

# Niched Walls in Inca Design

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*Inca architecture is highly standardized, with familiar building types and architectural arrangements found throughout the empire. Niches, a feature of Inca design found in most buildings, are also standardized, both in their size and in their orderly arrangement in walls. The construction of such uniform architectural features by gangs of conscripted laborers obeyed general rules of construction, which are best seen in buildings of the intermediate masonry style. Standing architectural remains reveal horizontal and vertical seams, changes in block size, and slight disjunctures in block fit that show how niche frames were used to arrange niches in walls under construction, and how exterior building corners were used as frames to orient buildings on sites. The rules outlined to account for wall construction of intermediate masonry style buildings permit us to account for the construction of buildings of fieldstone masonry as well. Buildings of the highest quality Cuzco style stonework seem to have been constructed following different rules for niche placement.*

ALL OF Inca architecture is based on construction of rectangular buildings, most of a single room, with stone foundations and a thatched roof. Elaborations of the basic design by changes in size, proportion, and the arrangement of structures in groups are seen in the specialized building types devised by Inca architects to meet the administrative needs of the expanding empire, while differences in the style of masonry used in construction also served to reflect the status distinctions that were important in imperial Inca style.

## *Inca design: Masonry style*

There is variety in the styles of Inca stone masonry, but the distribution of styles is predictable. In a general sense, the most

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important buildings have the style of masonry that represents the most work.<sup>1</sup> The importance of buildings, gauged in Inca terms, is judged by the prestige of activities carried out there. Activities associated with the state religion or with the royal families were more important than activities carried out by commoners; activities that took place in Cuzco were more prestigious than activities that took place outside of the capital city.

There are three major stylistic traditions of Inca stone construction which serve as markers of building prestige. Inca masonry of the high-prestige tradition includes well-fitted coursed or polygonal blocks. Sometimes they are beveled to give a nice shadow on the surface; in other places the joins are so smooth they show almost no trace of a seam. Blocks of the high-prestige tradition are generally large, show careful attention to fit, and may be worked on all the faces that meet, whether visible or not.<sup>2</sup> This fancy masonry is found in Inca Cuzco, for example, in the polygonal masonry walls of building terraces, as in the Archbishop's Palace on Hatun Rumiyoq (Fig. 1), or the coursed masonry walls of the Qorikancha (Fig. 2). Outside of Cuzco, high-prestige masonry is rare, occurring in a few buildings at a handful of important sites. Cuzco style walls are by no means typical Inca masonry, and they are clearly associated with the special administrative and ceremonial functions of the Inca capital.<sup>3</sup>

At the bottom end of the spectrum are walls of locally available fieldstone set into a matrix of clay. Fieldstone masonry is seen in the small buildings that make up the planned Inca support communities around the ancient capital, and it is generally

1. Gasparini and Margolies note that it is the quality of Inca stonework that establishes the prestige of buildings, in part because Inca architecture lacks other ornamental detail. The argument is presented in Graziano Gasparini and Luise Margolies, *Inca Architecture*, trans. Patricia J. Lyon, Bloomington and London, 1980, 320. Other attributes of prestige in Inca design are the scale of building forms and the complexity of building arrangements. The attribution of prestige to Inca buildings is by reference to ethnohistorical sources that identify some structures. The division of Inca stone masonry into three stylistic traditions is my own and is made here for the first time.

2. Jean-Pierre Protzen, "Inca Quarrying and Stonecutting," *JSAH*, 44 (1985), 177–182.

3. John H. Rowe, "What Kind of a Settlement Was Inca Cuzco?" *Ñawpa Pacha*, 5 (1967), 59–75.

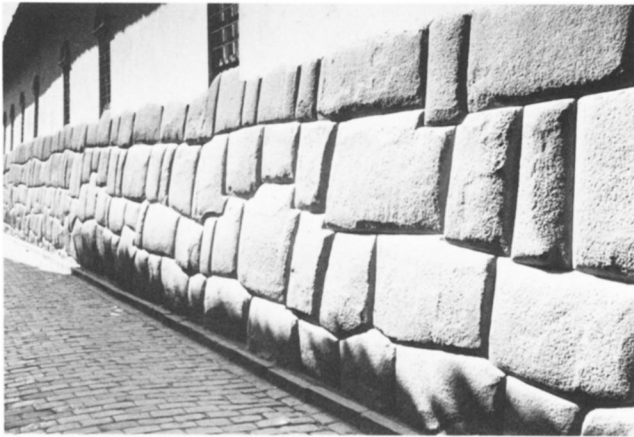


Fig. 1. Polygonal masonry building terrace of the high-prestige tradition serves as the foundation of the Spanish-built Archbishop's Palace, Cuzco (author).

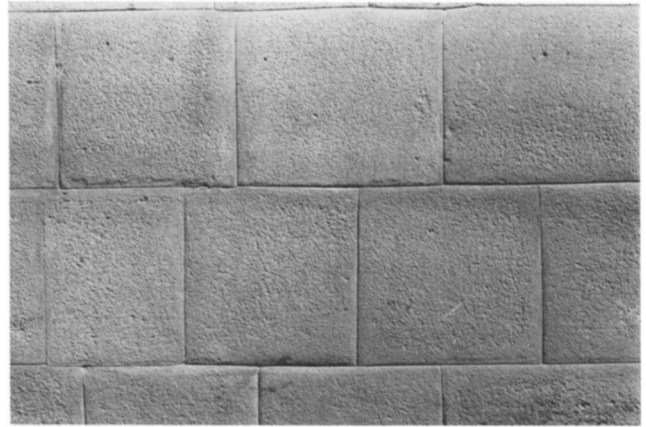


Fig. 2. Coursed stone masonry of the high-prestige tradition from the exterior of the Qorikancha, in Cuzco (author).



Fig. 3. Fieldstone wall of the great hall at Tipón, a royal estate near Cuzco (author).

best considered to be low-prestige masonry.<sup>4</sup> However, it is sometimes seen in buildings of a form more often associated with higher-prestige activities, for example, the great hall at Tipón, a royal estate near Cuzco (Fig. 3). In fieldstone walls, some attention is paid to fitting stones on exterior building corners and around doorways so that these parts of the building generally have worked stone.

Stylistically between the well-fitted stone masonry of Cuzco and the fieldstone walls of its environs is a tradition I call "in-

termediate" masonry, which is composed of worked or partially worked blocks that may be fitted, coursed, or simply accommodated to form the walls of structures or of terraces (Fig. 4). Intermediate masonry walls are generally at least 80 cm thick and are most often composed of two layers of blocks, with the visible faces worked, held together with a clay and rubble core. This masonry tradition is seen in fairly high-prestige building forms (such as *kanchas* and great halls) in suburban Cuzco, usually at sites known to be associated with royal activity, and it is also seen in some buildings in provincial sites. The tradition seems to be intermediate between fieldstone and Cuzco masonry in prestige as well as style and is best considered to be a separate tradition, rather than a failed attempt to copy Cuzco style walls.

4. Susan A. Niles, "Architectural Form and Social Function in Inca Towns Near Cuzco," in *Current Archaeological Projects in the Central Andes: Some Approaches and Results*, ed. Ann Kendall, B.A.R. International Series 210, Oxford, 1984, 205-223.

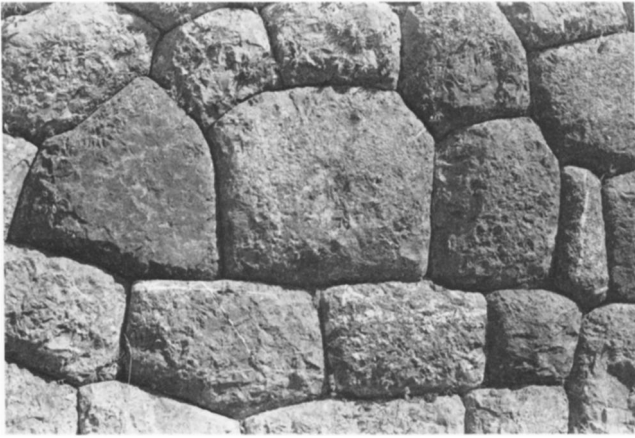


Fig. 4. Detail, fitted polygonal masonry of the intermediate tradition, Rumi Wasi terrace wall (author).



Fig. 5. The lower architectural group from Rumi Wasi, near Cuzco (author).

#### *Inca design: Niche design*

Most Inca buildings, of any masonry style and of most forms, were provided with niches in the interior walls, and the Inca sense of design called for special attention to their arrangement.<sup>5</sup> The absolute number of niches varies with the size and kind of building, but they are always placed in a symmetrical composition with respect to the doorways, and they are disposed symmetrically on facing short walls. For example, the simple farmers' houses of Raqay-Raqayniyoq, near Cuzco, which average 5.35 m × 9.68 m, had four niches on the rear wall, two each on the side walls, and two flanking the central doorway on the front wall.<sup>6</sup> The great hall at Tipón measures 6.9 m × 22.3 m and has 13 niches evenly spaced along the interior rear wall; the hall at Incallacta, in Bolivia, three-and-a-half times the size of Tipón's hall (it measures 26 m × 78 m), has about three-and-a-half times as many niches (44) on the rear wall. It also has ten niches on each side wall and has 13 windows, centered

5. In addition to stone masonry, Inca architects also worked with sun-dried adobe brick and with sod blocks. Adobe is a fairly common material that is always found on top of a stone foundation, which may be of any of the masonry traditions discussed. In buildings with adobe upper walls, niches may be placed either in the stone foundation or in the adobe upper wall, depending on the height of the foundation. Lintels in niches built exclusively of adobe are generally of wood or bunches of cane or grass lashed together. Niches placed in the stone foundation obey the construction rules outlined here; a discussion of niche construction in adobe is beyond the scope of this paper. No Inca sod structure is preserved, and nothing can be said about niches in such buildings. Discussions of adobe walls are offered by John H. Rowe, "Inca Culture at the Time of the Spanish Conquest," in *Handbook of South American Indians*, ed. Julian Steward, Bureau of American Ethnology, Bulletin 143, vol. 2, Washington, 1946, 226–227; and Elisabeth L. Moorehead, "Highland Inca Architecture in Adobe," *Naupa Pacha*, 16 (1978), 65–94.

6. Susan A. Niles, "Civil and Social Engineers: Inca Planning in the Cuzco Region" (Ph.D. diss., University of California, Berkeley, 1980), 34–35.

between the 12 doorways on the front wall.<sup>7</sup> Niche placement in Inca buildings is fairly constant in relation to the level of the ground, with standard niches of about 80 to 90 cm tall placed so that their base is about 1.25 m above the level of the ground.<sup>8</sup> Within any given site, the size and shape of the niches is quite regular, though across Inca sites there is a range of acceptable niche shapes from noticeably trapezoidal to a more nearly rectangular form. Windows on the ground-floor level are rare in Inca buildings near Cuzco, but when they are seen they are the same size and shape as niches and either take the place of niches or alternate with them on walls, obeying the rules of placement and construction outlined for niches. Oversize niches and body-sized niches occur on some buildings, as do niches on exterior walls and niches elaborated with double or even triple jambs.<sup>9</sup> All of these elaborations are uncommon, however, and appear to be restricted to buildings associated with a high-prestige function.

Given the obvious importance of orderly niche arrangements in Inca architecture, this raises a question: How did Inca builders place niches in buildings without making mistakes? Examination of standing architectural remains permits a suggestion of one way that this was done.

#### *Niche construction*

All styles of masonry are used to construct walls with niches, but walls of the intermediate masonry tradition tell us most about niche construction for reasons that will become clear. I shall focus on the buildings of Rumi Wasi, part of a royal estate

7. Gasparini and Margolies, *Inca Architecture*, 208.

8. Ann Kendall, "Descripción e inventario de las formas arquitectónicas inca. Patrones de distribución e inferencias cronológicas," *Revista del Museo Nacional* [Lima], 42 (1976), 38.

9. Kendall, "Descripción e inventario," 41.

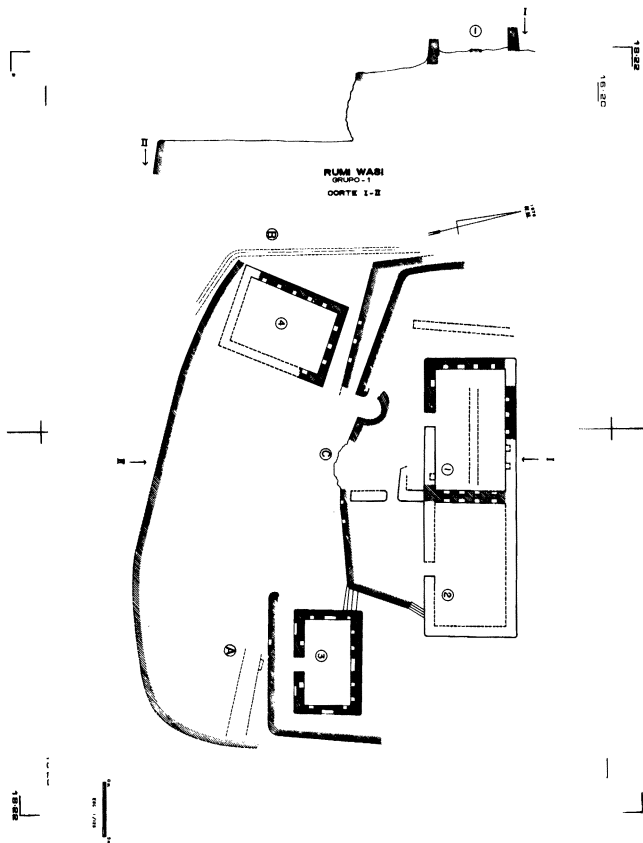


Fig. 6. Plan of the lower architectural group at Rumi Wasi (author).

located just outside of Cuzco along the old Collasuyu Road.<sup>10</sup> The site includes a number of buildings disposed in two groups, of which the lower group will be discussed here (Figs. 5 and 6). Rumi Wasi is of special interest because it has relatively well-preserved buildings which present the full range of possibilities for Inca niche placement in intermediate style architecture: It has standard interior niches (Buildings 1, 2, 3, and 4), oversize interior niches and body-sized exterior niches (Building 3), niching on both faces of a common wall (Buildings 1 and 2), niched terrace walls, and even a subterranean niche carved in bedrock (see Fig. 6, feature A). Further, there is preservation of some of the adobe wall portion in one building in this group (Building 4), so that we have an indication of the original height of the wall and we know that it has not been reconstructed. By considering a single, small architectural group such as the buildings of Rumi Wasi, we are to some extent ruling out the possibility of stylistic changes over time.

The first problem faced by Inca builders was that of achieving a level wall height for the placement of niches at a standard

10. Rumi Wasi is best reached by a dirt road, usually passable by car, which climbs to the ex-hacienda Callachaca after splitting from Avenida Collasuyu at the mouth of the Cachimayo canyon. By foot, one reaches Rumi Wasi following a walled path from the north side of the parish of San Sebastián for about half an hour.



Fig. 7. Detail, northwest wall, Building 4, Rumi Wasi. A stub of an adobe upper wall is seen in the upper-right portion of the photograph (author).

distance above the floor. The interior of Building 4 at Rumi Wasi (Fig. 7) gives some insight into the solution to this problem. In this building, there is a conspicuous line across the relatively poorly fitted blocks just below the level of the niche bases. The wall also shows a change in the relative size of the stones used in the area just below the niches, which gives the effect of a horizontal seam across the wall at the base of the niches. It appears that the foundations were built up to the approximate height of the niches, with particularly close attention paid to achieving a flattish surface on the course of stones at the base of the niche (Fig. 8a). In some buildings this is done by careful selection of the blocks placed in that course; in others, such as Building 4, masons filled in the low places with small or flat stones to even out the layer. The fact that some walls have "low" places suggests that there was a starting point on the building that was judged to be the right height. In Building 4, we can surmise that the wall in the north corner was thought to be tall enough for niches, while the rest of the northwest wall had to be built up with little stones to meet that height. Thus, the north corner at least, and possibly the northeast wall, would have been built up to niche height before the northwest wall (Fig. 9).

After a building's foundation was the right height, blocks were laid on it to construct a niche frame (Fig. 8b). Niche blocks are relatively well worked, finished so that they have a smooth edge on the surface of the wall and a smooth edge at approximately right angles to form the inside of the niche. Niche blocks are invariably larger in size than the blocks used in the masonry of the wall just below them, and they are always worked at least as well as the best-fitting blocks in the wall. The niche blocks are stacked on top of one another to frame the niche. In stone walls, a flat stone lintel is set over the top of the niche blocks to complete the niche frame. In walls completed with adobe, the lintel may be wood or even clay-wrapped bunches of grass.

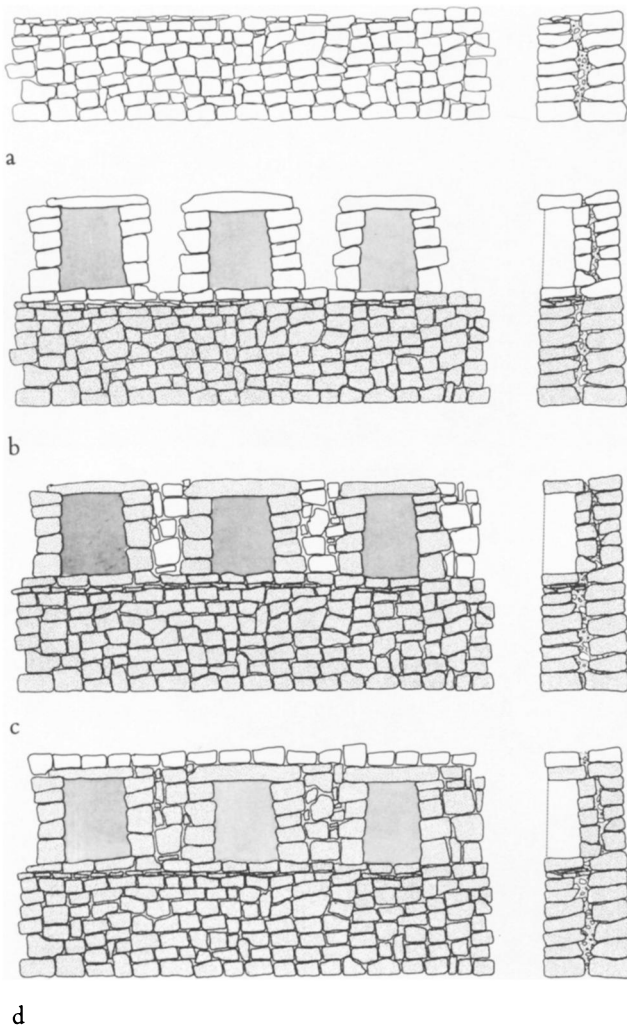


Fig. 8. Construction sequence in Inca niche placement (author).

The laying out of niche blocks into niche frames makes a good deal of sense in Inca construction. In this way, all the niches on a particular wall (or, for that matter, in the whole building) can be placed tentatively on the foundation so that the arrangement can be inspected to meet the planned design. In this way, errors in niche arrangement could be avoided, or at least caught at an early stage, and corrected before the entire wall was built up. Further, if errors in niche size and shape were avoided, then there was less chance of having to repeat time-consuming work on the fitting of the well-worked niche blocks.<sup>11</sup>

To return to the problem of wall construction, we can observe that once the niche frames are put into place the gaps between the niches must be filled in (Fig. 8c). The task of filling in is of some interest and shows obedience to several general rules. In many walls, the largest blocks possible are used first to fill

11. The use of niche frames to plan layouts and correct errors may be the architectural equivalent of the outline stitches used to organize work on the elaborately embroidered textiles of Paracas culture. See Anne Paul and Susan Niles, "Identifying Hands at Work on a Paracas Mantle," *The Textile Museum Journal*, 23 (1984), 5–15.

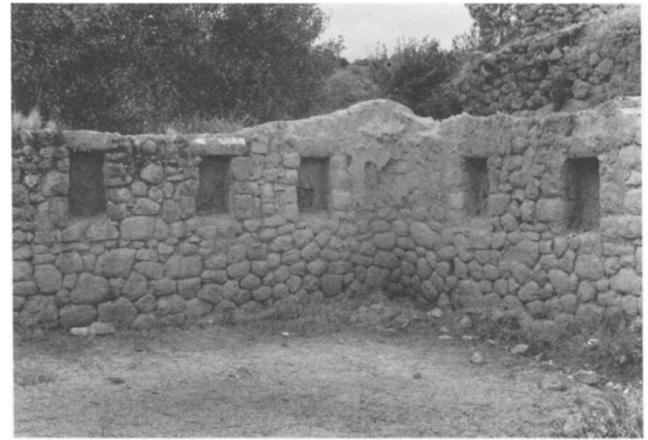


Fig. 9. Detail, interior building corner, Building 4, Rumi Wasi (author).



Fig. 10. Detail, Building 3, Rumi Wasi, west and north walls, showing niche construction on both oversize and standard interior niches (author).

up the space. In buildings of intermediate style masonry, there may be room for one good-sized block (Fig. 10). The block is often round or squarish and is generally at least equal in size to the largest blocks used in the lower part of the wall. In walls where a large block has been used to fill up the space, we can observe that gaps between the block and the niche frames are filled in by small stones, usually of odd shapes, and often not particularly well worked. In some cases it is clear that some of the small blocks were placed in last and from the front, to function as a keystone, but it is not always possible to tell, and at least some of them must have been put in before the big block to hold it in place.<sup>12</sup> One frequently sees narrow blocks placed vertically with respect to the lower courses in the area between niches. In many walls there is more conspicuous mud mortar visible in the interniche wall space than is seen in the lower walls, suggesting that there is, all in all, not a great deal

12. Protzen, "Inca Quarrying," 20.



Fig. 11. Detail, Building 3, east wall, showing niche frames in intermediate coursed masonry building (author).



Fig. 13. Detail, niched terrace wall, Rumi Wasi (author).



Fig. 12. Detail, west wall, Building 2, Rumi Wasi, showing niche frame and conspicuous mud mortar in the area between niches (author).



Fig. 14. Detail, niches on rear wall of the great hall at Tipón (author).

of attention paid to achieving a good fit of the blocks used between niches (Fig. 11).

Once the wall between the niches is built up to about the height of the lintel, the wall is completed with regular coursing to finish it to the proper height for roofing or for supporting an adobe upper wall (see Fig. 8d).

The visual trace of this system of laying out niches is quite apparent on Inca buildings of intermediate style masonry, whether of fitted, coursed, or accommodated stone (Fig. 12). The general rule holds up for the masonry of freestanding walls and niched terrace walls (Fig. 13), and it seems to hold up for niched walls of fieldstone masonry, such as the great hall at Tipón, where the niche frames are the only trace of order in a chaotic arrangement of stones (Fig. 14).

The niche frame solves the problem of correct sizing and placement of niches on wall surfaces, and it requires a special method of providing a back for the niche. Intermediate style masonry is made almost like a sandwich, with worked surfaces

visible and less worked surfaces fit into a core of clay and rock. Inca aesthetics demanded a flattish surface as the rear of a niche; to achieve this end, appropriately worked stones were placed from the back of the niche and fitted to the niche blocks. In some cases, at least, the worked blocks appear to be specially fit into the core and sandwiched against the blocks of the outside wall (see Fig. 8a, b, c, d, cross sections). It is possible to imagine that intermediate style buildings could be constructed so that a single layer of fitted blocks would be used to form the exterior wall surface and the rear of the niches, but I have not seen this manner of construction in the fallen walls I have observed.

It is worth noting that the depth of a niche is related to the wall thickness rather than to the size of the niche itself. For example, the Palace of Huascar at Calca has niches that have a height of 1.15 m, a width at the base of 84 cm, and a depth of 35 cm, set into walls of 80 cm thickness. The Palace of Huayna Capac at Urubamba has niches with a width at the base of approximately 70 cm, with a depth of 50 cm, set into a wall



Fig. 15. Detail, exterior building corner, Rumi Wasi, Building 1, front wall (author).

that is 97 cm thick; small niches in a second building at this site have a height of 70 cm, width at the base of 50 cm, and depth of 50 cm, again in walls just about 1 m thick. It appears that Inca niches were never deeper than one-half the thickness of the wall into which they were built, perhaps to allow for the possibility that niche backs could be formed by blocks from the exterior wall.

The shared niched wall of “double houses” also gives some insight into the problem of providing backs for niches.<sup>13</sup> Most typically, the shared wall is the long niched wall opposite the doorways, but it can be one of the short walls, as at Rumi Wasi (Buildings 1 and 2). In many of the double buildings the niches in the common walls are placed opposite one another. The shared wall is one-and-a-half to two times the thickness of other walls. In the common center wall of the temple at the Ecuadorian site of Ingapirca building deterioration shows a nice bit of wall cross section, with clear evidence of a layer of blocks embedded in the core of the shared wall.<sup>14</sup> This is precisely the sort of pattern one would expect to see if the backs of the opposed niches were formed by a separate layer of blocks in the core of the wall.

The visual traces of niche construction on exterior walls are subtle, as there is nothing corresponding to a niche frame, and there is no discontinuity in the fitting of blocks between niches. It appears that Inca builders took greater care to secure a good fit of blocks on wall exteriors than on interiors, which may explain why traces of construction technique are less easily ob-

13. Gasparini and Margolies, *Inca Architecture*, 165–167.

14. John Hemming and Edward Ranney, *Monuments of the Incas*, Boston, 1982, 207. In the lower part of the building they illustrate, one can see how these blocks have been used to form the common backs of niches, although this part of the wall may be a modern reconstruction. The large niches of the end walls show clear evidence of having been constructed by niche frames.

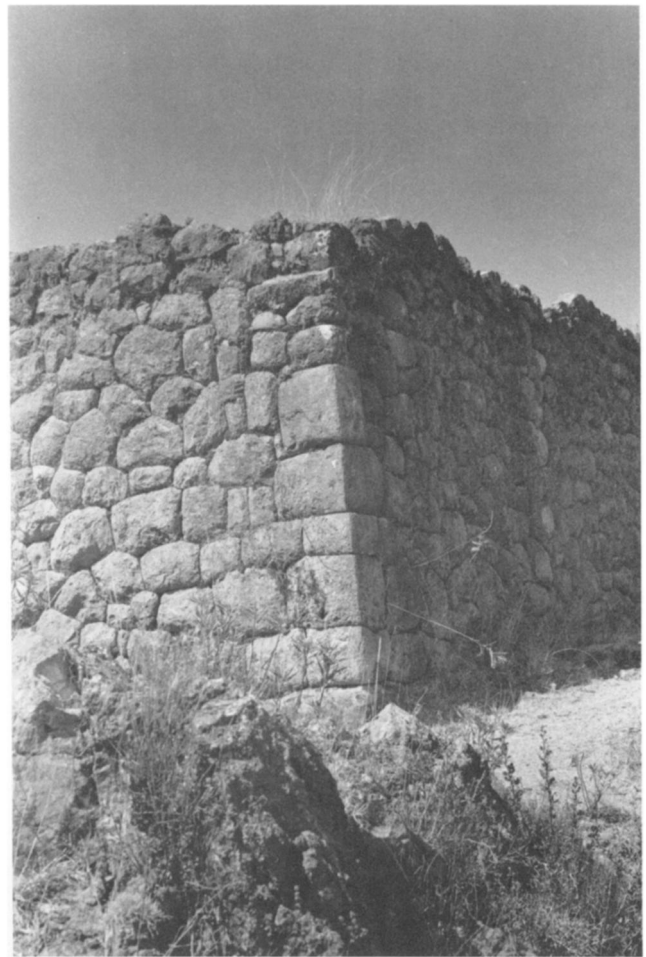


Fig. 16. Detail, exterior building corner from Rumi Wasi, Building 1, rear wall (author).

served on the outside of buildings. There is some evidence from exterior walls to support the manner of construction proposed. In the northeast exterior wall of Building 4 there is a horizontal seam in a wall which is in other regards not coursed (Fig. 15; the seam is not conspicuous but can be seen as a slight disjuncture in the masonry on the end wall, above the level of the sixth cornerstone from the bottom). This would be the level to which the wall was built up before niche placement on the interior.

#### *Building frames*

The problem of arranging niches in buildings can be solved by providing half-built walls with niche frames. The Incas devised an analogous solution to the problem of placing buildings with respect to the relative location of natural and architectural features that were deemed important by using corners as “building frames” to set the position of the foundations.

In most Inca structures exterior corners are composed of relatively well-worked blocks, usually larger than those in the rest of the wall. Cornerstones usually pertain to each of the walls meeting at the corner (Fig. 16; and see Fig. 15). The corners



Fig. 17. Front wall, Building 1, Rumi Wasi, with coursed doorway edge (author).

have a similar visual impact relative to the exterior walls as the niche frames have to the interior walls, and they probably serve much the same function. The placement of exterior corners first would allow the critical points of the building to be laid out so that errors could be corrected on the ground before the building got started. The carefully worked corners, coursed like a column, could also show the angle of inclination of the wall and could set its height. The corners thus laid were perhaps more durable, and because the cornerstones formed part of two walls the building could be constructed without unsightly and structurally unsound vertical seams at the meeting of two walls. The edges of doorways are likewise well worked and appear to have been seen as critical points in framing the upper portion of the front wall (Fig. 17). It seems likely that buildings were constructed from the corners in toward the center of walls. This observation suggests the possibility that workers on construction crews were disposed in such a way as to work simultaneously from the ends of walls, meeting in the center.

Examination of interior building corners supports the view that exterior corners were set first, and that interior construction followed. Most Inca structures of intermediate and fieldstone masonry have slightly rounded interior building corners (see Fig. 9). It is possible to account for this observation by arguing that the inside corners were placed like a layer on pre-existing outside corners. Unless particular care was taken in setting up the corner, by carefully coursing stones, for example, a rounded corner is likely to result when one is building an interior by continuing the surface of one wall around to the adjacent wall. I have the impression that in some buildings interior construction proceeded from a single starting point, continuing around the inside. A few Inca interior corners show a distinct vertical seam, a pattern which would result from completing one wall at a time so that later walls abut a finished one.<sup>15</sup>

15. The illustration of an open-front structure from Machu Picchu shows such a seam. Hemming and Ranney, *Monuments*, 32.

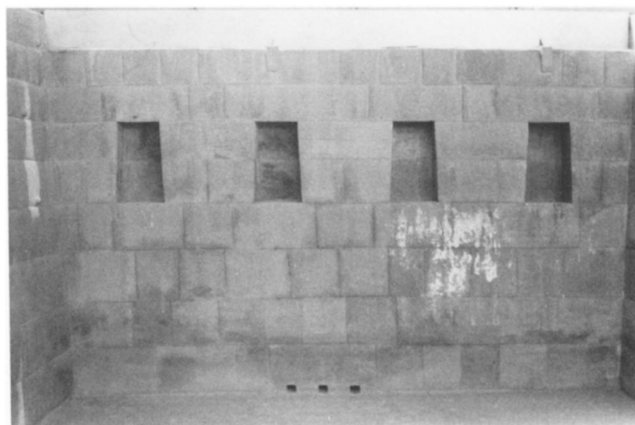


Fig. 18. Niched wall between two buildings, the Qorikancha in Cuzco (author).

One final observation to be made about building frames is that a first course of blocks for the exterior walls, at least, was laid out before the upper portion of the walls was set by building up the corners. The evidence for this suggestion is the presence of perfectly even coursing just above ground level on some structures. This subsoil course is most noticeable in the central wall of the temple of Viracocha at Raqchi, where it continues even through the open space of the doorways, but it also shows clearly in published photographs of the puma gates at Huánuco Pampa and in an entryway from Mawk'allaqta.<sup>16</sup> In the unexcavated foundation of Building 1 at Rumi Wasi, a straight course can be seen along the front wall just at ground level (see Fig. 15). Without excavation, it is not possible to tell whether this feature is evidence of a single course laid to set the line of the wall or if it is the top of a deeper subsurface foundation laid and then filled in to stabilize the walls to a ground level from which the walls would be built up. In either case, it appears that the plan of buildings was delineated on the ground as part of the framing of the structure.

### Conclusions

In solving the problem of constructing uniform niches arranged symmetrically in buildings, the Inca devised a means of construction that has left its mark in the standing walls of many sites. The observation of niched wall construction in standing architecture also gives insight into more general points about Inca aesthetics, status, and work patterns.

It might seem to be a conflict of Inca aesthetic values to tolerate poorly fitted blocks in the masonry in the spaces between

16. The Temple of Viracocha is shown by Gasparini and Margolies, *Inca Architecture*, 246, Fig. 232; 252, Fig. 238; 254, Fig. 241; Hemming and Ranney, *Monuments*, 190. The puma gates at Huánuco Pampa are illustrated by Hemming and Ranney, *Monuments*, 199, and by Craig Morris and Donald E. Thompson, *Huánuco Pampa: An Inca City and its Hinterland*, London, 1985, 68, Pl. III and IV. An entryway at Mawk'allaqta is shown by Gasparini and Margolies, *Inca Architecture*, 219, Fig. 208.





Fig. 19. Niched building interior, Machu Picchu (author).

carefully laid-out niches, but there is an explanation for this otherwise sloppy looking wall construction. A number of building interiors in intermediate and fieldstone masonry structures show traces of one or more thick coats of clay used to even out and cover the wall. I have seen clay coatings that are up to 3.5 cm thick. While most of the plastered walls around Cuzco are badly weathered, one could imagine that a thick coat of clay would mask disjunctions in the fit of blocks on a wall and could be used to square off the sides and backs of niches.

The rules outlined for niche placement hold well for intermediate style masonry and seem to account for fieldstone structures as well. The Incas commonly used aspects of form, scale, and complexity to mark prestige differences in their architecture, and it is not surprising that the highest quality walls do not always show the method of niche construction noted. High quality walls often use careful fitting or coursing to achieve an even wall height without the need for filling in with smaller blocks. In such walls, the fit of blocks in the space between niches shows no discontinuity with the lower courses because the component blocks are so carefully fitted and worked. The highest quality walls, such as those of the Qorikancha (Fig. 18) and some at Machu Picchu (Fig. 19), generally have the smallest number of blocks between the niches and often show carefully worked blocks forming both the niche side and the interniche space. In the most extreme examples, one worked stone will form parts of two different niche frames and the intervening space, as seen in the terrace wall at Ollantaytambo.<sup>17</sup> In the Temple of Three Windows at Machu Picchu, in which the three central windows are flanked by two blocked windows, the

17. The niched wall at Ollantaytambo is illustrated by Gasparini and Margolies, *Inca Architecture*, 74, Fig. 57, and by Hemming and Ranney, *Monuments*, 33, 107.



Fig. 20. Central window, the Temple of Three Windows, Machu Picchu (author).

height of these features does not follow the courses at all; rather, they are carved into a course of finely worked blocks (Fig. 20). Fancy walls often are composed of two layers of blocks worked on all the surfaces that meet, so niche backs could have been formed by the rear side of blocks of the outer wall layer. In the highest quality walls, a good deal of work would have gone into the preparation of blocks used in the courses, demonstrating lavish use of labor. One might surmise that the masons working on these buildings were more skilled or more closely supervised than those working on intermediate style buildings, as it is obvious from the way that niches are created that there is little room to correct errors easily in the highest quality walls.

We can deduce certain principles of Inca organization from the construction rules observed in the architecture. Use of niche frames to place niches allows for the possibility that a niche boss, expert in the rules of niche placement, could oversee the positioning of frames by relatively unskilled workers. Further, the use of building frames to set the orientation of buildings would allow a building boss to set up a number of buildings so that different gangs of laborers could work on many identical constructions simultaneously, minimizing the possibility of individual innovation and mistakes. Such a ratio of overseers to workers is in keeping with what we know about Inca organization of workers into decimal groups, and it is in line with what we might expect for solving the problem of managing conscripted labor.<sup>18</sup>

18. The Inca policy of tribute in labor is noted in a number of 16th- and 17th-century sources. Modern discussions are provided in Rowe, "Inca Culture," 263–269; and in John H. Rowe, "Inca Policies and Institutions Relating to the Cultural Unification of the Empire," in *The Inca and Aztec States 1400–1800: Anthropology and History*, ed. G. Collier, R. Rosaldo, and J. Wirth, New York, 93–118.