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Abstract	<p>The Htilominlo Temple is a colossal religious building constructed by King <i>Nātoṅmyā</i> (Nataungmya) (AD 1211-1231) in the early 13th century AD. In addition to the title “Htilominlo”, it is also called ‘<i>Trilokamaṅgalā</i>’ meaning ‘Blessing of the Three Worlds’. It stands magnificently on the side of the Bagan-Nyaung U car road. Architecturally, it is a two-storeyed temple with a voluminous solid core and entresol. It is built of both brick and stone. The brick-bond used in it good and sandstone blocks are interspersed among the bricks. Through the study of the architecture of this temple, the high architectural standard of ancient Myanmar architects can be known. Besides, through the comparative study of Early, Middle and Late Bagan Period temples, evolution of Bagan architecture can be learnt. Moreover, numerous religious building can reflect the living standard of the people of Bagan and their economic, political and religious situations of that time.</p>
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Introduction

Bagan is a region which is teeming with many ancient buildings, historical and cultural heritages of Myanmar. The majority of the ancient buildings in Bagan are religious structures. Out of these religious buildings, *stupa* and temples form the greatest number. In the construction of the *stupa*, relics are enshrined in the topmost stupa or the umbrella or the conical spire or the hemispherical dome. In the temples, the main shrine is built to house Buddha images and the entresols are constructed for pilgrims to go round the temple. Just as the temples differ in size, so also they differ in the architectural design. Especially, they are different from one another in the shape of the plan, the formation of the halls, the construction of the main-body, the lighting system, the formation of entresols, etc. The Htilominlo Temple is one of the temples which possess the best architectural design in Bagan. This temple is built of bricks and reinforcement stone blocks. Using of brick-arches totally free from iron, wood, etc is the distinctiveness of the architecture of this temple. The distinctive architectural works of the Htilominlo Temple such as good brick-bonding, the systematic lay-out of the plan, the consolidated *cañkram* which can bear the colossal main-body for a long time, the good lighting system which can provide the main-body with sufficient light, decoration style of the terraces, construction of the arches which are not only strong but also beautiful, formation of the stair-cases, using hewn sandstone blocks apart from bricks where the temple is easily fragile, and making the entresol level to save bricks and to reduce weight are wonderful architectural works of Bagan Period. In this paper, it will present some architectural works of the Htilominlo Temple such as Use of Reinforcement Sandstone Blocks, Secret Entresol, Arches and Brick Bonds system.

Use of Reinforcement Sandstone Blocks

It is found that although majority of Bagan religious buildings are built of bricks, their important parts are reinforced with blocks of sandstone. In particular, the easily fragile parts of the buildings are reinforced with blocks of sandstone.¹

The Htilominlo Temple is one of the colossal temples in Bagan.² It is found that it was built of clay bricks and reinforced stone blocks. It is made strong with the use of corner-controlling and recess stone blocks. Every corner of the main - body is controlled by right-angular shaped sandstone blocks. The reinforcement stone blocks are sculptured into the right-angular shape in the brick-laid corners above the *Gon Nyin Htaung* (vertical brick works) and the parts above it are carved in dadoes to control the corners.³

A half-hewn stone block is placed under the lower cornice at the base of the main body to change the direction of brick-works.⁴ Thus a brick seems to be corbelled, thus being different from other bricks in direction. If the bricks are laid in a straight line without a change in direction, they will be broken.⁵ Reinforcement stone-blocks are used in the corners of the brick-walls under the crenellations which are above the lower cornice of the main-body of the Htilominlo Temple. Moreover, a right-angular shaped sandstone block is also installed there.

¹ U Myo Nyunt, *ပုဂံစေတီပုထိုးများ၏ပိသုကာနှင့်အနုလင်္ကာ* (*Architectural and Artistic Works of Bagan Pagodas and Temples*), Yangon, Yaung Sin Press, 1st Edition, December 1999, pp.100,101 (Hereafter cited as U MyoNyunt, *Architectural Works of Bagan Temples*)

² Fig-1, Htilominlo Temple

³ Fig-2, Corner sandstone of the Gon Nyin Htaung & carved sandstone dadoes above it

⁴ Fig-3, Reinforcement sandstone block at the corner of the brick laid above the recesses

⁵ Minbu Aung Kyaing & Mg Kyi Pann, *နာမတောင်းများမင်းကြီးကောင်းမှုတော်ထီးလိုမင်းလိုဘုရားကြီး* (*The King Natonmya's Merit; Htilominlo Temple*), Yangon, Htay Yaung Sone Press, 1st Edition, June 2010, p.85, (Hereafter cited as Minbu Aung Kyaing and Mg Kyi Pann, *Htilominlo Temple*)

The right-angular shaped sand-stone blocks are fitted into every corner of the main body and vestibules at 4 feet apart to control the corners.¹ Fitting of the right-angular shaped stone blocks in every interior and exterior corner of the walls at equal distance is the key to the consolidation of the walls of gigantic buildings.² Especially, fitting of elongated stone-blocks into the brick-walls of cantilevers jutting out from the upper cornices of the main - body is simply to support the overlying weight.³ As the cantilevers are protruded, reinforcement stone blocks have to be used to consolidate the whole cornice.⁴ The sandstone projected bands 10 inches in height are fitted 1 foot and 6 inches into the upper parts of the lower and upper storeys of the main body to supported by the protruding parts of the elongated sandstone blocks fitted into the walls, for if the protruding parts are of bricks, they will be small in length and consequently broken easily.⁵ It is found that sandstone blocks are the temples from the plinth up to the upper part of the main body. Moreover, the drain-holes or drain-pipes on the roofs of the Htilominlo Temple are made of hewn sandstone blocks.⁶

Sandstone is carved as door-chandrasilas, door-sockets, threshold stones and floor-slabs in the temples. The remnants show that every opening of the Htilominlo Temple was fitted with the door-leaf at the time of its construction. The door-sockets and the diagonally-crossed stone-slabs which pressed the iron-bar in which the door-posts were put on are found. The door-sockets are square-shaped in outer and circular-shaped in inner.⁷ The southern, western and northern vestibules of the main body are

¹ Fig-4, Right - angular shaped reinforcement sandstone blocks from the corners of the main body

² U Myo Nyunt, *Architectural Works of Bagan Temple*, p. 103

³ Fig-5, Sandstone projection around the main body

⁴ U Myo Nyunt, *Architectural Works of Bagan Temple*, p. 101

⁵ Minbu Aung Kyaing & Mg Kyi Pann, *Htilominlo Temple*, p. 85

⁶ Fig-6, Sandstone drain - pipe

⁷ Fig-7, Sandstone door - socket

flanked by two small rooms, thus totaling 6 small rooms.¹ The threshold stones at the lower frames of the small room are made of hewn sandstone blocks, each measuring 4 feet and 9 inches.² Therefore, it is found that sandstone blocks are used not only to control but also to make the frames of the rooms and threshold stones.

In the construction of Bagan colossal temples, not only bricks but also sandstone blocks would have been used in important parts for their durability. Due to hardness and compactness of sandstone, the bricks-walls could have been stronger. So sandstone blocks would have been used extensively.

Secret Entresol

The Htilominlo Temple is a very large two-storeyed temple, with a very large solid core. Although this temple is classified as two-storeyed, there is a secret entresol level as a passage above the upper floor.³ The spiral stair-case in the eastern vestibule of the ground floor leads to that entresol.⁴ There is an aperture on the wall at the top of the turning of the spiral stair-case.⁵ It measures 2 feet and 9 inches in height and 1 foot and 6 inches in width. It leads into the corridor of the first terrace of the eastern porch.⁶ That terrace corridor has two entrances into entresol.⁷ One is located on the southern end and the other on the northern end, both facing to the east. As both entrances are located in the corridor outside the terrace, they cannot be easily visible.

¹ Fig-8, Small room in the main body

² Fig-9, Sandstone threshold at the lower frame of the small room

³ Fig-10, Secret entresol Plan (Adapted from Pichard, *Inventory*, Vol-VII, p.93)

⁴ Fig-11, Stair-case of the ground floor

⁵ Fig-12, Aperture on the wall at the top of stair-case

⁶ Fig-13, First terrace of the eastern porch

⁷ Fig-14, Two entrances into secret entresol

The entrance measures 3 feet in height and 2 feet and 9 inches in width. Both entrances are of the same shape. Four steps down that entresol is the long cave which is the entrance to the entresol.¹ The right wall of the long cave which is the southern entrance is not blank but there are two steps at the base on which damaged sandstone Buddha images are placed in rows.² The left wall of the long cave, which is the northern entrance, has likewise two steps at its base. These steps are connected with the wall which has a small entrance into the entresol.³ The bricks in the connection with the wall in the southern cave are heavily damaged.⁴ So it does not give clear information about it. But, generally the shapes and the sizes of the southern and northern long caves are the same. The damaged Buddha images are preserved and placed on the interior wall of the northern cave. The southern long cave measures 9 feet and 8 inches in height, its ceiling 6 feet in width, its floor 4 feet and 8 inches in width and 40 feet and 1 inch from the east to the west respectively. There stands a high wall at the end of the southern entrance long cave. A casual look convinces one that it is a solid wall without any openings. But there is a small hole big enough just for a person to pass through at the top of it near the vaulted roof.⁵ It is only 2 feet and 1 inch in height. If one ascends the wall, passes through the small hole and descends, one will reach the entresol.⁶

The secret entresol is 13 feet and 7 inches high from its floor up to its ceiling. Starting from this point, the whole entresol is pitch dark, for it is made exclusively as a secret cave with no aperture along it. The secret entresol encircles the temple, keeping the solid core (central pillar) on the right. Although the floor of the entresol is

¹ Fig-15, Southern entrance of the secret entresol

Fig-16, Northern entrance of the secret entresol

² Fig-17, Southern entrance in which placed damaged sandstone Buddha Images

³ Fig-18, Inside the northern entrance of the secret entresol

⁴ Fig-19, Inside the southern entrance of the secret entresol with small hole

⁵ Fig-20, Small hole inside the northern entrance as inside the southern entrance

⁶ Fig-21, Inside the secret entresol

even and flat, the part of its floor at the top of the vestibule of the ground-floor is uplifted and installed with a flight of steps.¹ The secret entresol curves around the central pillar.² The secret entresol ends on the northern side. At the end of the secret entresol, there is a stair-case with a small hole at the top.³ The other small hole stands on the opposite wall. Therefore, near end of the secret entresol stand two small brick-walls with a hole each. These two walls lie between the southern and the northern entrances. There is a space between the two walls, through which the vaulted roof of the eastern vestibule in the ground-floor is visible.⁴ The edge of the hole is not even but rugged with bricks. However, the hole is rounded. The holes on the two opposite walls are two feet apart from each other and they are also some distance apart from the vaulted roof of the vestibule in the ground-floor. The architectural standard of the architects who made that part strong to that extent with the vaulted roof and the floor of the entresol some distance apart is miraculous. The rounded holes are very small and, moreover, these two holes are two feet apart. Therefore, they were connected with a passage with difficulty. The holes are big enough just for a person to pass through with his bent.⁵ Only after passing through these two holes, one can get into the long cave which is the entrance to the southern entresol. The reason of uplifting the floor of the secret entresol and opening small holes at the top may be that the vaulted roof of the vestibule under it is too high. This idea is conceived, for the vaulted roof the vestibule in the ground floor is visible through between the two small holes.

¹ Fig-22, Flight of steps inside the secret entresol

² Fig-23, Secret entresol around the central pillar

³ Fig-24, Stair-case with small hole at the end of the secret entresol

⁴ Fig-25, Vaulted roof of eastern vestibule in the ground floor is visible through the small hole

⁵ Fig-26, Small hole to pass through with difficulty

The vaulted roofs of the two long caves into the entresol are lower than that of the secret entresol. At the end of the long cave is made a vault connecting the two walls. This vault is a radiating double-layered one and the interval between the vaulted roof and the connecting vault is filled with bricks to connect the two walls.¹ The secret entresol is roofed with barrel vaults. The wall of the whole entresol is lined with these alignments of bricks laid horizontally and vertically in the alternate sequence. And they are edged with the brick-frames. The roof of the long cave entrance into the secret entresol is a low vault which is made of the bricks laid from the base horizontally and vertically in the alternate sequence.² A semi-circular double-layered lean-to-vault against the opposite wall is found at a place inside the entresol.³ This entresol is a secret encircling passage.

The main purpose of making the secret entresol is to save bricks and to reduce weight. By thus making an entresol, bricks can be saved and the vaulted roof of the circulating passage right under it is still left to bear less weight. If the entresol is a solid one, the underlying vaulted roof will have to bear heavier weight, thus making it less durable.⁴ Therefore, an entresol had to be constructed right at the centre of the temple simply to make it more durable, to save bricks and to reduce the overlying weight. Besides, as the entresol is constructed exclusively, it is not easily accessible. Consequently, it has not been damaged too much, with the exception of living of bats. The brick-bonds in the floor, flights of steps, vaulted roofs and walls of the entresol are excellent. Moreover, it is found that the vaulting and arching technology of the high standard is applied to the various types of vaults and arches along the entresol. The Bagan architects built such high, gigantic, massive temples with good

¹ Fig-27, Radiating arch connecting between the two walls inside the secret entresol

² Fig-28, Roof of secret entresol

³ Fig-29, Semi-circular double-layered lean-to-vault inside the secret entresol

⁴ Minbu Aung Kyaing & Mg Kyi Pann, *Htilominlo Temple*, p. 84

inspirations to be able to bear the overlying weight. In addition, they could manage to make the secret entresol invisible to the observers from the outside. As they were equipped with such architecture of the high standard, they could build the temples and pagodas systematically and beautifully.

Arches

The essence of the technique of constructing temples in Bagan is to bear the overlying loads with the underlying arches and vaults. The nature of the arches is that the heavier the overlying weight is, the more underlying arches have to be made and the more consolidated they are. Consequently, the underlying arches can bear the overlying loads more stably.¹

The majority of the arches used in the Htilominlo Temple are radiating arch, lean-to-vaults and straight arch. The vaults and arches can be witnessed at the niches, porches and the roofs of vestibules, the corridors of the main-body, the main shrine-hall, spiral stair-cases, windows, entresols, the gate-ways of the enclosure walls, etc. Most of the radiating vaults used in the Htilominlo Temple are of the type of voussoired vaults. They are found driven with wedges. In making voussoired vaults, according to the shape of the vaults, the bricks are gradually laid horizontally to gain height. A triangular shaped space is left when the last two bricks of the two opposite brick-works meet at the top. Then a triangular shaped brick which dovetails with the triangular space at the top of the two brick-works is driven. Thus the work of laying bricks is finished off. By laying bricks layer after layer thus, the size of the arch or the vaults can be made as one wishes. Not only can this type of arch or vault bear the

¹ U Myo Nyunt, *Architecture of Bagan Temple*, p. 40

overlying weight but also it is made stronger and more consolidated due to the overlying weight.¹ It is found that the vestibule of the Htilominlo Temple is skillfully vaulted up to 24 feet with bricks only, with no wood and iron at all.²

All the roofs the four gate-ways of the enclosure wall are cross-vaults.³ The making of cross-vaults is considered the most difficult.⁴ The four parts of the roof which coming upwards on four sides meet at the centre. They do not have beams and joists which bear the overlying weight. Remaining of the vaults and arches of four gate-ways intact for many years due to repeated earth-quakes, except the plaster detached, can be attributed to the high standard of technology of vaulting in those days.

The four vestibules are use radiating vaults in which bricks are laid horizontally. The radiating vaults are three-layered.⁵ In the lateral porches, about the lower half of the radiating vault is made of the alternate sequences of the bricks- one brick laid horizontally and two vertically whereas the upper half of the radiating vault is made of the bricks laid horizontally.⁶ The roofs of the corridors are tunnel vaults.⁷ The vaults of the corridors inside the main body are three-layered radiating ones where the bricks are laid horizontally.⁸ With the exception of the eastern aspect of the above the small chambers on both sides of the main shrines on other three aspects are decorated with flat or straight arches and radiating arches. The radiating arches are three layered with the bricks- one brick laid horizontally and two bricks vertically in

¹ U Myo Nyunt, *Architecture of Bagan Temple*, p.28

² Fig-30, Roof of the vestibule of the Htilominlo Temple

³ Fig-31, Roof of the gate-ways

⁴ Minbu Aung Kyaing, *yk*HacwfAdokumvuf&mrsm; (Architectural works of Bagan Period)*, Yangon Aung Chan Tha Press, 3rd Edition, January, 1997, p. 43 (Hereafter cited as Minbu Aung Kyaing, *Architectural works of Bagan Period*)

⁵ Fig-32, Three-layered radiating arch at the vestibule

⁶ Fig-33, Radiating arch at the lateral porch

⁷ Fig-34, Tunnel vault, roof to the corridor

⁸ Fig-35, Three-layered radiating arches inside the corridor

the alternate sequence.¹ The frame of the small chamber below the radiating arch are made of straight arches with the bricks laid vertically face to face.² The distinctive feature of this arch is that, unlike other arches, they are not curved but erected upright face to face. It is difficult to attach the opposite bricks in the vertical position without any prop. The intervals between the radiating arches and straight arches are filled with the bricks laid sequentially. As the plaster and bricks of the straight arches were not detached due to repeated earth-quakes in Bagan, it is clear that the brick-bond of Bagan period was miraculously good.

In brief, arching and vaulting technology developed with the passing of times and reached its height. So, large and high temples like the Htilominlo Temple could be built during the 13th century A.D. The vaults could be constructed boldly without beams and joists. During the age of science and technology like today, iron-works are used for the durability of buildings. However, the arches and vaults of Bagan Period were made only of bricks without any iron and wood at all. Therefore, arching and vaulting technology of Bagan Period is wonderful and pride-taking.

Brick Bonds

Most of the buildings in ancient Bagan are built of bricks while very few of them are of stone. In addition to the buildings, enclosure-walls are also built of bricks.

The Htilominlo Temple is a temple built of brick.³ The whole main body is made of bricks laid horizontally and vertically in the alternate sequence.⁴

¹ Fig-36, Radiating arch above the small chamber

² Fig-37, Straight arch above the small chamber

³ Fig-38, Brick wall of the Htilominlo Temple

⁴ Fig-39, Alternate the brick laid horizontally and vertically

Consequently, the brick laid cannot be detached from one another. Not only is the whole temple built of bricks laid horizontally and vertically in the alternate sequence but the alignments of bricks made of bricks laid vertically only are also built to consolidate the walls more. These brick-alignments are built round the circumference of the main body. These vertically-laid brick-alignments are called Gon-nyin-htaung and starts from the pedestal at the base of the main body. Building these vertically-laid brick-alignments at the base of the main body as reinforcement can give consolidation to the temple. The spots from which some glazed sand-stone slabs are peeled off show that the underlying alignments of bricks on which there are horizontal of recesses covered with glazed sandstone slabs on the pedestal at the base of the main-body are vertically-laid brick-alignments.¹ Besides, the curvilinear roof on the pedestal at the base of the main body is supported by vertically-laid brick-alignments.² The walls encircling the main body above the pedestal at its base are made of 29 layers of bricks laid vertically and horizontally in the alternate sequence and then an alignment of the bricks laid vertically is also built around the main body, above which come 16 layers of bricks laid vertically and horizontally in the alternate sequence. Again, above these 16 brick layers comes an alignment of the bricks laid vertically. Above this alignment again come alignments of the bricks laid vertically are built 4 feet apart from each other around the main body. Building of such vertically laid-brick alignments means leveling of the laid bricks.³ Only then the brick alignments encircling the main body will be even.

When studying brick-bonds of the Htilominlo Temple, it is found that the bricks are not bonded end to end but laid so closely that even the tip of a needle

¹ Fig-40, Vertically bricks alignments on which covered with glazed sandstone slabs

² Fig-41, Vertically bricks alignments supported to the curvilinear roof

³ Fig-42, Vertically brick alignment

cannot be driven into the space between them. Apart from it, another peculiarity is that the necessary figures are carved on the original brick-works rather than on the plastered surface of the brick-works.¹ In laying bricks in the section from the plinth up to the umbrella, unbaked bricks of various sizes are moulded to be able to form such decorative works as back-drops, hooks of back-drops, kalasapots, cornices, ogees, mayobalans, lotus flowers, projected corners, curvilinear roofs, projected bands, etc.² Then they are baked. Thus the decorative works of parts of the temple can be created by laying up the already moulded baked-bricks.³ The bricks are not laid end to end but are hewn in floral designs. Although cement is detached from some back-drops of the Htilominlo Temple, flames of dummy pediments are carved. As a consequence, the back-drops still remain beautiful and tidy. The hooks on the back-drops are also found carved beautifully and tidily on the original brick sections. Therefore, the detailed parts of the whole temple smoothed in the original brick-works before being covered with cement reflect the high skill of the architect of the age of temple-building and their good brick-bond system.

Bricks have to be laid with the greatest difficulty in arching or vaulting.⁴ In the Htilominlo Temple, with the exception of refilling some places of vaults with a few bricks, any bricks are not peeled off from the vaults. This proves the good brick-bond system of this temple. Besides, except the eastern face at the Htilominlo Temple, the straight-arches above the cells on the right and left sides of the shrine room on other

¹ U Myo Nyunt, *Architecture of Bagan Temple*, pp. 95

² Fig-43, Decorative works of bricks

(a) Decorative brick art works of hooks of back-drops

(b) Decorative brick art works in the head of stair-cases as the shape of young mangoes fruits

(c) Decorative brick art works in the roof of stair-cases

³ Bo mhu Bashin, “yk*HacwfAdokumESifhtEkynmrsm;ay:aygufwdk;wufajymif;vJvmyHk” (“The Development of the Art and Architecture of Bagan Period”), *Journal of Literary and Social science*, 1969, p.38 (Hereafter cited as Bomhu Ba Shin, “Development of Art and Architecture”)

⁴ U Myo Nyunt, *Architectural Works of Bagan Temple*, pp. 96

three faces of the main body are made with very difficult brick-bond system.¹ There, the bricks inclining slightly to one side, have to be laid vertically face to face. Although the straight arch which is 4 feet and 9 inches in width is made only of bricks without wooden imposts, it has remained intact up to today with no brick detached from it at all.

The Htilominlo Temple is one of the large temples of good brick-bond. Although red-earth mortar is used in laying bricks, the durability of this temple up to today is due to its good brick-bond system. Due to the good brick-bond system, bricks are not detached from the walls of the main body and vaults of the Htilominlo Temple. With the exception of a little renovation given to some parts of the main body and vaults, the damage is too little remaining of the Htilominlo Temple in situ is attributed to its good brick-bond system.

¹ U Myo Nyunt, *Architectural Works of Bagan Temple*, pp. 96

Conclusion

No brick human residence but numerous religious structures such as stupas, temples, pagodas, etc are found either intact or in ruin in Old Bagan. The reason is that as the people of Bagan were very devoted to religion, they constructed the buildings related to the Triple Gem of brick and stone in a grand manner but their houses of easily perishable wood, bamboo, etc. The temples have one entrance or four entrances. However, in Bagan, the temples with four entrances are the most common. The Early Bagan temples called Mon temples are one-storeyed temples being in repose style. The most obvious fact is that it is dark inside the temples. The striking characteristics of the 12th century AD Middle Bagan Period, which is the transitional period of architecture, are that the vestibules are made to get more light and the temples are made high with more storeys. Getting more light and air by opening four porches and windows and making direct access into the main shrines and vestibules from the lateral porches are the proto-types of Late Bagan Period temples.

During the 13th century AD when the architecture of the temple reached its zenith, Bagan temples are the modified ones of Early Bagan temples which are built based on Sri Ksetra temples. The temples built during the 13th century AD which is Late Bagan Period, are called Myanmar style temples. The 13th century AD temples are higher than those of the 12th century AD. As they take on a higher form and bear the sense of 'bravery', they assume the energetic style called '*Vīra*' in Pali. As an invention, distinctive room-formation was started on the ground plan. As the main body received enough light and air and was endowed with stone and stucco carvings which are more elaborate than those of Early Bagan Period, it can be said that the art and architectural standards of Late Bagan Period improved more.

The Htilominlo Temple, which belongs to the 13th century AD, which is Late Bagan Period, is a Myanmar style temple of high architectural standard and excellent stucco works. Unlike the Early Bagan Period stubby temples which are built emphasizing horizontal lines, this temple is built high emphasizing vertical lines. As the solid core of the Htilominlo Temple is very large, strong and high, it can support such a gigantic edifice. The thoughts and skill on architecture of ancient Myanmar architects who built such a large solid core which fits this colossal temple can be known. In addition to the solid core, the base pedestal of the main body which can bear the overlying weight of the whole temple is very strong. As entresol between the ground floor and the first storey could be built to reduce the overlying weight and to bear the weight for a long time, it can be assumed that excellent architectural technologies would have appeared at that time. Moreover, wide arches and vaults of the Htilominlo Temple are made entirely of bricks, with no wood at all. Therefore, it can be assumed that the art of brick-bond and arching and vaulting technology developed at that time.

The brick-bond of the Htilominlo Temple is excellent. In making brick-walls, the system of laying brick horizontally and vertically in the alternate sequence was used. To adjust the brick-works, the vertically-laid brick alignments are built around the main body four or five feet apart from each other. This brick-laying system is not used in the Sulamani Temple built in the 12th century AD. Instead, sand stone blocks are interspersed among the bricks as reinforcements. It seems that, although architects used sand stone extensively with their confidence in its durability, they were not brave enough to use bricks only. In the Htilominlo Temple which was built the 13th century which belongs to Late Bagan Period, sand stone is used mainly in the corners, but not in other places of the walls of the main body. The people of Bagan period

seemed to know the compactness and resistance of sandstone. Moreover, they would have been acquainted with architectural knowledge as to which parts of the edifices were easily fragile and that they would be stronger if sand stone blocks were used there. But it is thought that architects might have known how to lay only bricks in a more consolidated manner. Therefore, it can be considered that the art of brick-bond developed at that time. The technique of mixing bricks with sand stone proves that the architectural standard of Bagan period was high. According to the tradition of the architectural works of Late Bagan Period, windows and lateral porches are kept open to get more air and light. In the construction of the Htilominlo Temple, not only is emphasis placed on the great height of the temple but also small chambers on either side of the vestibules on the faces except the eastern vestibule are built as peculiar formation of rooms.

In brief, the people of Bagan might have received architectural heritages, from Sri Ksetra, architectural technologies from Thaton and culture and arts from India about at the same time. Then they could have combined and adapted these diverse technologies and arts to their environment. The construction of the grand Myanmar style Htilominlo Temple can be ascribed to the combination of modern and changing ideas of the Bagan architects, their higher architectural technologies and the great confidence of King Nātoṇmyā in the Sāsana. Despite repeated weatherings for many years, this temple can stand intact up to today. This suggests that the technology of constructing temple would develop with great momentum at that time. Through the study of the architecture and arts of the Htilominlo Temple, the political, economic and religious conditions of Bagan at the time, in addition to the architectural standard of ancient Myanmar architects and their expertise in making excellently artistic works, can be known.



Fig-1, Htilominlo Temple

Photo by researcher



Fig-2, Corner sandstone of the GonNyinHtaung and carved sandstone dadoes above it



Fig-3, Reinforcement sandstone block at the corner of the brick laid above the recesses

Photos by Researcher



Fig-4, Right-angular shape reinforcement sandstone blocks from the corners of the main-body



Fig-5, Sandstone projection around the main body

Photos by Researcher



Fig-6, Sandstone drain-pipe



Fig-7, Sandstone door-socket

Photos by Researcher



Fig-8, Small room in the main-body



Fig-9, Sandstone threshold at the lower frame of the small room

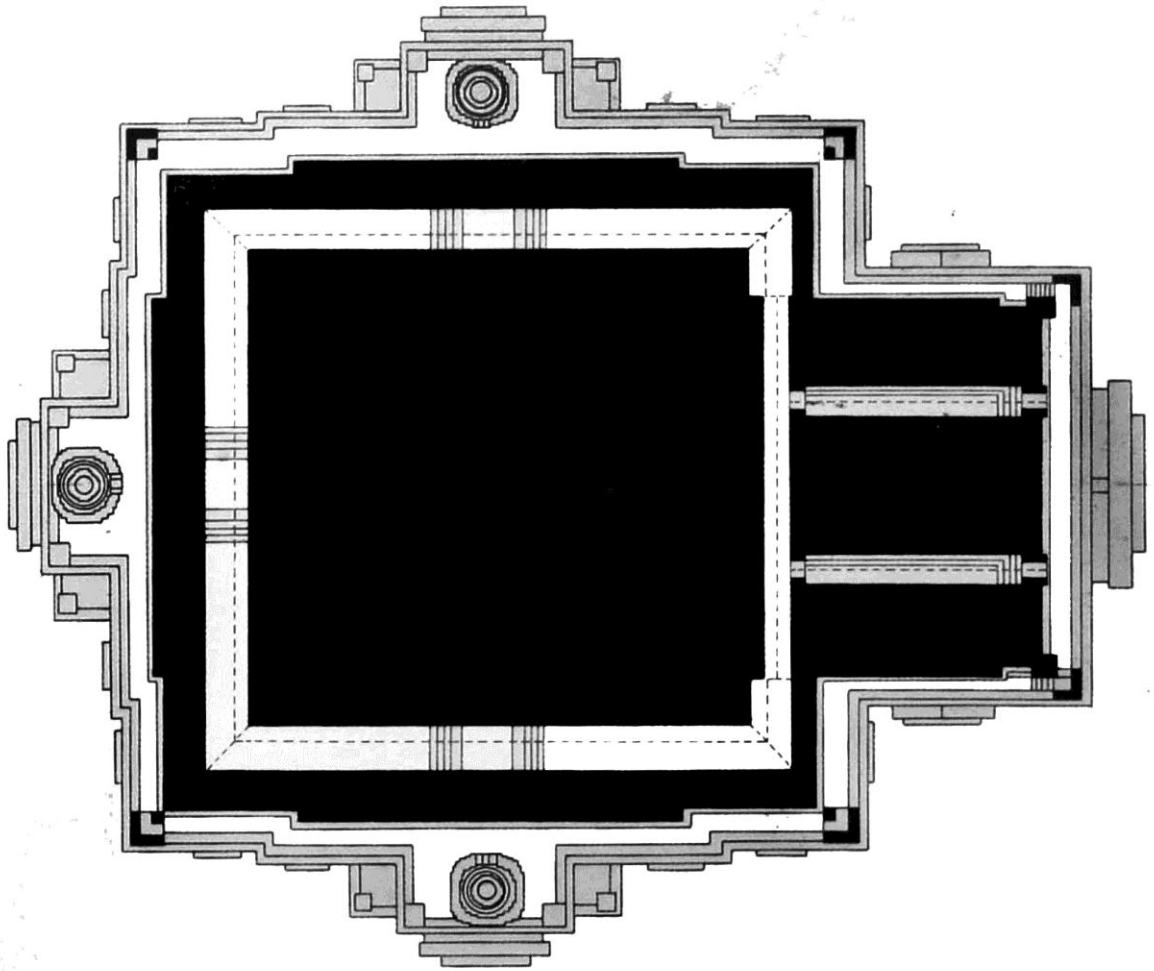


Fig-10, Secret Entresol plan of the Htilominlo Temple

(Adapted from Pichard: *Inventory*, p. 93)



Fig-11, Stair-case of the ground floor

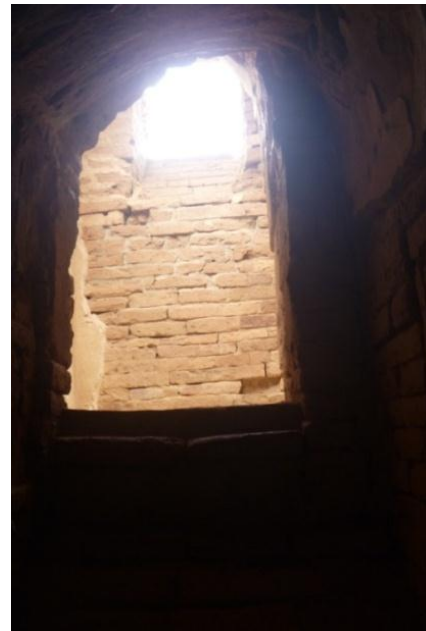


Fig-12, Aperture on the wall at the top of stair-case



Fig-13, First terrace of the eastern porch

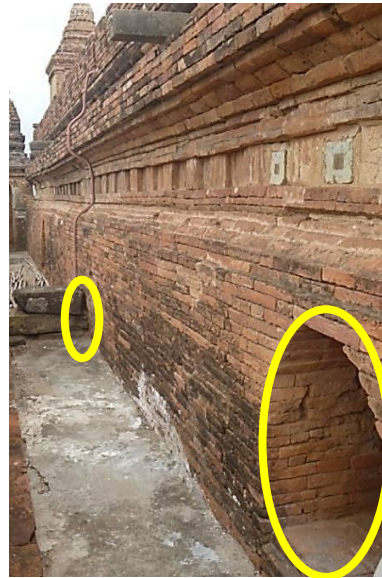


Fig-14, Two entrances into secret entresol

Photos by researcher



Fig-15, Southern entrance



Fig-16, Northern entrance



Fig-17, Southern long cave



Fig-18, Northern long cave



Fig-19, Small hole (Southern entrance)



Fig-20, Small hole (Northern entrance)



Fig-21, Inside the secret entresol



Fig-22, Flight of steps inside the secret entresol



Fig-23, Secret entresol around the central pillar

Photos by researcher



Fig-24, Stair-case with small hole at the end of the secret entresol



Fig-25, Vaulted roof of eastern vestibule in the ground floor is visible through the small hole



Fig-26, Small hole to pass through with difficulty

Photos by researcher



Fig-27, Radiating arch inside the long cave

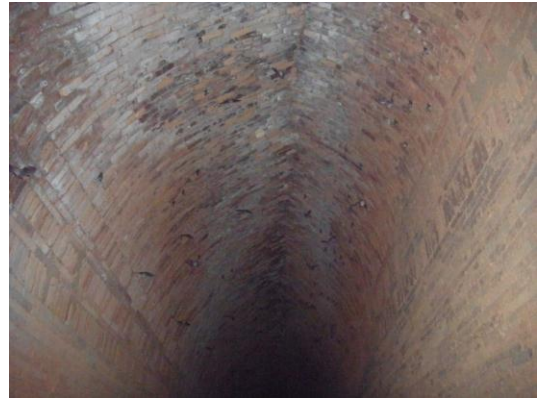


Fig-28, Roof of secret entresol



Fig-29, Semi-circular double-layered lean-to-vault inside the secret entresol

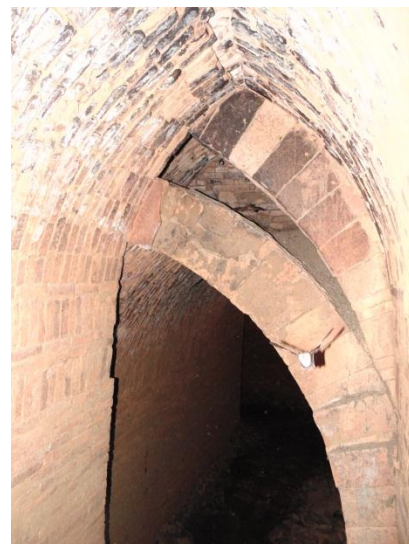


Fig-30, Roof of the vestibule of the Htilominlo Temple

Photos by researcher



Fig-31, Roof of the Gate-way



Fig-32, Three-layered radiating arch at the vestibule

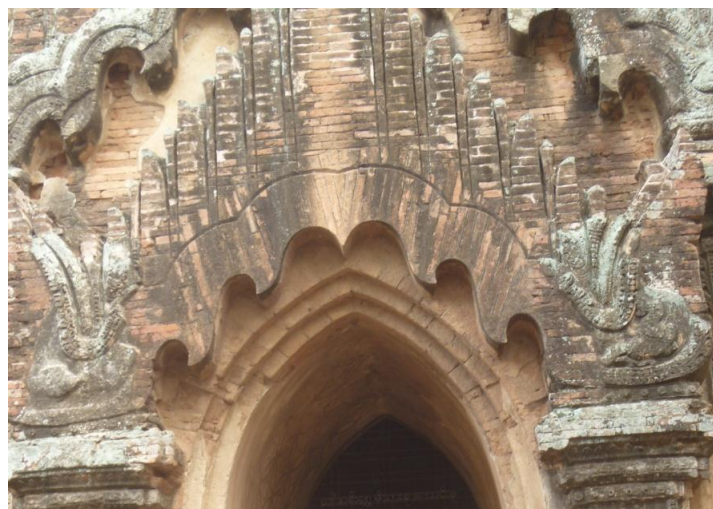


Fig-33, Radiating arch at the lateral porch

Photos by researcher



Fig-34, Tunnel vault, Roof of the corridor



Fig-35, Three-layered radiating arches inside the corridor

Photos by researcher



Fig-36, Radiating arch above the straight arch



Fig-37, Straight arch with the bricks laid vertically face to face



Fig-38, Brick wall of the Htilominlo Temple

Photos by researcher



Fig-39, Alternate the brick laid horizontally and vertically



Fig-40, Vertically bricks alignment on which covered with glazed sandstone slabs

Photos by researcher



Fig-41, Vertically bricks alignments supported to the curvilinear roof

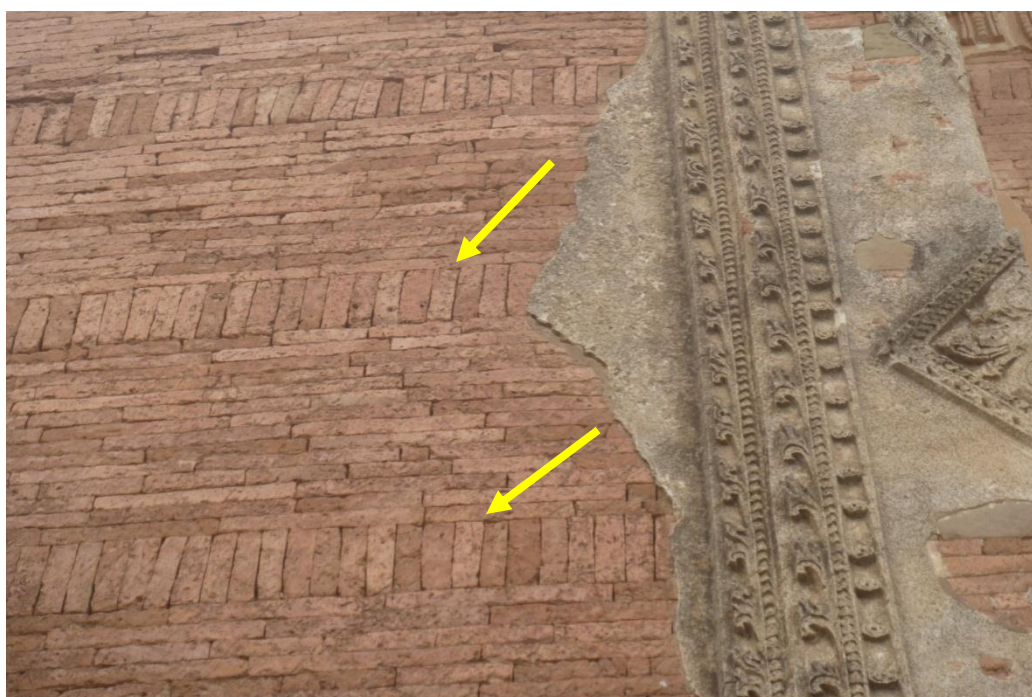


Fig-42, Vertically bricks alignments

Photos by researcher

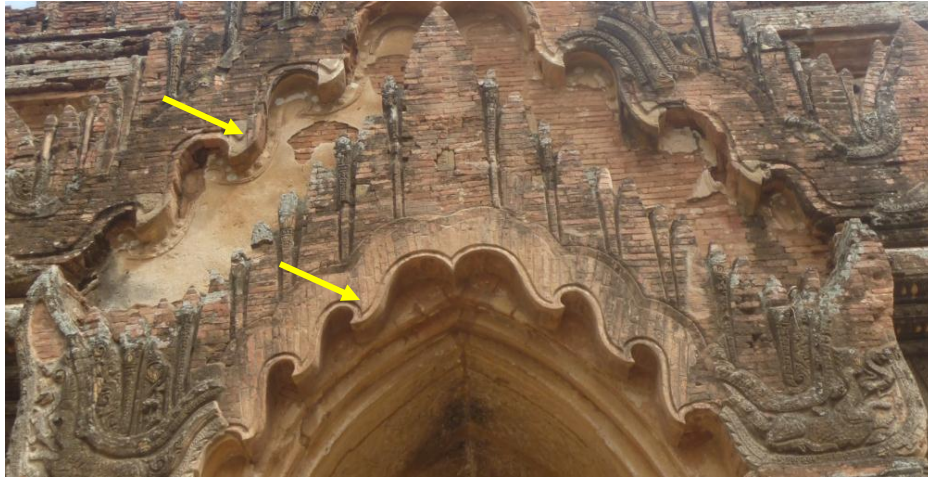


Fig-43(a), Decorative brick art works of hooks of arched pediments



Fig-43(b), Decorative brick art works in the head of stair-cases as the shape of young mangoes fruits



Fig-43(c), Decorative brick art works in the roof of stair-cases

Fig-43, Decorative art works of bricks

Photos by researcher

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