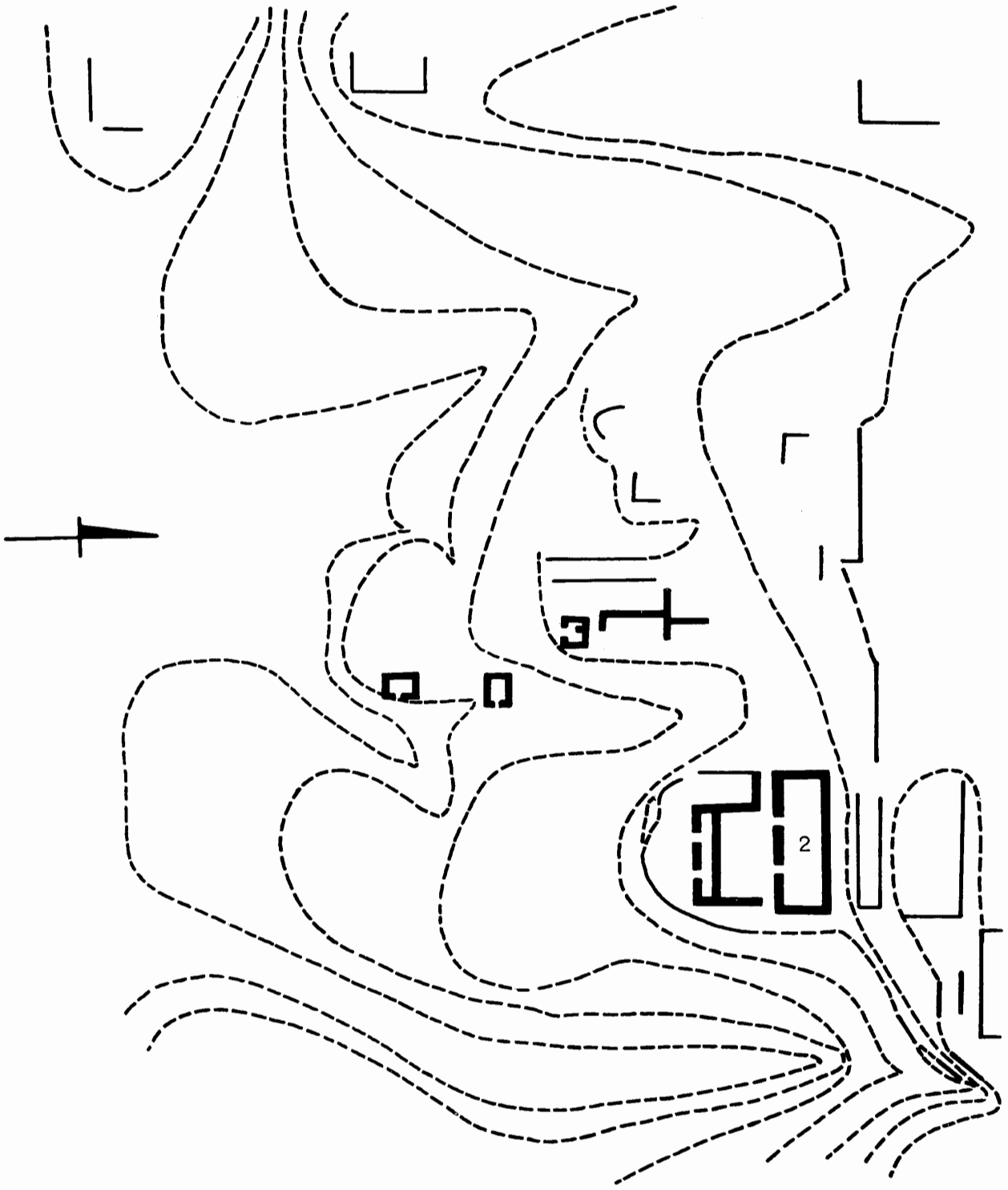


Plate XII. Fig. 1, sketch map of the area of the San Sebastian site around Structure 2, based on the author's observations; slope is down to the left; see fig. 3. Not to scale; orientation approximate.

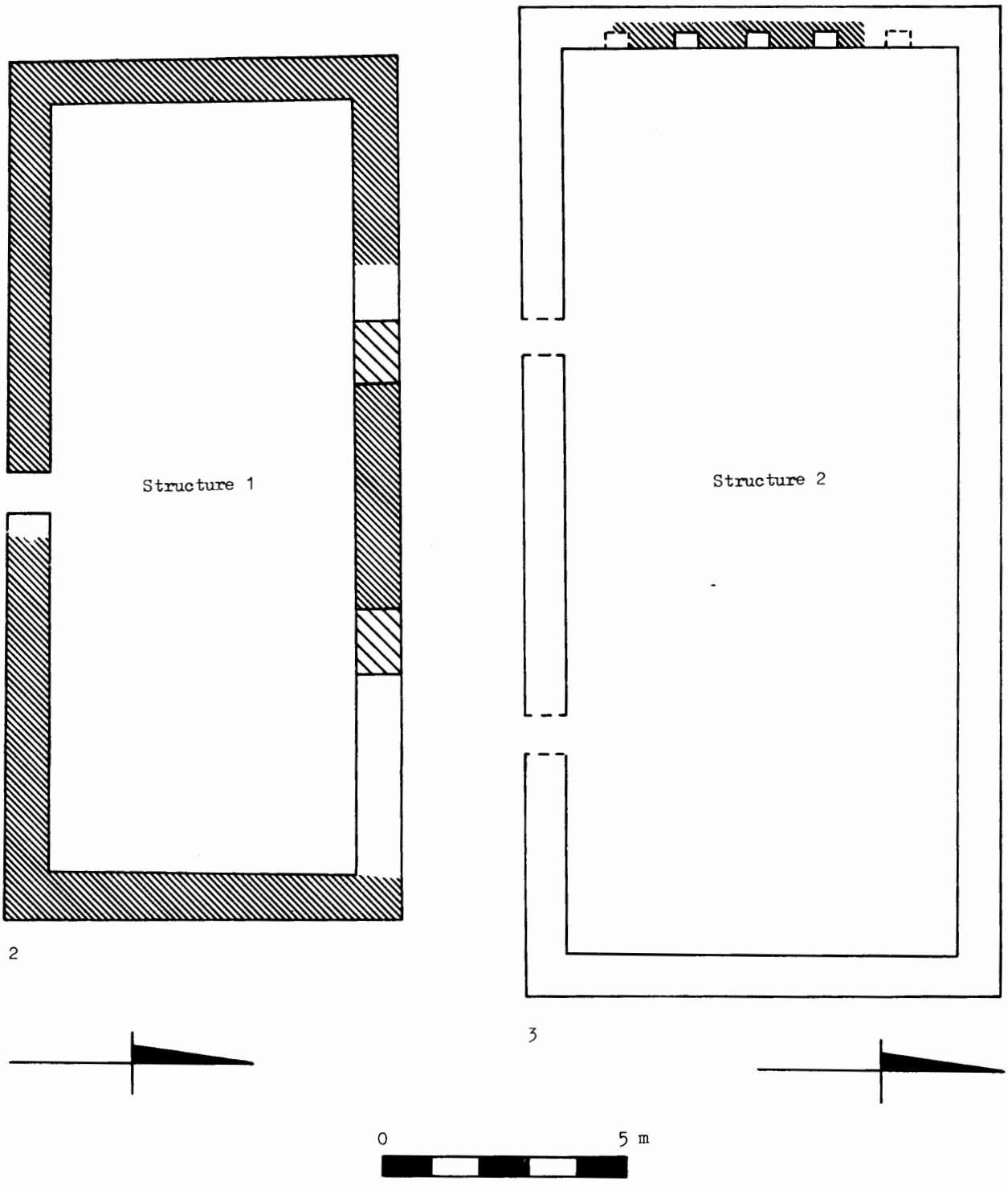


Plate XIII. Figs. 2-3, structures at San Sebastian site; see fig. 1. Orientations approximate, see Key to Illustrations.

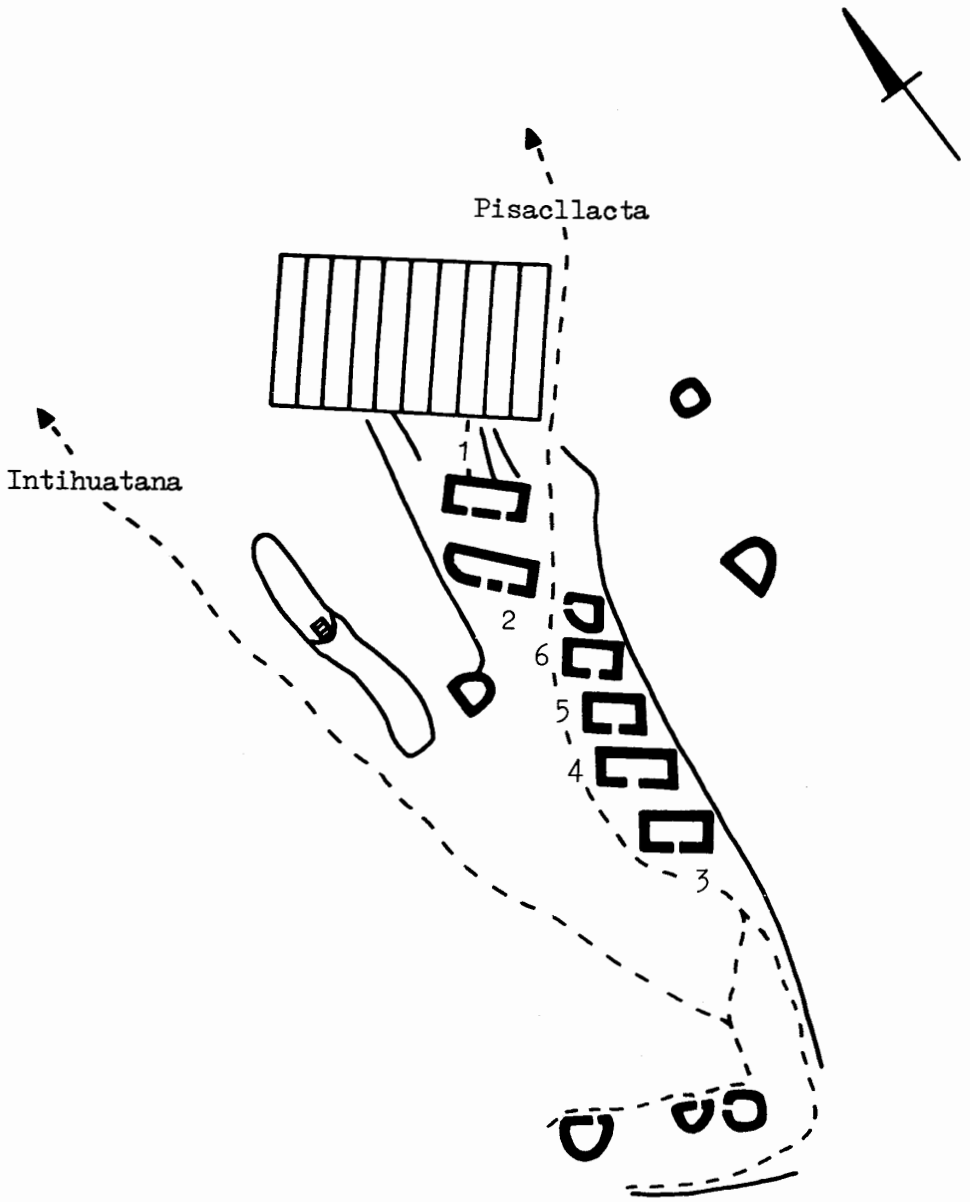


Plate XIV. Fig. 4, Hospitalniyoc cluster, Pisac; slope is down to the right; see figs. 5-10 and Key to Illustrations.

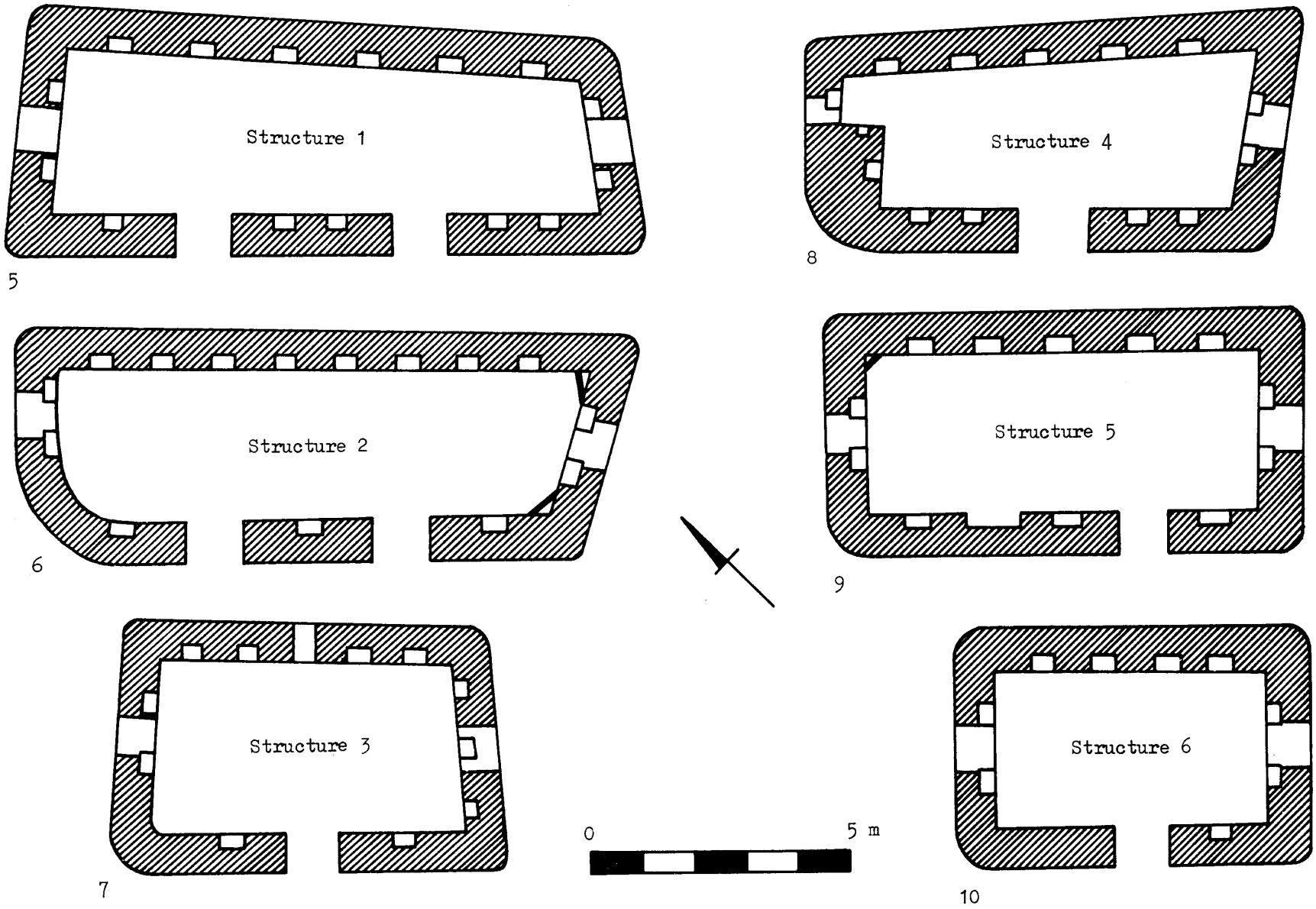


Plate XV. Figs. 5-10, structures at Hospitalniyoc; see fig. 4 and Key to Illustrations.

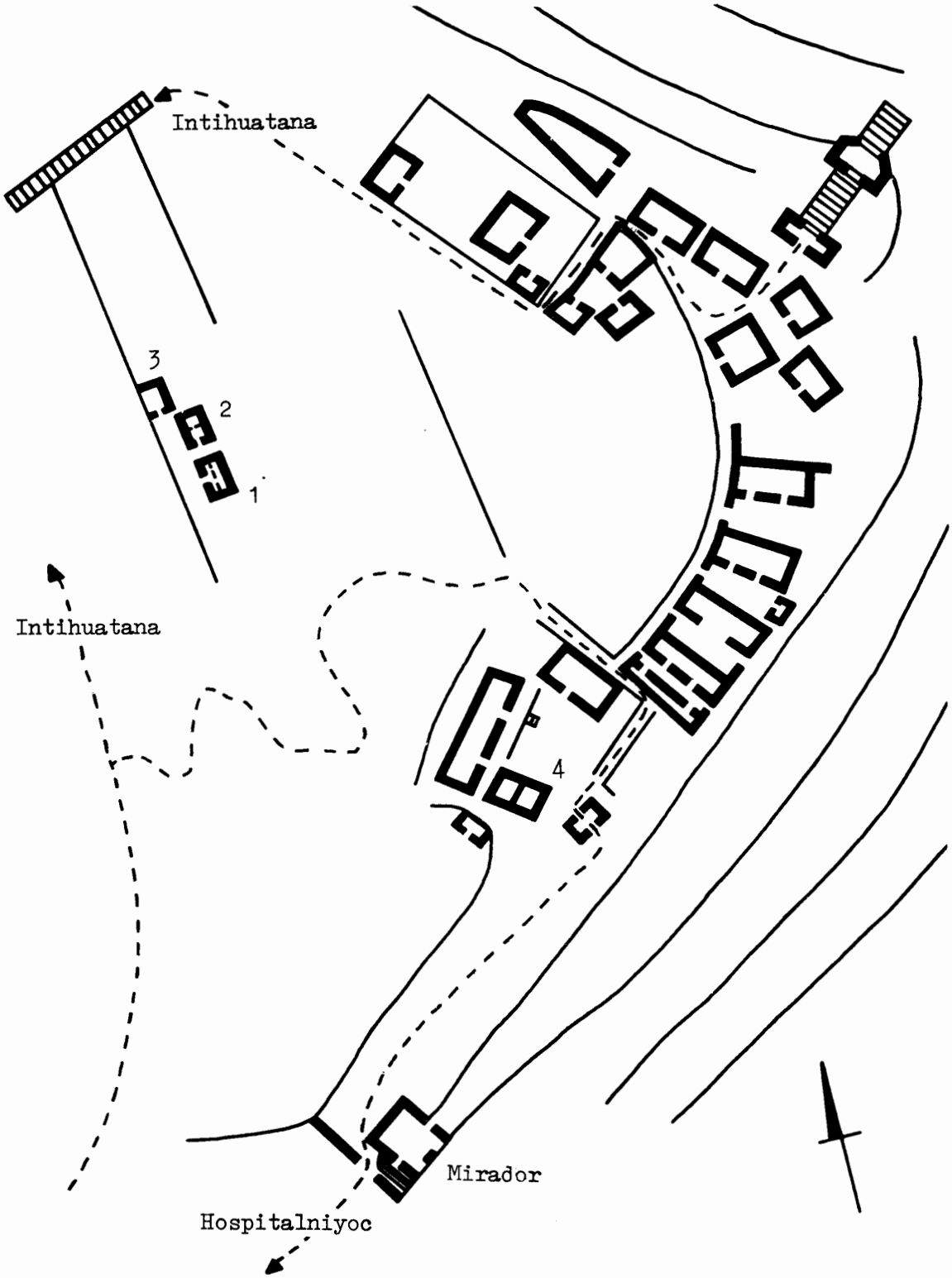


Plate XVI. Fig. 11, Pisacllacta cluster, Pisac; slope is down to the right; see figs. 12–14 and Key to Illustrations.

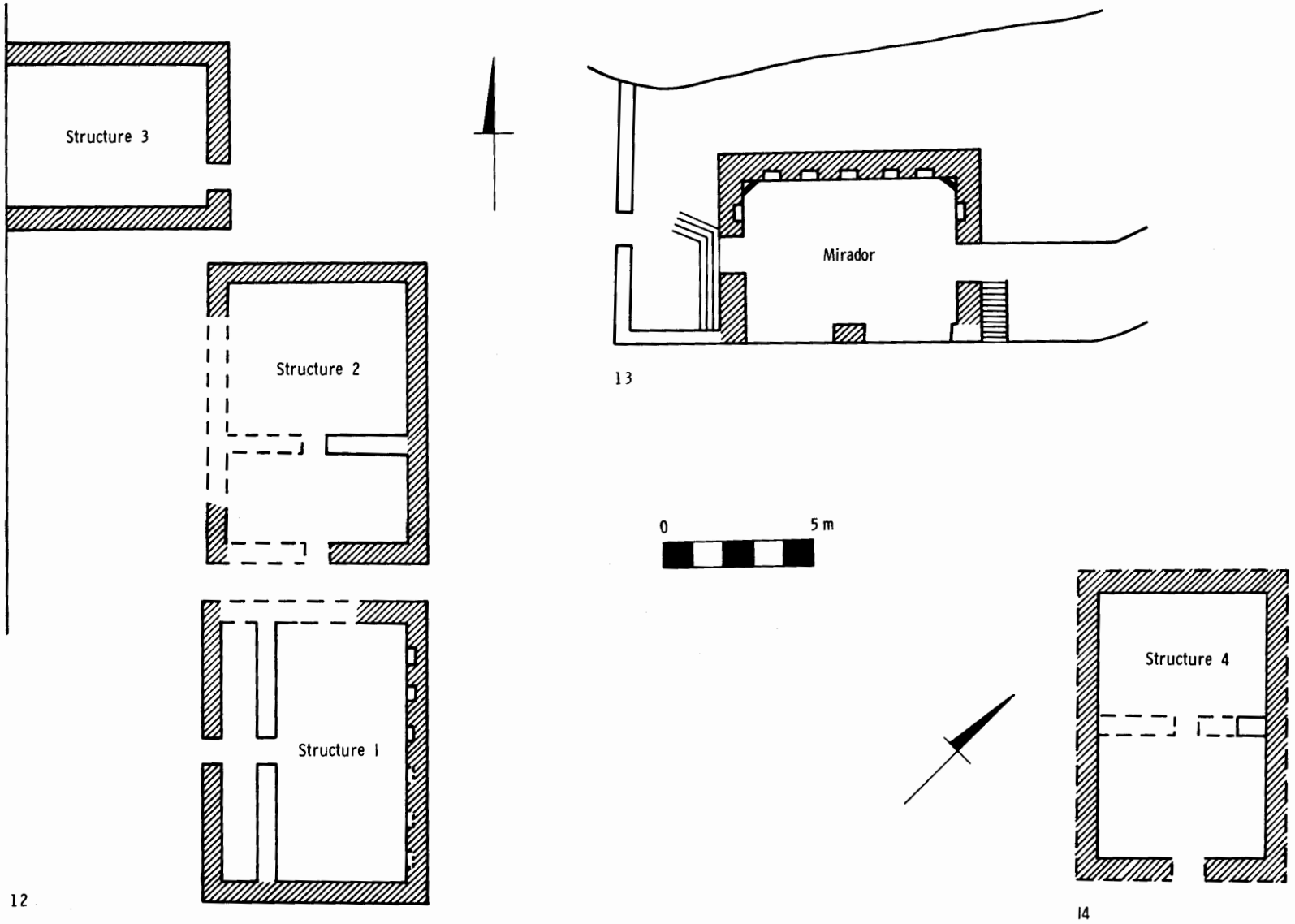


Plate XVII. Structures at Pisacllacta; see fig. 11. Fig. 12, structures 1-3; fig. 13, Mirador; fig. 14, Structure 4. See Key to Illustrations.

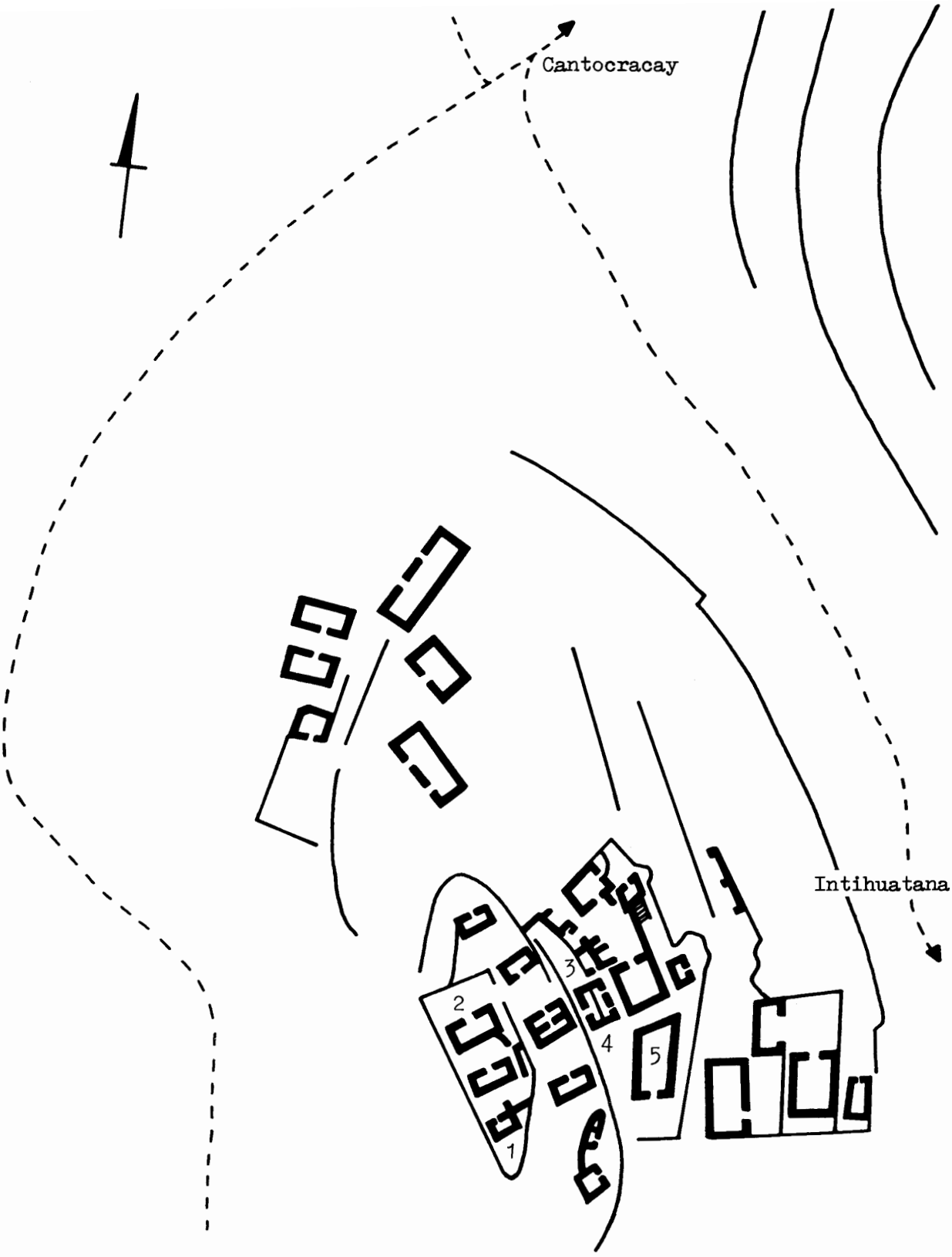


Plate XVIII. Fig. 15, Callacasa cluster, Pisac; slope is down to the right and the top; see figs. 16–20 and Key to Illustrations.

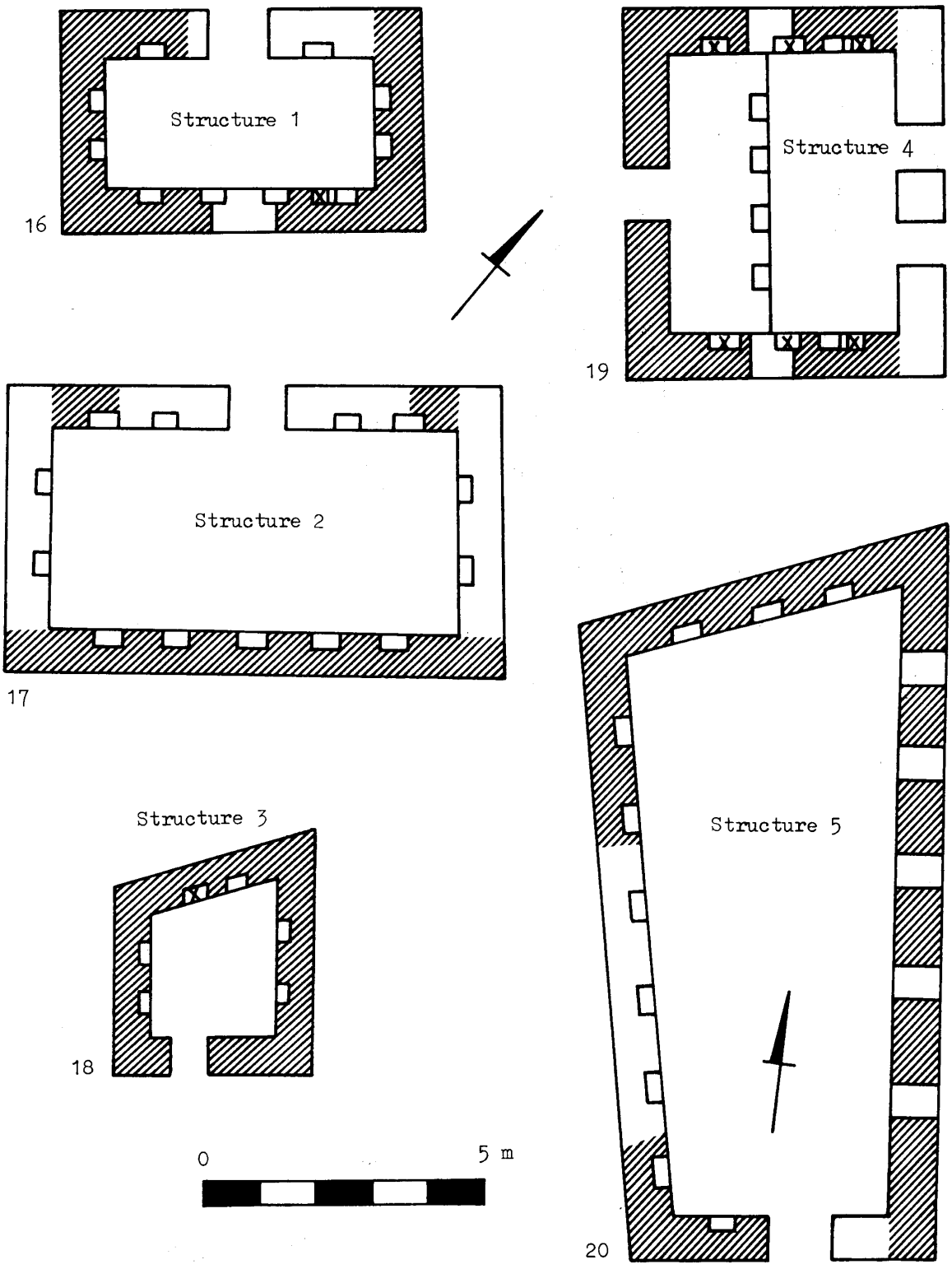
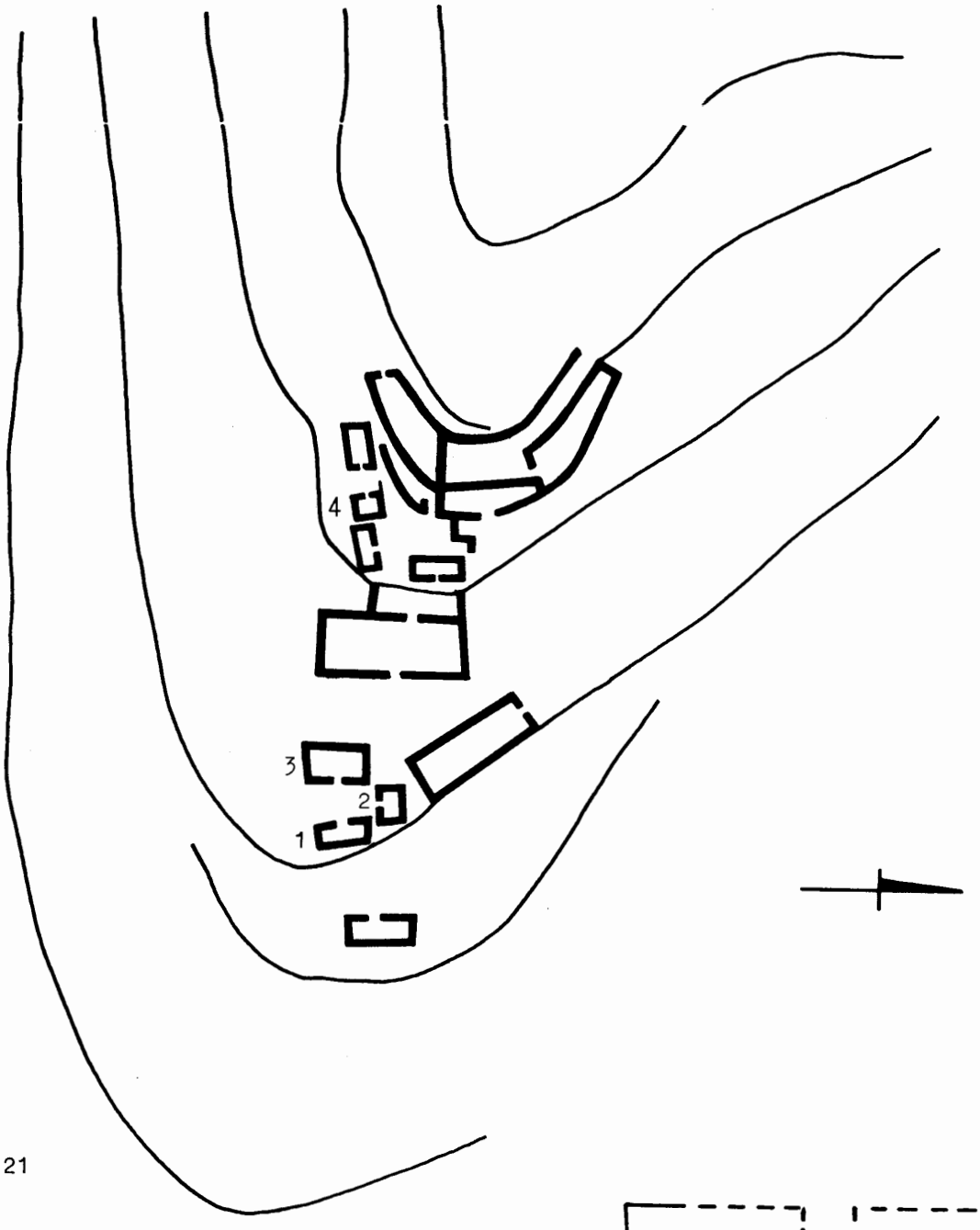


Plate XIX. Figs. 16–20, structures at Callacasa; see fig. 15 and Key to Illustrations.



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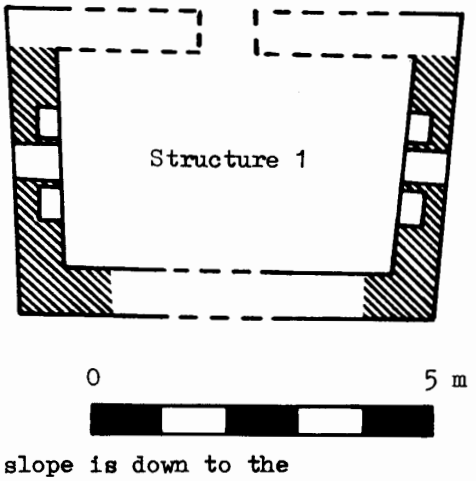

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Plate XX. Fig. 21, Cantocracay cluster, Pisac; slope is down to the bottom of drawing; fig. 22, Structure 1 at Cantocracay. See Key to Illustrations.

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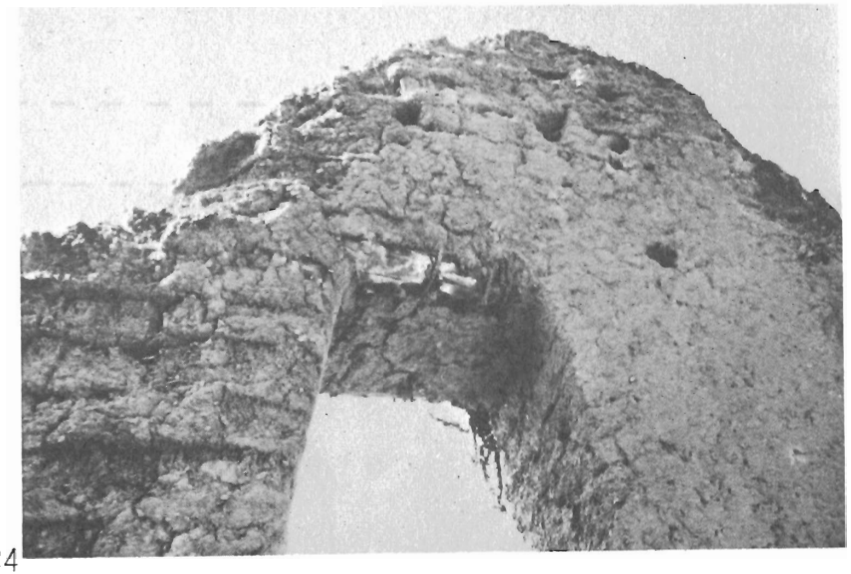

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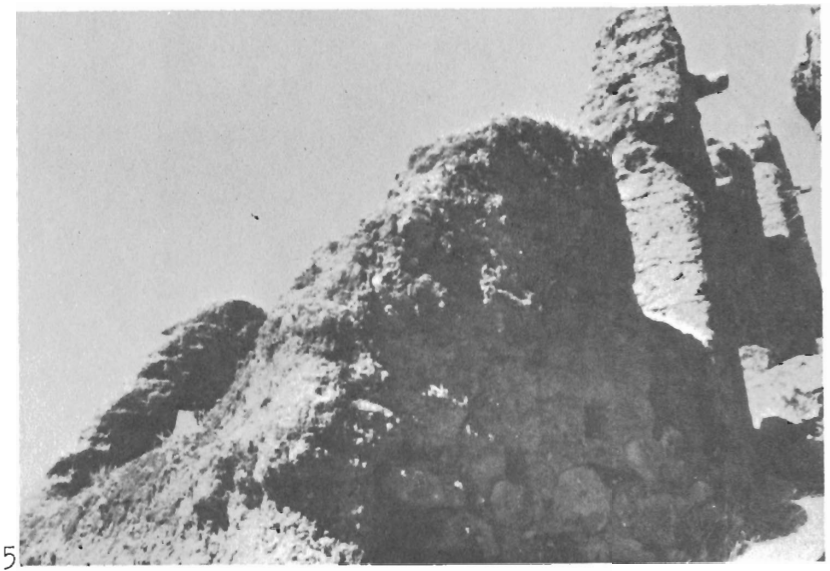

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Plate XXI. Pisac. Fig. 23, Structure 1, Hospitalniyoc (see fig. 5); fig. 24, Structure 4, Hospitalniyoc (see fig. 8); fig. 25, path, Hospitalniyoc; fig. 26, Mirador, Pisacllacta (see fig. 13). See Key to Illustrations.

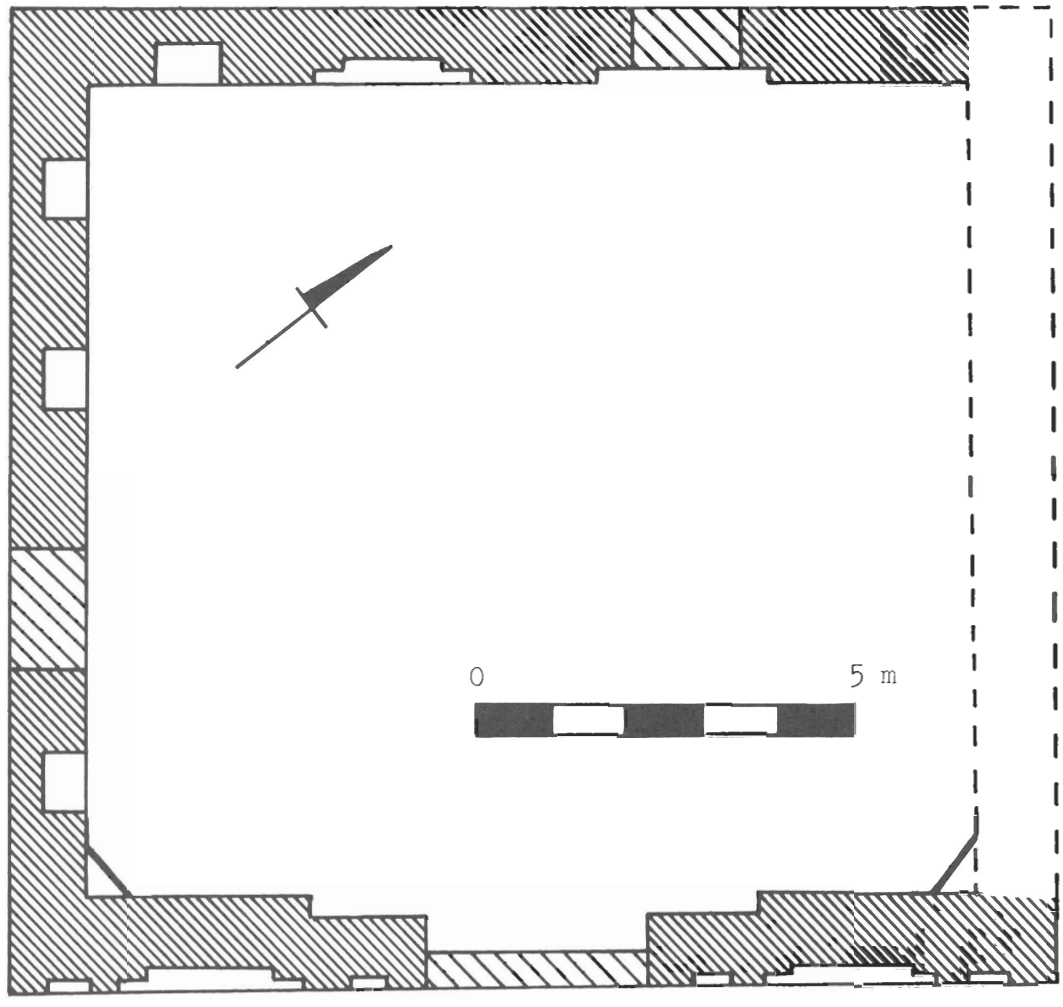

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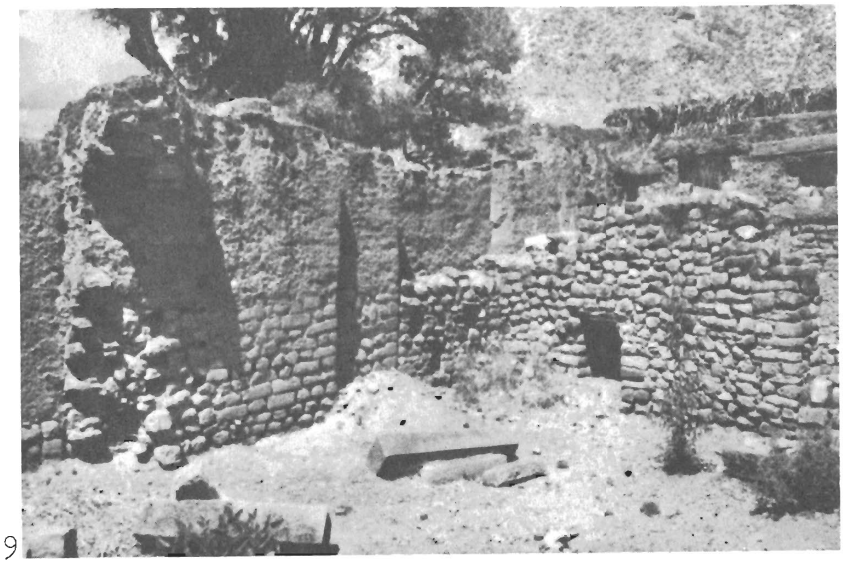
Plate XXII. Fig. 27, Palace of Sayri Thupa, Yucay; fig. 28, southeast façade of Palace of Sayri Thupa. Photo courtesy of John H. Rowe.



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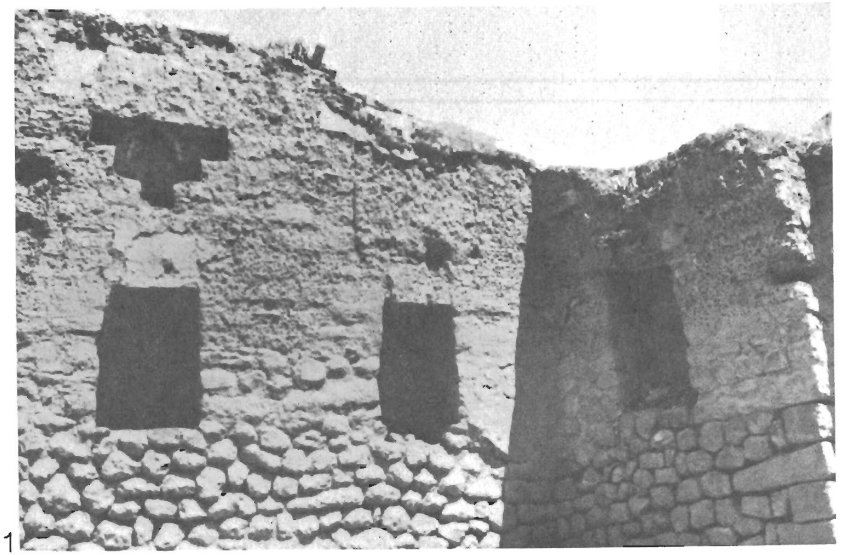

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Plate XXIII. Interior, Palace of Sayri Thupa, Yucay; see fig. 27 and Key to Illustrations. Fig. 29, southeast wall and south corner; figs. 30–31, southwest wall; fig. 32, northwest wall.

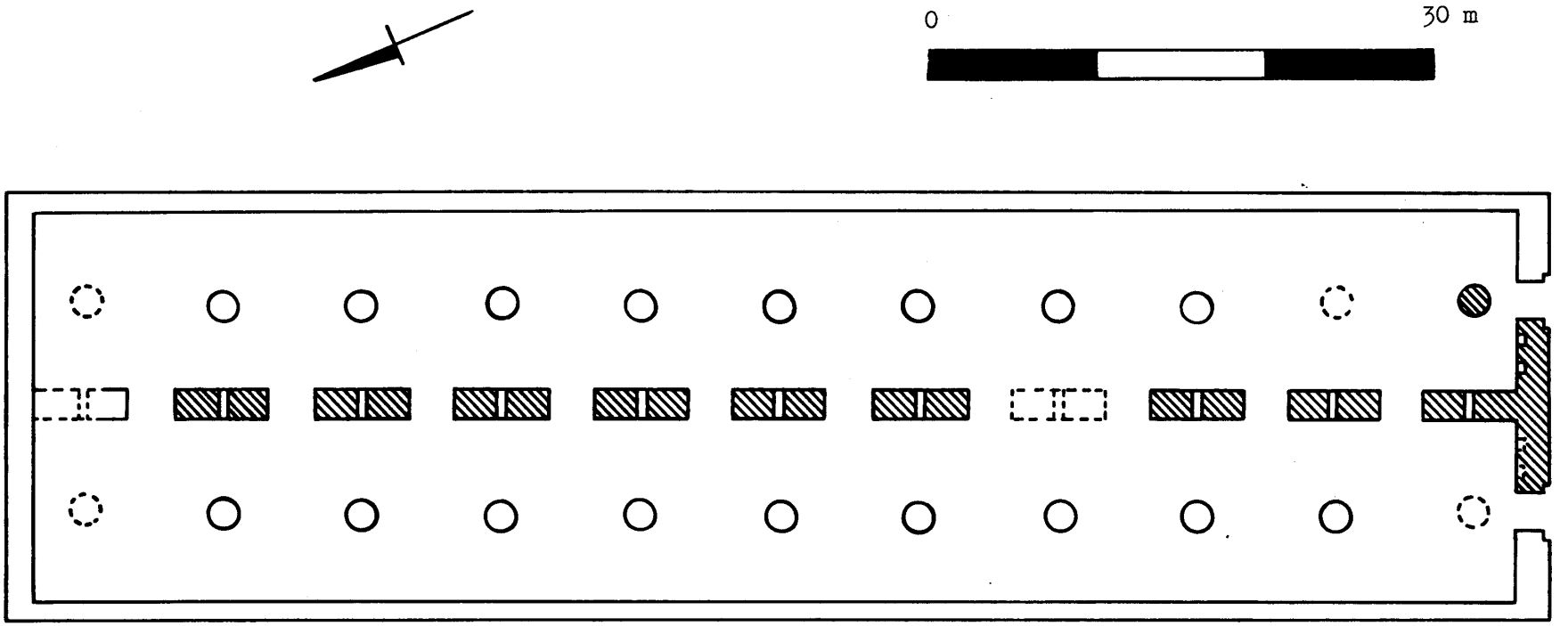
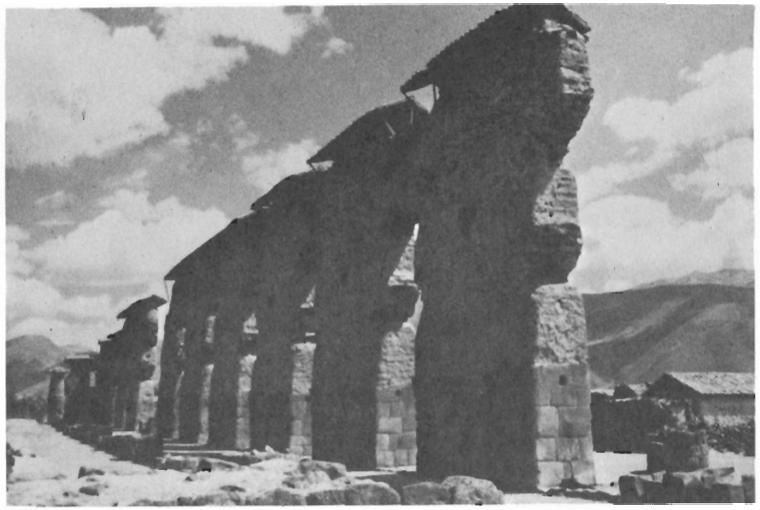


Plate XXIV. Fig. 33, Temple of Viracocha at Cacha; see fig. 34 and Key to Illustrations.



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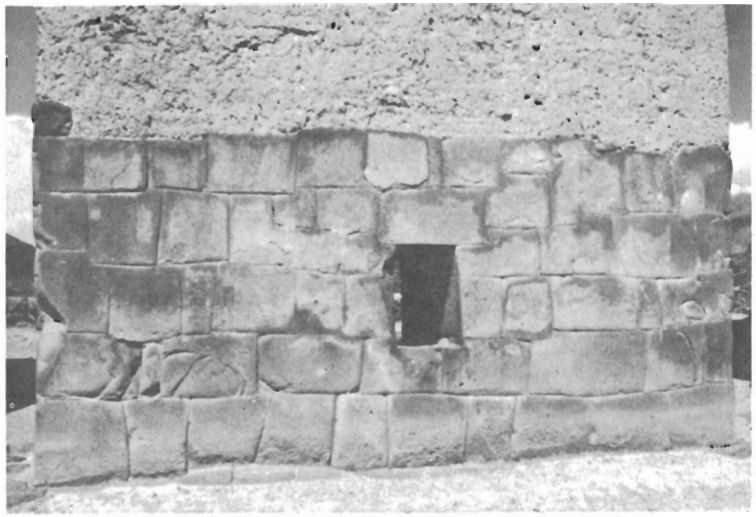

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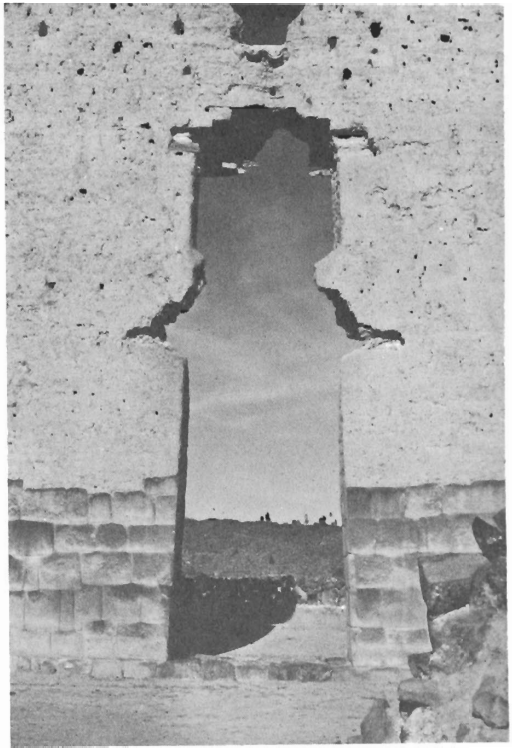

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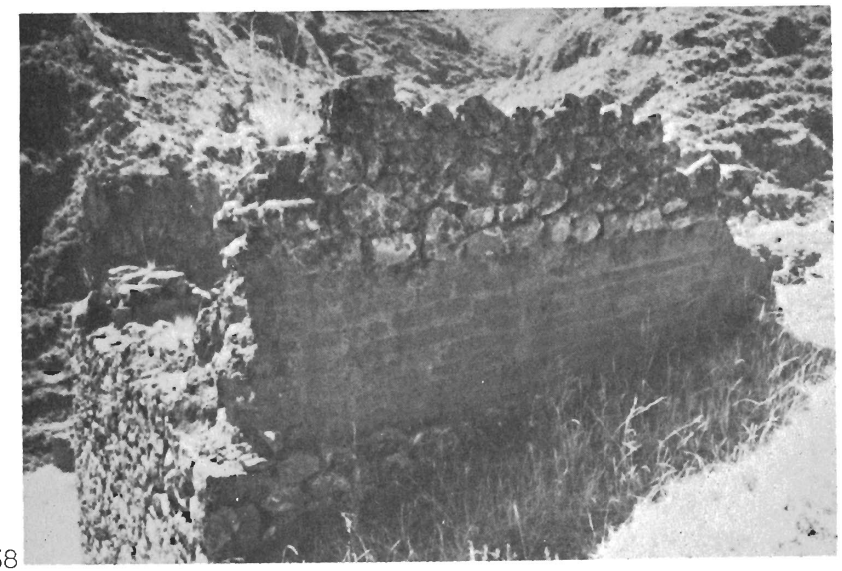
Plate XXV. Temple of Viracocha at Cacha; see fig. 33 and Key to Illustrations.



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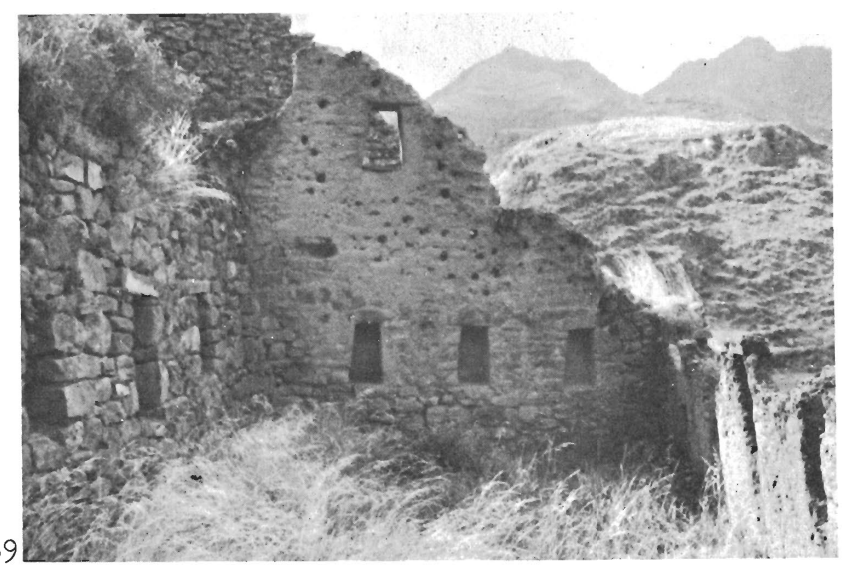

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Plate XXVI. Pisac. Fig. 38, Structure 2, Callacasa (see fig. 17); fig. 39, Structure 5, Callacasa (see fig. 20); fig. 40, Cantocracay (see fig. 21). See Key to Illustrations.