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Masonry buildings at Piedras Negras
which lacked the "Maya Arch".

Abstract

Unpublished plans and data respecting certain buildings at the Maya "Old Empire" site Piedras Negras is presented. The information used has been gathered by Dr. J. Alden Mason and by the writer working under his direction during three Eldridge R. Johnson Expeditions to Middle America, and during two subsequent seasons, all on behalf of the University Museum, University of Pennsylvania.

The buildings discussed are distinguished from those usually called to mind by the term "Maya Architecture" since in them the masonry vaulted roof or "Maya Arch" was not used. They are therefore not subject to structural limitations on wall thickness and room width which are imposed by the heavy vault and its side-thrusts.

The ground plans are seen to fall into the categories generally applied to vaulted buildings, with a considerable variety in temple plans.

Non-vaulted buildings are shown to occur at plaza level, on low platform, on low and high platform-like terraces, and on pyramids.

In some of these buildings it is probable that masonry walls or piers were combined with the use of wooden posts and wattle-and-daub walls.

Although free of structural limitations imposed by vaulted roofs, certain of these buildings combine thick walls with narrow rooms, while others do not.

Some non-vaulted ground plans are duplicated, to greater or less degree, in vaulted buildings at the same site.

Two non-vaulted buildings are shown by stratigraphy ^{to be earlier} than, in each case, certain vaulted buildings which can be provisionally and approximately dated in Maya chronology, by associated monuments. A third non-vaulted building is a proximately dated by similar association.

It is concluded that:

At this site small and inconspicuous, and also large and

Abstract • Masonry Buildings at Piedras Negras -2.

imposing Maya buildings were erected ^{with} the vaulted roof.

Non-vaulted types include the use of the masonry pier, resulting in well ventilated and well lighted rooms.

At least one very large temple chamber was constructed in fairly early Old Empire times.

The following hypotheses are suggested by the facts presented, but require corroboration:

In the western part of the southern Maya area imposing masonry buildings may have developed directly from wooden prototypes, or may be derived from other areas where such a development took place.

Buildings of this type formed part of a typical southern Maya material culture, ~~xxxxxxxxxxxxxxxxxxxx~~ apart from the vault itself and associated traits.

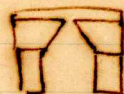
In tracing the historical origin and development of Maya architecture in general it is necessary to distinguish sharply between vaulted and non-vaulted buildings, because of the structural problems present in the former and absent in the latter type; nevertheless factors other than the vault may bring about thick walls and narrow rooms.

The probable chronological positions of certain of the non-vaulted temples discussed suggest that Maya culture was at this site well advanced on other lines before the vaulted roof came into use.

I want to discuss the non-vaulted ceremonially important buildings at a particular southern Maya site as opposed to those at the same site which were roofed with the "Maya arch".

Having grouped particular buildings in this negative way I should explain why.

The Maya vault is formed by two masonry cantilevers which support the final roof-cap of concrete or plastered flag-stones.



It is heavy ↓

It introduces side thrusts which ~~tend~~ to distribute the load unevenly on the walls outer walls or piers.

Either the weight or the thrusts increase if the span is widened or the outer walls are made thinner.

The vaulted roof therefore imposes technical limits on the walls and the plan:

It discourages wide rooms, thin or high walls, or weakening them by the introduction of multiple doorways separated by pier.

Two other roof types may have been available to the early Maya.

The beam-and-mortar roof

The thatch roof supported on wooden trusses.



These are relatively very light, and introduce no side thrusts.

~~The~~ ~~advantages~~ structural limitations being so different, buildings of the same function but differing roof construction must be divided into two groups for preliminary analysis.

There is an additional region for doing so at Piedras Negras. In general discussions of Maya architecture vaulted buildings are usually meant. They are distributed all over the Maya lowland area, ~~even where stone is present~~, and ~~even in some instances where it is not~~. Little attempt has been made to picture a typical Maya center without them.

at Piedras Negras, the ~~non-vaulted temples outnumber the vaulted~~; the ~~Type X buildings surviving long buildings - the so-called palaces~~ include a respectable showing of non-vaulted examples. Considering important ceremonial buildings only, this site is almost as much a non-vaulted as a vaulted ~~site~~ center. For this reason it may be interesting ^{to} pass typical plans in rapid review.

I ~~should say frankly that we think most or all of the non-vaulted buildings to be mentioned pre-date all of the vaulted ones and certain evidence~~ ^{for this} will be referred to. But this is ~~hardly established~~; the main point is that non-vaulted buildings are here entirely at home in an otherwise typical Maya site.

The actual proportion of non-vaulted temples so far known (including all pyramid temples at the surface) is 12 out of 18. Ten of these survived to the end, at which time there were 10 out of 16.

At the end there were ^{non-vaulted} 4 ^{non-vaulted} out of 15 palaces, with 4 or 5 ~~untested but unsampled~~ mounds suspected ~~as non-vaulted~~ as palaces, certainly non-vaulted.

There are eight "Type X" buildings, which we think were sweat houses. Probably only one of these used the vault, ~~though~~ ~~the~~

The plans result from work by J. Alden Mason and myself under his direction, ^{during 5 seasons} ~~while~~ at Piedras Negras for the University ^{of Pa.} Museum.

~~slide~~ → The first slide shows only temples. The principles of identification are these. Twelve ~~temp~~ ^{of the final period} buildings are called temples because they are isolated on pyramidal substructures from 8 to 30 meters high, and usually furnished with stelae.

Eleven of these #12 contained a ~~peal~~ peculiar stone column altar. We take this as an additional criterion for identifying other buildings which contain it, since ~~it always is the center of interest of the room in which it is found~~. On this principal we identify certain buildings not on the orthodox pyramid.

I have shown 2 vaulted temples at the top of the plate for purposes of comparison.

Str. K-S-151 is the type for 4 of the 6 vaulted temples.

~~It is~~

The chamber is small, has 3 doorways, a low sill along the rear wall, and a niche for the column altar at the center.

Str. J-29 is shown very much restored, ~~at~~ but in perspective and as if cut in half. Its plan is identical with those mentioned except that the rear wall is a thick mass of fill, presumably for the support of a roof comb. This is pierced by a flue, probably to carry off smoke from the fires around the altar. ~~to~~

The flue probably was a part of the complex in the other 4 temples, but they had fallen below the probable level.

The only other vaulted temple, Str. O-13, is entirely different in plan, originally consisting of one very narrow room behind the other, and is the temple which lacked the ~~at~~ column altar, apparently. ~~These~~

The rest of these plans are of non-vaulted temples.

Str. K-S-3d, two levels below K-S-151 presents the largest room of which I know in the Old Empire area. The span is 5 meters, the length about 18 meters.

The column altar is in the center of the room. There is no niche or ventilator. A deep and relatively high bench runs ~~across the~~ along the rear wall. Perhaps the mere sill of other temples is reminiscent of this bench. There are 3 doorways.

Str. R-9, ^{of a pyramid} on the surface, in another part of the city, seems to have had the same plan. The piers are certain, the walls ~~no~~ by no means. The altar seemed to be in place ~~as shown~~. One other ^{pyramid} temple seems to have been the same, though walls again could not be identified. Possibly they were in kind of perishable materials.

Str. R-3-12¹, on the surface in the same group, seems to bridge the gap between K-5-3d + K-5-12¹ in that the low sill is present, but the altar was apparently in the center of the room and not in a niche. On the other hand it has a single doorway.

Two other pyramid temples seem to conform to this type, though badly destroyed, possibly intentionally. ~~Of one~~

Str. J-7-Sub 2 is apparently on a small buried pyramid. It lacks the altar but was divided into three tiny cells, as was one of the vaulted temples by secondary modification.

The partition walls must have been of wattle-and-daub, and therefore we restore wooden posts. The whole front of the ruin was removed at the time of burial by later construction. Notice the difference in size between this and K-5-3d, above it on the slide.

Str. O-16 rests directly on the plaza floor, without any substructure other than the usual plinth. The altar was displaced, but its central position^{is} marked by a cache.

Str. U-3 is unique in plan for this city. In this case the altar has not been looked for. Since this is on a low platform the identification ^{as a} ~~as a~~ temple may be wrong.

But Str. O-15 is also on a low platform. This plan is also unique. The front gallery is secondary. There are two doorways, the niche and altar are in the front instead of the rear wall, a rectangular bench appearing against the rear wall.

It is quite possible that the front gallery of U-3 is also secondary.

slide

Palace here is a term of convenience for buildings never isolated on high pyramids, usually long, nearly always with multiple doorways, often more than three. They occur in two main types - double ranged and single ranged. The double range palaces always have additional transverse rooms.

Str. J-12 is a non-vaulted double range palace - the only example known, possibly a survival of many.

The plan is so typical of the 7 vaulted examples that none are shown. Two of the vaulted examples duplicate this plan in every particular except proportions and dimensions.

It consists of two long open galleries, communicating with each other and with the transverse end rooms.

The single range vaulted temples, 4 in number ~~are all~~ form a unique group in being built out from terracing of the Acropolis hill, so that there is no free standing rear wall. None have the transverse end rooms. They are an obvious adaptation to the terrain and special requirements.

R'm 3 of the composite Str. J.6 is ^{shown} ~~illustrated~~ as an illustration of the vaulted ~~type~~ group.

Str. S-18 is non vaulted. Like the complete and final J-6, it has nine doorways. End and rear walls stand free as in all non-vaulted palaces, which are not found where special requirements were limited. Apart from this they are essentially identical with the vaulted examples in plan. Str. S-17 is very similar, but has only seven doorways. There are probably two or three examples with only three doorways nearby.

Str. O-18 is thus far unique. The ruin consists only of the small mounds left by the piers. Apparently there were no walls, unless of wattle and daub. Given a thatched roof, this would differ little from a modern Maya *hau*, with the substitution of ~~stone~~ masonry piers for wooden posts.

St. N-1 belongs to our Type X. It is a composite building, the very small piers, ~~also~~ about 75 cms. to a side, rather obviously predating the central chamber. Here the piers are joined by walls, very thin.

It seems necessary to postulate a thatched roof over the building as a whole, though the roofing of the central chamber was probably a combination of cantilever vaulting and beam-and-mortar.

The presence of wooden posts in the front must be postulated. There certainly were no stone piers. Post holes were not found, but it must be confessed were not carefully looked for.

This building seems to combine very small post-like piers with ^{wooden posts and} non supporting walls. ~~and a thatch roof.~~

Some of the evidence for the chronological position of these non-vaulted buildings can be sketched. All known plans are represented in the slides.

Slide

It is rather clear that ~~the~~ non-vaulted temples occurred in early P. Negro times. Stela 29 is early in style, and Morley reads its probable contemporaneous date as 9.5.5.0.0. The d.s. reads 9.5.5. after which the inscription breaks off. It was placed at the top of the pyramid, and the carved lintel of the building, very badly weathered, seems to be in the same style.

On the other hand it is certainly not the earliest building in the city, as 2 buildings, probably three, preceded it. (slide).

K-5-3d is three levels below the surface, ~~at~~ on which was found lintel II, with an d.s. 9.9.8. ?? which Morley places as 9.12.10.0.0, a middle period date.

J-7-Sub 2 is 6 building episodes before the latest building above it.

~~The~~ single non-vaulted double range palace is in the same court with typical vaulted ones, one of which is known to have replaced an earlier building in its substructure. We are at liberty to postulate the removal of other non-vaulted palaces to make way for the

2 mins

vaulted mes. All ~~of~~ these are about closely integrated courts in the Acropolis.

All ^(known) nm-vaulted single range palaces occur in the S.E. section, far removed from vaulted examples, and adjoining the S. group which contains all the monuments dating before 9.12.5.0.0. ^(There are probably others in it.) The only exception is Stn O-18, the building leaving only piers.

All nm vaulted ^{pyramid} temples which survived to the end are in the south group with its early stelae, as are two of the three on low platforms. The remaining two are in a cul de sac, cut off from the main ceremonial groups.

That is, both the horizontal distribution and what remains specific associations with monuments exist, suggest an early period date for these buildings, to say nothing of two stratifications.

From another angle, how far back do the vaulted buildings go? It seems safe to assume a fairly orthodox hypothesis - that due to their weight and thrusts of vaults, the earliest vaults must have been on thick walls and over narrow spans. If any of our vaulted buildings go back to the beginning of the city's history, which is fairly early, they will be among the heaviest.

Slide 6 To facilitate matters all vaulted units are listed in this slide, in ~~descending order of~~ in the order of an index reflecting the degree of massiveness. The index is the ^{OUTER} wall thickness divided by the span. Extraneous factors may modify this index, as for instance lack of space, or heavy roof combs, the presence or absence of piers. Whenever there is reason to suspect such factors the direction in which ~~the~~ corrections for them would move the index are indicated by the arrows. On the next line the nature of the factor is indicated.

In nearly all cases the index should show a lighter building if anything.

(J-29)
Among the Temples the lowest postulates a curved panel which was broken up and used in its construction. Presumably because obsolete. Its inscription is illegible.

The next ^(0-13-2nd) follows a platform 5 or 6 meters below it.

Str. K-5-15¹ is the 3^d building on its site, and probably on or after Lintel 7, which Morley puts at 9.12.10.0.0.

Str. R-5 similarly is probably on or after Lintel 4, placed at 9.11.15.0.0.

Thus Four of the 6 vaulted temples, including the two heaviest, are known to post-date other ^{building} activity; two associated dates go back only to about 35 years after the middle of the cycle.

Among the palaces the heaviest ⁽⁵⁻⁹⁾ post-dates ^{building} 6 episodes. The next ⁽⁵⁻²⁾ certainly post-dates one of those, probably all.

A palace ⁽⁵⁻⁶⁾ about in the middle of the series is well dated by its carved throne ~~at~~ at 9.17.15.0.0

The only known vaulted Type X building follows 8 building episodes.

There are only 3 other known vaulted units, and it is certain that not more than 2 or ^{others} 3 will be found on the surface. Of these two are quite or very light, the other ~~is~~ is fairly well dated by Lintel 3 as on or after 9.16.0.0.0, and is the 3^d unit on the spot. There seems little reason to expect buried vaulted buildings in future work.

It seems fairly clear that there was an early ~~to~~ pre-vault period all the city. There is no reason to end this before about the middle of the Cycle 9, though nothing like a precise date can be given. The non-vaulted temples, palaces and type X buildings seem to have given place to vaulted ones, but with not a great deal of fundamental change ^{in plan}. The pyramids ^{building} and the stela ~~carving~~ were in full swing before the change in fashion and the city was more or less completely laid out before the change in fashion occurred. This is the main point to-day, but a few interesting side-lights may be mentioned.

It has been suggested that pyramids were developed before temples were placed ^{upon} ~~before~~ them. Our apparently early temples on low platforms, and on none at all, rather argue the other way.

Until the limitations of the vaulted roof were introduced, temples ~~may not~~ could ^{be} and ~~did~~ were built much larger than later on.

But ~~small~~, and in some cases very "heavy" non-vaulted buildings were built. The reason for this is a problem for which I have no answer. However, very much lighter buildings seem to belong to the pre-vault period.

It is interesting to note that some of the details, such as ~~the~~ very slender piers, widely spaced, combined with wooden posts, as in ~~str.~~ the Type X building, and wattle and daub partitions in a stone walled building, suggest the possibility that these stone buildings have developed directly from wooden prototypes.

It is quite clear that any attempt to evolve the ^{late} stone columns of northern Yucatan from the pier of the Usumocinta, as has been suggested, must reckon with its ~~possible use before the vault was~~ ~~invented~~. The possible ^(early) use ~~there also~~ of in other regions of piers under thatched or beam-and-mortar roofs. These buildings leave inconspicuous mounds, very easily overlooked and difficult to dig.

Finally I want to point out the implications of the situation here in respect to the history of vaulting itself. It is apparently made earlier in the central Peten, where earlier dates ^(also) are found. So far as the west is concerned, that is the probable center of distribution. ~~But~~ for vaulting as well as for carved stelae. But if the city was typically high ^{Maya} culture Maya with the exception of the vault ~~before~~ before it ~~was~~ received that, at an earlier time it may have been occupied for some time before it received the stela complex. In other words the earliest known dates, destruction of monuments aside, do not necessarily tell us when the region was first occupied by temple building Maya. Both in architecture and sculpture they ^(Western Maya) seem to have greatly modified ~~very much~~ greatly what they received from the center.