CHAPTER - VII

HISTORICAL CONTEXT, CONSTRUCTION AND CONSERVATION

In order to understand the Muktesvara temple in its proper historical context, it is necessary to know the history of the then ruling dynasty. The Somavamśis, also referred to as the Keśarīs, replaced the rule of the Bhaumakaras sometime in 931 AD. Originally belonging to Dakśīna Kośala, they utilised their matrimonial alliance with the Bhaumakaras to advance their imperial designs. It was Yayāti I who, taking advantage of the declining Bhaumakara power, annexed their kingdom. Thereafter, he united the kingdoms of Kośala and Utkala and made Yayātinagar his capital. And it was only about 1108 AD that the Somavamśis were overthrown by the Eastern Gaṅga ruler, Anantavarman Choḍagaṇḍadeva.

The Somavamśis ushered in a period of stability and progress in all fields, including art and architecture. Their activity brought in a new age for Orissa, that made a lasting impression on the minds of the people. They have left behind traditions that are still in vogue in Orissa. The process of unifying the diverse cultural factors had already been started by the Bhaumas, but the final shape was given by the Somavamśī dynasty, that gave birth to a distinct Orissan culture. From

2. Ibid., p. 155.
the Brahmeśvara temple inscription we come to know that the Somavaṃśis were primarily the kings of Dakṣhiṇa Kośala, and it was Janamejaya who first conquered Odra by killing its king with a kunta. But after him, kośala, Utkala, Konγada and the parts of what was known as Kaliṅga gradually came to be united by cultural and linguistic bonds.

From the sculptures of the temples built in Bhubaneswar during the period, it is difficult to say which was the favoured cult of the Somavaṃśis. They seem to have been cosmopolitan in their religious outlook, retaining all the conventions that had acquired religious sanction through long practice in the preceding centuries. And the revolting practices as were indulged in by the kāpāllikas did not find favour with them. Anyway, the temples built during this period do not furnish any such evidence as are furnished by the Vaitāl temple. Śakti images were sculpted in their terrific forms as seen in the Brahmeśvara, but the only Śākta image that serves as the presiding deity of the Gaurī temple assigned to the Somavaṃśis, is found in the pacific form.

The Somavaṃśis under Yayāti I revived the shrine of Jagannāth at Puri by building a new temple.3 And again the kings of this dynasty built the greatest Śaiva temple at Bhubaneswar - Liṅgarāja and it is the rulers of this dynasty who erected the Gaurī temple and the Brahmeśvara at Bhubaneswar.

The seven mother goddesses near the Mārkandēśvara tank at Puri, were also installed during the Somavamśī period. The temple of Mukteśvara was also a contribution of the Somavamśīs. Janamejaya is said to have performed an Āsvamedha sacrifice while Yayāti Kesāri is credited with the performance of a great sacrifice to which he is said to have invited ten-thousand Brahmanas from Kanyakubja.

We know for certain that Śaivism was the official religion of the Somavamśīs. And from the evidence just mentioned, we can infer that the Somavamśīs were typical Hindus, sticking to a family deity, 'Śiva', of their own, but worshipping all other deities and extending toleration and patronage to all the other sects. The following genealogical table of the Somavamśī dynasty can be reconstructed from the Brahmeśvara temple inscription and the Ratnagiri charter.

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<tr>
<td>2. Yayāti I, Mahāśiva-gupta I (c. A.D. 922-955)</td>
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<td>3. Bhīmaratha, Mahābhavagupta II (c. A.D. 955-980)</td>
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<td>4. Dharmaratha, Mahāśiva-gupta II (c. A.D. 980-1005)</td>
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<td>5. Nahauga, Mahābhavagupta III (c. A.D. 1005-1021)</td>
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<td>6. Yayāti II, Chandihara, Mahāśiva-gupta II (c. A.D. 1025-1040)</td>
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<td>7. Uddyotakesāri, Mahābhavagupta IV (c. A.D. 1040-1065)</td>
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<td>8. Janamejaya II, Mahāśiva-gupta IV (c. A.D. 1065-1085)</td>
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<td>9. Puranjaya, Mahābhavagupta V (c. A.D. 1085-1110)</td>
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<td>10. Karpadeva, Mahāśiva-gupta V (c. A.D. 1110-1140)</td>
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Janamejaya I (882-922 AD)

It was Janamejaya I who founded the Somavamśī dynasty, but no where we find in any record that they were successors of the Pāṇḍuvamśī - Somavamśīs. His ancestral home was probably destroyed by the Kalachuri king, Śaṅkaragāṇa. Driven from his ancestral home Janamejaya took refuge in the Sambalpur tract where he established an independent kingdom with Suvarṇapura (Sonepur) as his capital and thereafter adopted the title of "Trikaliṅgadhipati". From the copper plate grant of his son and successor Yayāti I issued in the eighth year of his reign, we come to know that Svabhāvatunāga (surname of Janamejaya I) became king by his own manliness and by defeating the Chaidyas (Kalachuris), spread the fortunes of his kingdom. It further mentions that he was like the sun to the lotus of the Soma family and was like a full moon in protecting the Kośala country. From this grant it is evident that he was a member of the Somavaṃśa and the kingdom that he founded was in the Kośala country.

From recent discoveries it has been proved that some of the Rāṣṭrakūṭa chiefs were Janamejaya's feudatories. The westward expansion of Kośala was not possible because of the existence of the powerful Kalachuris in that direction. So, it is assumed that he casted his eyes on the coastal region

where the Bhañjas were the most powerful. However, we do not have any record of a conflict among the two.

It was the matrimonial alliance with the Bhaumas, that gave him the chance to interfere in their politics. And from the Brahmesvara inscription of Udyota-keśarī we come to know that Janamejaya killed the Odra king with his kunta, and thereafter must have placed his daughter on the Bhauma throne. However, he didn't annex this Bhauma kingdom, but just had his influence on it.

What can be finally said about Janamejaya is that, he succeeded in establishing a kingdom, kept it intact during his long tenure of kingship and finally handed it down to his successor with expanded territories inspite of opposition from the powerful Kalachuri kingdom. After Janamejaya the successor were better know as the 'Keśarīs'. This fact is proved when we refer to the Mādalā Pāṇji which mentions the names of the Somavaṃśī rulers as Keśarīs.

Yayāti I (922-955 AD)

It was Yayāti I, who shifted the old capital from Survarṇapura to Vinītapura renamed as Yayātinagara on the bank of the Mahānadī river near Baudh. From two charters of Yayāti I and one charter of his son and successor Bhīmaratha we come to know of a border conflict of the Somavaṃśīs with the Kalachuris. Yayāti's major achievement was the annexation of the Bhauma Kingdom. The mention of his gifting the village of Chāndagrāma
in the 9th year of his reign shows that by 931 AD he had taken over the Bhauma kingdom. Before occupying the coastal tract from the Bhaumas, Yayāti must have subdued the Bhaṅjas, because they occupied the portion between the two kingdoms of Bhauma and Somavaṃśī. That Yayāti successfully ousted the Bhaṅjas is proved in the copper plate grant issued in his 13th regnal year, which mention the gifting of a village named Gandhaṭapaṭi, now known as Gandharāḍī (within the Bhaṅja kingdom). The occupation of Gandhaṭapaṭi shows that Yayāti I had successfully ousted Śatrubhaṅja from the Baudh region, and further, Śatrubhaṅja III of the Bhaṅja line in his charter had styled himself as Rāṇaka, rather than Mahārāja. This is a definite indication that he maintained a feudatory status. Without ousting or subduing the Bhaṅjas it would not have been possible on Yayāti's part to gift a village from the Bhaṅja territory.

One of the major works done by Yayāti I was the re-establishment of the shrine of Jagannāth at Puri, and the building of the temple. Yayāti I is also credited with building another capital, known as Abhinava Yayātinagara which is identified with modern Jajpur, where he performed ten Aśvamedha sacrifices to which he invited ten thousand brahmanas from Kanyakubja. From evidences it appears that the Somavaṃśīs during the early period ruled from Yayātinagara while Abhinava Yayātinagara was the second headquarters.
**Bhīmaratha (955-980 AD)**

About Bhīmaratha nothing is known. The Bilhāri Stone Inscription of the Kalachuri king Yuvarāja II mentions that Laksmanarāja who ruled at Tripuri (Jabalpur) from 945 to 970 AD "worshipped Somaśvara with that (effigy) of Kāliya wrought of jewels and gold, which had been obtained from the prince of Oḍra, after defeating the Lord of Kośala". This shows that Oḍra was under Kośala, and only with the defeat of Kośala, could the bejewelled image of Kaliṅga be taken from the prince of Oḍra. This inscription further shows that by the second half of the 10th century AD, Oḍra or Orissa was under the Somavāṁśīs. This conflict between the Kalachuris and Somavāṁśīs would have taken place in the reign of Bhīmaratha.

**Dharmaratha (980-1005 AD) and Nahuṣa (1005-1021 AD)**

Nothing much is known about Dharmaratha and Nahuṣa except that there were some invasions during Nahuṣa's reign. From the Udepur Prasasti we come to know that the Bhoja army defeated the lord of Chedi, Indraratha, Tommanna and Bhīmala. This Indraratha, was a subordinate of Dharmaratha and was ruling at Yayātinagara (Jajpur). Because Indraratha came into conflict with his contemporary rulers, he has figured mostly in the records. It is probable that the three great powers of India, viz. - the Paramāras, the Cholas and the Kalachuris, invaded the Somavāṁśī kingdom within a short period coinciding with

Nahuṣa's reign. These invasions may have resulted in the defeat and death of both Nahuṣa and Indraratha.

After the death of Nahuṣa and Indraratha, Yayāti II, a member of the Somavaṃśi dynasty, was placed on the throne as king. He was a distinguished soldier and a person with great valour. This is fully corroborated by the Brahmeśvara inscription, when it states that "when he (Dharmaratha), the Rājamālla (the best of the kings), departed unto heaven without issue, all his kingdom as laid waste by various warriors of different countries there was a lapse of short and eventless time. Then Chandihara, son of Abhimanyu and grandson of Vichitravira, a lineal discendent of the celebrated Janamejaya, was made king by the ministers and he was powerful and spirited like his father". This statement thus confirms that Yayāti II was the next in line.

Yayāti II (1025–1040 AD)

Yayāti II during the initial years of his career was busy stabilising the country and pushing out the enemies. In Yayāti II's third regnal year he issued the Māraṇja-Murā Charater where the name of the Kalachuris is a significant omission. This charter gives a list of enemy territories with which Yayāti II was involved in conflict. This means that Yayāti II had made an alliance with the Kalachuri king Gaṅgeyādeva of Tripuri who helped him is restoring the Somavaṃśi kingdom.

From the Māraṇja-Murā inscription we further come to know that Yayāti came in possession of the throne of Kaliṅga as a result of his marriage with a princess in a Svayambhara, i.e. being selected by the princess as her husband. The achievement of Yayāti were the consolidation and the unification of Kośala, Kaliṅga, Utkala and Kongada. By the might of his arms, he was victorious over the Gauda, Radha and Vaṅga country. Yayāti is also regarded as a great monument builder. It is said that he performed an Asvamedha Yajna on the banks of river Vaitaranī. During his tenure we know that Śaivism got a boost and many temples were constructed, but could not withstand the onslaught of time. The construction of the Liṅgarāja temple at Bhubaneswar has been credited to him. This temple as we all know stands as one of the foremost architectural monument of India. Yayāti's wife kolāvatī, mother of Uddyota Keśarī is known to have built the Brahmeśvara temple at a place known as 'Siddhatirtha' in Ekāmra and it was dedicated to Śiva. It also said that the Kosaleśvara temple at Deogaon, and the Chandeśvara temple near Chilka were built by Yayāti II.

**Uddyota Keśarī (1040-1065 AD)**

Yayāti II was succeeded by his son Uddyota Keśarī. The Somavaṃśīs were at the height of their glory during the reign of Uddyota Keśarī. It is said that he was a great conqueror. He defeated the entire armies of Dāhala (Kalachuri), Odra and
Gauḍa as if it was a child's play, with his well trained warriors. It was during his period that the Kalachuri king Karna invaded the Somavamśi kingdom, but Uddyota withstood the invasion. The Sonepur plate of kumāra Someśvara Deva reveals that Uddyota keśarī granted Kośala to Abhimanyu, who was a feudatory of Uddyota. This Uddyota has been popularly identified with Lalāṭendu Keśarī. The inscription of Uddyota Keśarī in the Lalāṭendu Keśarī cave records that in his 5th regnal year, decayed tanks and ruined temples were restored and the images of the twenty-four Tīrthāṅkaras were set up.

**Janamejaya II (1065-1085 AD) and Puraṇjaya (1085-1100 AD)**

Uddyota Keśarī was succeeded by his son Janamejaya II. He was not a strong ruler and consequently the disintegration of the Somavamśi Kingdom started from his time. From the Ratnagiri plate inscription of Karṇadeva we can conclude that Janamejaya II had a conflict with a Nāga king, Someśvara I of Bastar, and was defeated. Consequently Someśvara occupied Kośala. Rather it would be more appropriate to say that the Somavamśis lost some of their territory to the Nāga king. Janamejaya II's reign also witnessed the invasion of the Gaṇga king Rājarāja I Devendravarman which probably resulted in the loss of the southern territories of the Somavamśi kingdom. This process of disintegration continued after Janamejaya's period on to the reign of his son Puraṇjaya.
Karna (1100-1110 AD)

It seems that when Karna, the younger brother of Puraṅjaya came to power, the Somavaṃśi kingdom was confined only to the coastal tracts comprising the present districts of Puri, Cuttack and Balasore. In due course this small kingdom became a piece of dispute between the Pālas and the Gaṅgas. From the Rāmcharita we learn that Jayasimha, a subordinate of the Pāla king Rāmapāla, lifted Karna Kesārī, the lord of Kośala, with his palm. And then in the Korni inscription of Choḍagaṅga we learn that Choḍagaṅga reinstated the fallen lord of Utkala. These two statements indicate that while the Pāla king ousted Karna, Choḍagaṅga brought him back to power. This he did, not out of benevolence, but was seeking an opportunity to annex the Somavaṃśi territory.

From the Mādalā Pāñji we learn that Vāsudeva Ratha, the commander-in-chief of the Somavaṃśi army, invited Choḍagaṅga to invade Orissa and take over. After receiving the invitation, Choḍagaṅga at an opportune moment invaded Orissa and took over the Somavaṃśi kingdom. This happened sometime in 1110 AD. and the last vestiges of the ruling Somavaṃśi dynasty became extinct.

DATE OF THE MUKTEŚVARA

The Mukteśvara temple is without any inscription, but a close study of its stylistic features and a comparison with
the Brahmesvara built by Queen kolavati in about 1060 AD shows that it is a monument of the Somavamsi period. From tradition current in Bhubaneswar we come to know that it was Yayati Kesari who built the temple of Muktesvara. Again from tradition and the Madala Panji ⁹ we come to know that Yayati Kesari and two other kings built the Lingaraja temple (Krittivasa). The Muktesvara and the Lingaraja temples are quite dissimilar in their attributions and belong to different time as chronologically proved. Hence, there could have been a slight confusion between Yayati I and Yayati II. And in all probability, the temple of Muktesvara was built by Yayati I.

In a palm leaf manuscript, preserved in the palace library of the defunct Keonjhar State, is recorded a verse stating that Lalatendu Kesari built the temple of Krittivasa in the saka year 888, which corresponds to 966 AD.¹⁰ The name of Lalatendu Kesari is otherwise unknown while the Krittivasa is generally identified as the Lingaraja temple. The Lingaraja we know belongs to the 11th century. So, if the recorded verse of the palm-leaf manuscript is accurate, it must be referring to another temple. Generally Krittivasa is an epithet of Śiva, and hence, any temple dedicated to Śiva can bear that name. Taking this into account K.C.Panigrahi suggests that this temple of Krittivasa could be no other than the Muktesvara temple. Hence, it is difficult to specify a year as far as the construction of the temple is concerned, but it can be safely assigned to the 10 century AD.

⁹. Madala Panji (Prachi Edition) p.6
BUILDING MATERIALS

For any large scale construction work, like that of a temple or fort, the building materials in the form of blocks or slabs were used in the historical past and for this, availability of rock in huge quantity at a cheaper price in the vicinity was the most important criterion. In view of the fact that Bhubaneswar is a 'City of Temples', during the time of construction of these temples, huge quantity of stone slabs and dimension stones were in requirement from around the old township of Bhubaneswar. A glance over all the temples indicates that the most important rock used was sandstone followed by khondolite and laterite, the last one being for outside pavement and boundary walls. The sandstone blocks, as is well known, have been ideal raw materials for sculpturing and even after a lapse of several centuries the nuances of the lines or curves in the body of the figures are so well preserved, that this sandstone can be considered as an excellent material for the purpose of architectural use.

This brings forth the question of a better understanding of what makes a rock a building material. Below are given the characters of the building materials.11

1. Proximity of the material from the site of construction
2. Huge bulk availability
3. Cheapness of the material
4. Resistance to weathering (durability)
5. Easy quarrying and winning (workability)
6. Hardness
7. Colour and Fabric
8. Porosity and texture

These have been discussed in detail by Coggin Brown and Dey - 1955, and S. Deb - 1980.

Discussion of these above character, and their application to the building materials used for the construction of temples of Bhubaneswar, and more specifically the Muktesvara, have been appended below.

Item 1 has already been discussed in the previous paragraphs. The sandstone, laterite and khondolite are available in plenty around Bhubaneswar. These sandstones are of Athgarh stage in the Gondowana super-group of rocks. Laterite is available from almost anywhere in the vicinity of Bhubaneswar. These are of 'low level' type, but the 'high level' type is available on Sidheśwar peak at Narāj and many other peaks beyond. Unless the materials is cheaply available, the cost of construction will be unduly high. Sandstone being a sedimentary rock has got bedding, joints and other characters causing easy breaking and transport. Laterite, similarly, is easy to cut in any direction in situ in the field and making blocks

is rather a not very difficult affair. Blocking is done in the quarry for, the rock during fresh cutting is very soft. It later harden on exposure because of dehydroxidation of the exposed part. Durability is important as it should not normally react quickly to weathering, climate, frost, heat or fire. This can be made clear from a present day example - the Taj Mahal (made of Makrāna marble), which has withstood the test of time, but the colour is fading as the environmentalists claim because of the smoke from the Mathurā refinery. This sandstone, especially when it is massive, fine-grained, and slightly ferruginised or siliceous, acts wonderfully well to maintain all the details of sculpturing. The laterite only becomes harder with lapse of time. The sandstone, being almost on the surface is easily quarried and its bedding and joints go a long way in assisting the quarry-man. The argillitic (clayey) sandstone is still more easily won, although as a rock it is less durable than the other sandstone type. Both colour and fabric are important, but are a factor of personal choice. The sandstone has a pinkish or yellowish brown hue, which was, in those days accepted as the colour of the building material. Fabric in this particular case didn't mean much, except fine bandings (because of bedding) and spotted appearance which, however went against, because the spots were shale pockets, which were soft and got weathered causing shallow pits of variable dimensions. Sandstone is compact, and naturally has less porosity. It is fine-textured and splitting and dressing are easy on them.
In view of the huge quantum of sandstone required for the construction of temples in Bhubaneswar, a curiosity was aroused as to the quarry sites of sandstones, especially when laterite almost covers the surface around the immediate vicinity of the old township of Bhubaneswar. The deforestation for the construction of the new township of Bhubaneswar to the west of the railway line didn't show any large scale quarrying anywhere. The nearest good quality and large exposures of sandstone was traced from Khandagiri and Udayagiri, which apparently forms a thick sandstone horizon dipping lowly (5°-9°) eastward. West of Khandagiri forms a wedge, sloping at a higher angle westward and is considered to be due to a fault. The road passing in between the two hillocks rises up and passes over a ridge (col). The two sides of the road shows boulders randomly strewn around. Such a valley in a sandstone topography cannot be normally accountable to the occurrence of a fault, because the valley along which the road passes does not form any low level gorge like feature except when faults occur. As such, one wonders if during the period of temple construction, a sandstone quarry was started in between the two hillocks, which not only supplied building materials for the temples, but also provide a road connecting the other side of the massive hillock, the only one of its type to the west of Bhubaneswar within a considerable distance.

13. S.Acharya - Personal communications.
As has been mentioned in different places, sandstone has been the main building materials for the construction of this temple. Detailed megascopic and microscopic studies of this sandstone was undertaken in order to better appreciate the causes of weathering at certain places of the blocks and maintenance of perfection of sculpturing in other parts. A block to block megascopic investigation resulted in the following conclusion.

1. The sandstone slabs can be classified as
   
   (a) pinkish, massive, uniform textured and fine grained, often ferruginised.
   
   (b) pinkish to yellow, coarse grained, massive to thinly banded.
   
   (c) yellowish to brownish, spotted and thinly banded (shaly). These shales bands get removed on weathering.

2. The yellowish coloured blocks being more clayey (also as inter-granular) gets eroded at a much higher rate than the pinkish massive type, which almost behaves like a homogeneous fine grained basalt - ideal for sculpturing (photo 108).

The microscopic characters have been appended here, with a view to explain the reason for the rate of weathering of the sandstone types.

**Ferruginished coarse grained sandstone (photo 107)**

The sandstone shows ferruginisation (brown colour). The minerals are essentially quartz of various types and rounded but not very well sorted. The quartz grain is coarser than
the finer sandstone (compare the sizes of the grains of quartz). Also note the lesser iron content in photo 108 and 109.

**Fine-grained hard sandstone (photo 108)**

A little silica is seen as intra-granular binding material (not shown in photo micrograph). It is also a little more finer grained at time and silicified as well. This is the best variety available for sculpturing to any fineness. The angularity of the quartz grain is noteworthy.

**Fine-grained ferruginised compact sandstone (photo 109)**

This type shows a sort of intermediate character where the iron is along the grain periphery. The boundary of the quartz grain in rather sutured causing a better grip which gets reflected in bringing additional strength to the rock.

**Very coarse grained ferruginus sandstone (photo 110)**

This is a photomicrograph of a highly ferruginised sandstone. The mesostasis (ground mass) exhibits intense ferruginisation which acts as cement for the sandstone. Hydroxidation of the ground mass causes loosening of the grains resulting in bluntness of the delicate features.

**Conclusion**

It has been observed that the coarse grained sandstone blocks are used at places where we find less carvings and
sculpturing. The ferruginised and silicified fine grained sandstone has been used for constructions where extensive sculpturing has been done. But one wonders why there has been the use of the yellowish argillaceous sandstone for the same purpose at times, although this variety is certainly of an inferior grade of building material. In all probability, the then architects and engineers were not well conversant with the petrographic characters of building materials.

TECHNIQUE OF CONSTRUCTION

Regarding the technique of construction of temples, our knowledge is limited. The Śilpa texts found so far give us very little idea about the method of construction, while it gives us a good amount of material regarding the decorative programme.

The Hindus had their self-defined parameters in the adoption of the trabeate system of construction. One really wonders as to why the arch, vault or other mechanical means, which from the early Roman times were commonly used throughout the world could never be popular in India. The Indian architects and builders were happy to continue with their system of vertical columns and horizontal lintels, of stone or wood, supported by brackets of iron if necessary.

The Kaliṅga style of temple building consistently employed the astylar corbelling method to all its structures, be it rekhā, khākharā or piḍhā. By using this astylar method in the Kaliṅgan
temples we see that the gandī maintains a vertical course and it is only at the bisama level that it starts its curvature. Again, because of this astyalar system, the baranda on the bada does not project outside, as it would affect the balance of the structure. One should remember that this principle of astyalar is strikingly indigenous of Kaliṅga, which it retained and found meaningful ways of developing it.

Because of the adoption of the trabeate system, the use of mortar to hold stones together, was dispensed with, for there was virtually no inclined pressure to be distributed between the courses of masonry. The stone blocks were held together by their own downward pressure. At times grooves were done on the blocks for fixing them together, and if necessary iron cramps and dowels were used.

After the choice of site of construction of the temple, the site was consecrated and the foundation stone was laid on an auspicious day. Thereafter, a large number of people were employed in its construction. Stone being the basic material in use, was required in huge quantities. First, stones were quarried and then cut into blocks and were transported to the construction site. At the site they were finally dressed and chiseled into the required shape and size. After this, the construction began as per the scheduled plan and elevation. The blocks were placed one above the other, and the sides were finely dressed resulting in a tight bond between them
even without the use of mortar, and as already mentioned iron cramps and dowels were used, if found necessary.

It has been suggested that the temple was gradually buried with earth as it progressed in height at the time of construction. Then, the sides were made inclined planes on which the stones of great weight could be dragged to their desired heights.\textsuperscript{14} Even the huge blocks, used for amalaka and ghaṇṭā were easily dragged on these inclined planes. K.C. Panigrahi suggests that almost all temples of Bhubaneswar excepting the miniature ones, seem to have been built by this method. He further says, that the inclined earthen ramp of the Liṅgarāja temple extended up to the Khandagiri hill, the remains of which in the shape of broken mounds are still visible.\textsuperscript{15} Refering to the Śīlpa-śāstras he further says that every temple must possess a tank. And it was from the tank that the earth was used for the ramp.

By adopting this method of burying the structure in earth at the time of construction, the architects could not built both the deul and the jagamohana simultaneously. The rule therefore was to build the main temple first, and then add the porch or the jagamohana. Normally, two columns were left uncarved on the main temple which formed the point of juncture between the two units.

\textsuperscript{14} K.C. Panigrahi, \textit{Archaeological Remains at Bhubaneswar}, p. 66.
\textsuperscript{15} Ibid.
After placing the stones in their positions, outlines of the carvings were drawn and thereafter the necessary sculpturing was undertaken. In some of the temples where carving has been left incomplete, these outlines are clearly discernible. This process of construction was applicable to both the deul and the jagamohana.

TEHODOLITE AND HEIGHT CALCULATION

The theodolite is the most intricate and accurate instrument used for measurement of horizontal and vertical angles. It consists of a telescope which has two distinct motions, one in the horizontal plane and the other in the vertical plane. The former being measured on a graduated horizontal circle by means of a set of verniers, and the latter on a graduated vertical circle by two verniers.

The theodolite which was used for our purpose was of the transit type. In this type, the telescope can be revolved through a complete revolution about its horizontal axis on a vertical plane. It has got a tribrach plate with three arms, each carrying a levelling screw. The lower parallel plate has a central aperture through which a plumb bob may be suspended. The upper parallel plate is supported by means of three levelling screws by which the instrument is levelled. The lower plate is graduated from 0° to 360° in a clockwise direction. It has got a clamp and tangent or slow motion screw by means of which it can be fixed accurately at any desired position.
Finding of the vertical angle

First of all the tripod was placed at a distance from the entrance of the **jagamohana** from which point the interior of the **garbhagrha** could be seen. Then the instrument was levelled and with the plumb bob, the point 'D' was marked. When the whole instrument is levelled the vertical scale and verniers were checked and adjusted to eliminate error. Then the telescope was fixed on the tip of the **kalaśa** 'C', and the vertical angle "CAB" was measured. Then the distance between the points of the plumb bob at "D", and point "E", the centre of the temple, was measured. The height of the instrument was also measured. Figure 8 shows clearly the various points and distances.

Given below is the calculation to show the height of the temple.

\[
\begin{align*}
DE &= 81'5'' \text{ (Distance from the plumb bob to the centre of the garbhagrha)} \\
DA &= 4'7'' \text{ (Height of the instrument)} \\
\angle CAB &= 19^\circ 38' \text{ (Vertical angle)} \\
AB &\text{ is parallel and equal to } DE
\end{align*}
\]

Let us take \( AB = Y \), and \( BC = x \).

So \( \tan \angle Q = \frac{x}{y} \)

or, \( \tan \angle BAC = \frac{BC}{AB} \)

or, \( \tan 19^\circ 38' = \frac{x}{81'5''} \)

or \( 0.35674 = \frac{x}{81'5''} \)
Therefore,
\[
x = 0.35674 \times 977'' \\
= 348.53498'' \\
= 29.044581'
\]
The height of the instrument is 4'7"

\[\therefore \] the height of the temple

\[= x + BE\]
\[= 29.044581' + 4'7''\]
\[= 29.044581' + 4.583333'\]
\[= 33.627913'\]
\[= 33.63'\]
\[= 10.4253 \text{ metres.}\]

**CONSERVATION**

Orissa has a number of monuments viz. temples, rock-cut shrines and inscriptions which form part of our national heritage. Hence, conservation is essential, for the maintenance of these monument and their protection from further deterioration. As we all know this assignment has been given to be Archaeological Survey of India, while some responsibility is also shared by the State Department of Archaeology. According to the Act of 1904, the Caves of Khandagiri and Udayagiri, Rājarāṇī, Konārk etc. were declared as monuments of national importance, and hence protected. The temple of Mukteśvara, which is under our consideration, was brought under the protection of the Archaeological Survey of India on 18th June, 1945. Since then,
the repair works of this temple are being done by the A.S.I., Bhubaneswar circle, which started functioning from 1st April, 1985. In the 19th century, the temples of Orissa, specifically those of Bhubaneswar were in a neglected state. This is evident from the drawings of James Fergusson and the photographs taken by R.L. Mitra. The restoration work of most of the temples of Bhubaneswar owe its origin to the visit paid in 1898 by the then Lieutenant Governor of Bengal, Sir John Woodburn. "Struck with the dilapidated condition, and realising to the full their archaeological value, he ordered estimates to be prepared for putting the four principal ones, namely, Brahmesvara, Rājarāṇī, Muktesvara and Paraśurāmeśvara into good order. These estimates were duly prepared and sanctioned and the work carried out between 1899 and 1901. In December 1900, Sir John Woodburn again visited Bhubaneswar and as a result of this second visit, he ordered the repair of the subsidiary temples near Muktesvara, including that of Sidhesvara and the four small temples in the compound of Brahmesvara, to be undertaken together with the compound wall of the latter. Estimates were submitted, sanctioned and the work put in hand, being fully completed in 1902".16

Towards the close of the 19th century as already said the temple repair works were started. These works were undertaken

16. M.H. Arnot - "Report with Photographs of the Repairs executed to some of the principal temples of Bhubaneswar and caves in the Khandagiri and Udayagiri hills, Orissa between 1898 and 1903".
by a British engineer by the name M.H. Arnot. He, in his report has described the condition of the temples prior to the repair works, and then what were the repairs that were done. He mentions that the method of the repairs for all temples were the same. He writes that "no attempt has been made to alter or improve, but simply to restore. Particular care has been taken not to merit the stricture passed, in the preface to Fergusson's Archaeology in India, on many of the archaeological repairs undertaken to Temples in that country. His words are under the specious plea of restoration, many of the most important of them have been subjected to a treatment by which some of their most interesting features have been entirely obliterated". Arnot says that "whenever a temple had to be completely or partially dismantled and rebuilt, as each stone was taken down it was numbered, obviating any chance of its not being put back in its proper place, so that by this means all the temples have exactly the same appearance that they had when originally erected and wherever gaps existed, new stones were inserted".

Arnot in his report on Mukteśvara, prior to its repair describes the condition of the temple as follows:

"Through unequal settlement and the growth of trees the joints in both the Deul and Jagamohan of Mukteśvara had opened out and the East Rāhāpāga of the Deul was bulging badly and was a source of danger to the structure. The Amlā, Beki and Ghat-Chakda, were out of repair and the kalaśa
had disappeared. The ornamental compound wall round the
temple was broken down for a good part of its length, and
trees were growing out of its joints. The gateway (Torāṇa)
to the West was not in good order, the roots of trees growing
out of it having displaced the stone. Round Mukteśvara are
sixteen small temples, fourteen of which were in a tumbled-down
condition, and the temple of Sidheśvara was also overgrown
with trees on the Jagamohan and the Deul. At the East of
Mukteśvara there is a tank with its sides faced with stones,
half of which were missing. It was full of silt, and the steps
to the West very uneven".

Arnot employed traditional śilpis of Orissa to undertake
the repair work. He strengthened the temple structure by providing
the missing parts and closing up the gaping joints. His report
is valuable because it describes the repairs undertaken along
with photographs. According to him the following repairs were
executed on the temple and the jagamohana.

1. To Mukteśvara

Quite half of the deul and the jagamohan was dismantled,
the roots of all trees removed, the dismantled portions rebuilt
and the joints closed up. The Amlā was repaired and a new
kalas provided. The fretwork in the windows of the North
and South Rāhāpāgas was repaired. The arch of the gateway
was taken down and rebuilt, missing stones were replaced by
new ones and carved. The ornamental wall of the inner courtyard
was entirely dismantled, roots of trees removed and the wall rebuilt. Many portions of this wall were found scattered about; they were collected and used, gaps being filled with new stones. Inside the outer courtyard is a small well known as Mērīchā Kuṇḍa, the enclosure wall to which was also out of order; this was altogether rebuilt with old and new material.

2. To the Tank

All silt was removed to bed level, the four walls were taken down and reconstructed with old and new materials. A drain was made to lead the excess water away from the Tank during the rainy season, communication being made with this drain by a hole in the East wall. To drain out the water at any time for silt clearing, an opening was left in the East wall also at bed level in connection with the drain. This remains closed at ordinary times. The steps on the West were dismantled and renovated with old and new stones.

3. To the Minor Temples

As stated, fourteen out of these sixteen Temples were out of repair, they were altogether demolished and rebuilt, new stones being used where necessary. In all cases new Kalaśes were provided.

An outer Compound Wall was constructed from 4 ft to 6 ft high according to the level of the ground, enclosing not only Mukteśvara, but the Tank, the subsidiary Temples and
Sidheśvara. The total cost of the restoration came to Rs.4,266.17

At present, the Mukteśvara temple is receiving attention of the A.S.I. mainly by way of chemical treatment. The sculptures of this temple have been lime-washed at different periods presumably as a protective measure against the weathering elements. T.R. Gairola, in his technical notes on the red paint, lime-washes and plasters on Bhubaneswar and Konārk temple has given us some findings. He says, that on analysis of the red paint of Mukteśvara, it was found to be "free from organic matter". "Nitrogen, as tested by Lassaigne method, was found absent and no carbonaceous matter could be detected. It was found to contain 36.42 per cent of Fe₂O₃ which accounts for the red tint". After this finding, he collected some sample of red ochre from the local market and got it analysed. Then his final analysis was "that the red paint on the Mukteśvara temple was either a poor quality of red ochre or a mixture of clay with a high grade local red ochre (haematite) free from manganese oxide. For tinting the blocks of stones, the powder was crushed fine, mixed with plain water and the blocks dipped in this solution or painted with a brush. In some cases the red paint was applied after lime-wash".

17. Ibid.
Orissa, being situated on the sea-coast, normally receives heavy annual rainfall. This results in the growth of moss, algae and lichen. Further due to wind action, seeds of plants get deposited in the crevices of stones. In the process, roots of the plants which grow on the structure disrupt the masonry and widen the gaps resulting in the seepage of water and consequent damage to the iron cramps used.

To stop this process of degeneration the ASI is doing its best by not only strengthening the structure of the temple but also by injecting liquid mortar which help in cementing the various members. The ASI, has a Chemical Branch which cleans the temples with chemicals and then treats it with preservatives. This surely helps in the maintenance of the temple. However, much more has to be done to protect this national heritage. Lately, the Indian National Trust for Art and Cultural Heritage (INTACH) has done a thorough survey of all the temples of Bhubaneswar and has made some recommendations. It proposes to develop the old township of Bhubaneswar into a heritage zone where these temples would be taken care off. This temple of Muktesvara as we all know is one of the best examples Kalingan architecture. And so, efforts should be made to include this temple in the world heritage list, which would necessitate a better state of preservation for the temple.