CHAPTER - II

AN ORISSAN TEMPLE

Concept of a Hindu Temple

During the medieval period in India there was no single dynastic power that could be considered the undisputed dispenser of cultural and artistic ideas. Yet, as we have seen Indian temple design, other than what may at best be described as regional flourishes, displayed a remarkable unity of aesthetic purposes. True, the profile of the Śikhara varied from region to region, temples were at some places raised on monumental plinths and at other hidden behind cloisters; the number of mandapas preceeding the deul or garbhagṛha would be anything between one to four; these would either be placed along a single linear axis, or in concentric rings; a northern temple would have a Śikhara and southern a Vimāna. Nevertheless, the evolution of each of these seemingly disparate elements was always motivated by a unified philosophy of design that permeated into the remotest corners where the Hindu craftsmen were at work.

The Hindus had their self-defined parameters in the universal adoption of the trabeate system of construction. It is really strange that the arch, vault or other mechanical means, which from the early Roman times were commonly used all over the world never became popular in India. The Indian builders, through centuries of development, were quite content to use the system of vertical columns and horizontal lintels
of stone or timber, supported by brackets if necessary, to cover the roof or the span openings. A facile excuse for not using the arch by the craftsmen was that "the arch never sleeps". ¹ As a rational result, the use of mortar was dispensed with, because there was virtually no inclined pressure to be distributed between the courses of masonry.

As we have already said, there was no single political power of any consequence from the Gupta period up to the 16th century when the Moghul rule was established. A unified authority, if any, was wielded only by the priestly Brahmana class. They had as we know very intelligently inveigled themselves into a position of controlling every facet of hindu activity - bureaucratic, commercial, domestic and of course religious. No ceremonial activity be it a birth, death, marriage or starting of construction of a building, could take place without the consent of a Brahmana.

The basic concepts of temple design were evolved through the creative activity of the master craftsmen. It was however, the Brahmana, who began laying down elaborate and complex rules of layouts for buildings. These rules were intentionally made so very complex that it went beyond the comprehension of even a skilled craftsman and naturally beyond his rights to challenge the Brahmana. When we see the great hindu

compendiums of architectural rules "the Vāstushāstra" we realise that there is much deliberate vagueness. The very simple acts of building - such as choice of site, layout, testing of soil and even the thickness of the walls and columns were based not on technology, but on mythology and astronomy. Naturally, under such conditions, creativity of the building craftsmen had to be carried out within the theological disciplines framed by the prists as was in the "Vāstushāstras". Not withstanding this, the myriads of temples all over India are an eloquent testimony to the indefatigable Indian craftsman, who was able to create such beautiful work of art, inspite of the many restrictions framed on him.

On few occasions the magnitude of work was so great that it forced "a group of craftsmen to settle down near the site of their labours for a generation or more". 2 It was such settlements at a single site, rather than purely academic thoughts, that gave rise to Art Centres - giving rise to a school and a style of architecture. So, from this we can say that a group of craftsmen working continuously for over a century for the Chandelas, gave rise to the characteristic khājurāho style. Or, those concentrated in and around Bhubaneswar that gave rise to the Orissan style of building.

The Vāstupuruṣhamaṇḍala

There are many theories regarding Hindu architecture - especially the temple. And the magic of the square is quite

an accepted one. When we see the thousands of exotic forms of the Hindu temple, it becomes difficult to believe that the guiding philosophy of design of the Maṇḍala was the square. For the earthy abode of the 'elusive God' there could be nothing better in forms — either the circle or a square. The Hindus chose the square. The circle, which was adopted by the Buddhists for reasons of their own, to the Hindus represented movement. The aim of the Hindus was quite different. For them the temple was meant to be the permanent abode of God or his deity. The image had to be installed in shapes symbolising stability rather than mobility. The square fulfilled the aim of the hindus appropriately.

Having acquired the square, the priests wanted the human body - Puruṣha, to suit itself into the geometric form 'Square'. After achieving this, the emerging chart was called the "Vāstupuruṣhamaṇḍala" — literally meaning the magic chart of the architecture of the Supreme man. This Maṇḍala was now fit to be transformed into an architectural ground plan for a temple. In its simplest form the outer ring of squares could denote the thickness of the walls of the garbhagrha. On another scale four central squares could constitute the inner cell surrounded by a ring of 12 squares which became the walls and the next 16 or 28 the Pradakšiṇā path and outer wall and so on (fig. 1).

The elementary division of the Maṇḍala was only the first step towards the creation of a rather more complex system.
With some artistic sense, the Maṇḍala could be expanded to create the most elaborate of forms, the basic unit of it always being the square. Hence, a large square was sub-divided into thousands of small squares by the architects. This helped him to add sculptural richness to the wall surfaces of the temple. It was with an artistic manipulation of the grid obtained by the "Vāstupuruṣha maṇḍala" that the Indian architect created the profusion of exotic shapes and forms that are the temples of India.

But again, the very form of the Śikhara defied measurement through the square, but the theoretician left little allowance for blunders in its profile. He ensured that the curve of this essentially bamboo shape was translated accurately into stone, by meticulously plotting it out against the curves of more precise geometric forms like the ellipse (fig. 2). Furthermore, the entire structure was classified into many smaller elements, each with its own defined function, and with names, analogous to parts of the human form or body. Percy Brown's assessment of this theory of the 'Maṇḍala' is that "if faithfully followed would make failure impossible". This is not based on empty claims. It is a fact, borne out by the quality of Indian temple activity through centuries.

Classification of Temples

The Śilpaśāstra texts mentions the Nāgara, Drāvida and Vesara types of temples. In the Nāgara style the emphasis
is on the verticality and hence the super-structure is curvilinear in character. In the Drāvida style the emphasis is on the horizontality and such structures are distinguished by their pyramidal super structure—gopurams, while the Vesara style are distinguished by their curved backs or circular body and towers.

Architecturally speaking, the temples of India can be broadly categorised into two styles viz. the Northern or Indo-Aryan or Nāgara style and the Drāvidian style. However, there always was deviations in these styles and they were the regional developments. One of these regional developments was the Orissan style or the Kaliṅga style of architecture which had certain distinct characteristics of its own. Basically it is a sub-class of the Nāgara style or the Indo Aryan style, but because of its distinct features, this style received due recognition as a separate style when it was mentioned in the Śilpa texts and the inscriptions. The Amriteśvara temple at Holal in Karnataka mentions four types of temples—Nāgara, Drāvida, Vesara and Kaliṅga. From this it is evident that the Kaliṅga style was accepted as a distinct regional style in Karnataka by the 12th century AD.

Architectonically the temples of Orissa can be categorised into three distinct and different types known in local Śilpaśāstra.

texts as Rekhā Deul, Piḍhā Deul and the Khākharā Deul.

The rekha-deul also called the bada-deul or "the big temple" (fig. 3) is the sanctum with the surmounting curvilinear spire which gives the optical impression of one continuous line.

The piḍhā-deul or the bhadra-deul also called the jagamohana or mukhaśālā is the frontal porch of the main temple. The roof of the piḍhā deul is made up of piḍhās or horizontal platforms characterised by a pyramidal roof of receding steps. 4 (fig. 4).

The khākharā type of temples are rare in Bhubaneswar. The shape of the roof is a modified survival of the primitive huts with a semicylindrical roof resting on a frame work of timber and having a hemispherical end on either side and a ridge along the crest line. This type of temple is best reflected in the Vaitāl deul (fig. 5).

In a typical Orissan temple we have two main units - the sanctum and the frontal hall. The sanctum can be divided into the two type - either the rekha type or the khākharā type of deul. Usually the Devi temples in Orissa are of the khākharā order. And the frontal hall or mukhaśālā is either a flat

4. There is no description of the flat-roofed rectangular type of Mukhaśālā or jagamohana of the earlier temples such as the Paraśūrāmeśvara temple in Silpa texts of Orissa. The reason was probably that when these texts were composed such type of flat roofed jagamohana were no longer in vogue.
roofed hall or a square hall with the roof arranged in piḍhās i.e. in tiers. In point of time the flat roof jagamohana belongs to an early period. The Paraśurāmeśvara temple of Bhubaneswar belonging to the 7th century AD represents a jagamohana with a flat roof. In course of evolution the mukhasālā came to be surmounted with a pyramidal super structure giving rise to a piḍhā-deul.

However, in a typical Orissan temple these two i.e. the rekha-deul and piḍhā-deul, go almost side by side and form the two component parts of one architectural composition. The temple is a combination of the two.

This is in conformity with the Hindu practice - for the cella is exclusively meant for the deity and rituals, and the porch or mukhasālā is meant for congregation, where the devotees may wait or meditate before entering the sanctum sanctorum.

We cannot say that the fully developed Orissan temple comprised of the bada deul and the mukhasālā. In fact, quite different from it, the fully mature temples may be dissected into four distinct architectural units along the same axis known as nāṭa-mandira or the dancing hall and the bhoga-mandapa - the hall of offering.

Rekha Deul

The śikhara or the tower is the characteristic feature of the rekha deul. Originally the sanctum was a modest square
structure having an elaborate door-way on one of its sides. At a later stage it was decided by the craftsmen to raise a tower on the roof in order to emphasise the height of the sanctum.

The interior plan of the rekha-deul is square. Externally they are broken by offset-projections in the centre of each exterior face and the number of these projections varied from temple to temple. These projections are known as rathas or pāgas.

Usually these offset-projections are of the tendency to divide the face of the exterior wall into three, or five, or seven, or nine divisions - contributing towards the creation of the tri-ratha, pañcha-ratha, sapta-ratha and the nava-ratha type of temples. These projections, relieving the flatness of the wall, produce an effective play of light and shade impression.

The Orissan craftsmen, conceived the temple as the body of the 'Cosmic Being'. Therefore, different parts of the temple have been considered as its limbs and are named accordingly. The cella where the presiding deity is enshrined is conceived as the womb of the 'Cosmic Being' and thus called the Garbhagrha. Like the womb this place is intensely dark. The dim light of the earthen lamp is the only source and this creates an impression of solemnity whereby a devotee is indirectly forced to concentrate on his beloved God.

The bada-deul can be segmented into four distinct parts along the vertical axis - the pitha, the bada, the gandi and the mastaka.

The pitha is the platform on which the entire structure of the temple stands. However, the pitha is a variable element for the structure of the temple. It is absent in many temples including some very important ones like the Lingarāja. Here, the temple rises abruptly from the ground.

The bada is the perpendicular wall of the vimāna. This wall is usually divided into three or five sections, thus forming the tryaṅga or the pañchāṅga type. In the tryaṅga type the bada is divided into pabhāga, the jāṅgha and the baranda. The pabhāga refers to the foot or the lowest element of the temple. The jāṅgha sits upon the pabhāga, literally implying the thigh of the temple. The baranda represents a series of mouldings which act as a connector between the bada and the gandi of the temple.

In the later type of temples which had the pañchāṅga type of bada, the bada is divided into five mouldings: the pabhāga, the tala-jāṅgha, the bāndhanā, the upara-jāṅgha and the baranda. Here the jāṅgha is sub-divided into the tala and upara segments, which in other way can be interpreted as the calf of the leg-(tala) and the thigh (upara) position of the leg. The bāndhanā acts as the binder which joins the tala to the upara jāṅgha.
We have already said that the pābhāga is the lowest section of the temple. This pābhāga consists of a set of mouldings. The types of pābhāga mouldings are related to the chronological sequence of the temples. In the early stage the pābhāga was characterised by three mouldings of which the lower one was in the shape of a hoof and hence the khurā. The second from the bottom takes the kumbha design. This design has been adapted from the vase and foliage motif which can be seen in the Śiśiresvara temple. And it is in the Muktesvara temple that we notice the complete kumbha. The next in sequence was the pāta. At a later date these three mouldings of the pābhāga were increased to five. The later two additions were the kaṇi and the vasanta. These mouldings run all along the pābhāga including its projections and recesses.

Coming to the jāṅgha, it is the vertical portion of the wall of the vimāna. The jāṅgha in its projections contain niches - the niches on the central projections (rāhā) on the three side are bigger. And these niches house in them the pārśvadevatās. An elaborate doorway dominates the front side of the bāḍa. The doorway occupies the position of the front central projection.

We have already mentioned that the bāḍa was either tryāṅga or pañchāṅga. The pañchāṅga type came on when the vimāna gained height. The increase of height warranted modification in the treatment of the jāṅgha. Instead of straight
away elongating the bada proportionately which would have with all probability looked odd, the bada was converted from the tryaṅga to the pañchāṅga type - by dividing the jāṅgha into tala and upara by the bandhanā.

The uppermost portion of the bada is called the barānda. It is a set of mouldings by which the śikhara is separated from the bada. In the earlier type of temples a recessed band or kāṇṭhi runs round the vimāna to demarcate the partition between the śikhara and the bada.

The bada is relieved with vertical projections called rathas. Depending upon the number of projections the design of bada becomes either tri-ratha or pañcha-ratha or sapta-ratha or nava-ratha. In the tri-ratha design there is a central projection and two corner ones, whereas in the pañcha-ratha design, in between the central and corner projections there are two intermediary projections. In this manner the sapta-ratha and nava-ratha designs were formed. Normally the central projection was wider than the others and it had a big niche which housed the pārśvadevatās.

When a comparison is made up to the barānda, one can hardly see any difference between the rekha-deul and the piḍhā-deul except their relative proportions. But with the ganḍi the two types assume their individual peculiarities. The śikhara without the crowning element is known as the ganḍi. In the case of the rekha-deul the ganḍi inclines inwards on
a convex curve, this being more pronounced towards the top in later temples. Like the bada, the gandi has offset projections called pagas or rathas. These pagas create the optical impression of one continuous line or rekha on the gandi.

The gandi of the rekha-deul is divided into several projections, locally called pagas. These pagas are the continuation of the projections of the bada. In the pañcha-ratha style of temple, the face of the wall has five pagas. The corner pagas are known as the kanika-pagas; and the adjoining pagas as the anuratha-pagas; and the central paga as the raha-paga.

In the sapta-ratha type of temple the pagas are seven in number. In this type of temple the projections flanking the raha-paga are called anurahā.

The kanika-pagas are further sub-divided into a number of horizontal sections or storeys or bhūmis by the miniature amlā or ribbed disc called bhūmi-amlā. The number of bhūmis normally ranges somewhere between three and ten. This depends upon the height of the gandi. The gandi of the rekha-deul ends with the bisama, the topmost course, with or without the paga divisions.

The portion above the gandi is called mastaka or head. The mastaka of the rekha-deul is successively composed of the beki or recessed cylindrical portion above the bisama. Then comes the amlā or amlaka which is shaped in such a fashion
that its central diameter measures a greater length than its polar diameter, above and below. When the amlaka is very big, supports are provided from below. These supports are in the form of lions with two hind-parts or seated dwarfish figures etc.

The khapuri, literally meaning the skull rests upon the amlaka. This is the flattish bell-shaped member. The khapuri is normally devoid of any canvings. The kalaśa is placed above the khapuri. It is this auspicious kalaśa or the water-pot which holds the āyudha or sacred weapon of the deity to whom the temple is dedicated.

Piḍhā Deul

We have already given a short brief on the piḍhā-deul. The piḍhā-deul or the bhadra-deul also called the jagamohana or mukhaśālā is the frontal porch of the main temple. Like the rekha-deul, piḍhā-deul became an important temple type, and both jointly constitute two component parts of one architectural scheme.

The ground plan of the piḍhā-deul is also square. The interior is slightly lighted because of the doorway and the latticed or balustraded windows. Normally, the interior of the piḍhā-deul is plain except perhaps a few like the Mukteśvara and the Brahmeśvara where the ceilings are carved.
Externally the pidhā-deul has divisions similar to those of the rekhā-deul i.e. pītha, bāda, gaṇḍi and mastaka. If the sanctum has a pītha then the mukhaśālā also has it. But the pītha is not a regular feature. The treatment of the bāda of the pidhā-deul is same as that of the rekhā-deul. Of course, there are certain variations but these are very rare.

It is only in the case of the gaṇḍi that the pidhā-deul differs from the rekhā-deul. It is the gaṇḍi which gives the pidhā-deul its distinctive place. The gaṇḍi of the pidhā-deul is made up of a number of pidhās diminishing in a pyramidal shape till the topmost pidhā is reduced to about a half of the lowest one. The pidhās on later temples are usually grouped into tiers called potalas, separated from one another by recessed vertical walls called kāṇṭi or kāṇṭhi.

The mastaka of the pidhā-deul is a bit different from the rekhā-deul or the khākharā-deul. In the pidhā-deul the lowest member of the mastaka is the beki, above which is the ghanṭā or an enormous bell-shaped member, which is at times ribbed. This is crowned by a succession of beki, amlaka, khapuri, kalaśa and the āyudha as is in the case of the rekhā-deul.

Khākharā Deul

This is the second type of sanctum used in the temples. This type is exclusively meant for the Śakti worship.6 Here

6. The rekhā-deul also houses Śakti deities e.g. - the Mohini temple in the southern bank of Bindusarovara houses a ten-armed dancing image of Chāmundā.
the shape of the roof is a vaulted semi-cylindrical one, the ground plan, oblong. This type of temple is best reflected in the Vaitāl deul of Bhubaneswar. The origin of the khākharā type of deul, as traced by M.M.Ganguly are the rock cut rathas of Mahabalipuranam.⁷

The ground plan of the khākharā type is oblong instead of square as is the case with the rekhā type of deul. Externally, the sanctum, on the vertical plane, is divided in the usual format: pīṭha, bāḍa, gaṇḍi and the mastaka. The treatment of all the divisions except the mastaka is the same as that of the rekhā-deul. Hence, the description of the rekhā-deul will suffice for this type of temple.

The most distinguished feature of the khākharā-deul is its semi-cylindrical vaulted roof which is separated from the gaṇḍi, either by a recessed panel or by a bold moulding. The roof is constructed in two levels with a recess in between.

To ensure the stability of the temple structure the architects resorted to the device of tying the opposite walls by means of ceilings or muda. Thus, in majority of the temples there is a ceiling above the cella - which is known as the garbha-muda. In the case of larger temples this process was repeated so that there was a second ceiling, generally known as the

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ratna-muda - which closed the hollow chamber above the garbha-muda. In keeping with the growing height of the temple as in case of the Liṅgarāja temple there is at least one more ceiling above the ratna-muda. Access to these upper chamber was often through an opening above the lintel of the door of the sanctum.

The temples which began as small insignificant structures, culminated in magnificent structures of great height and grandeur. In the case of the rekha-deul the basic characteristic i.e. the curvilinear gaḍḍi were already present in the earliest available type. The course of evolution being mainly towards the increase of height, leading to the increase in the ratio between the dimensions of the sanctum and the height of the deul. Further, it elaborated in its plan from tri-ratha giving way to pañcha-ratha sapta-ratha and nava-ratha. The bāḍa elevation switched over from the tryaṅga-bāḍa into the pañcāṅga-bāḍa and the increase in the number of mouldings in the pābhāga and the baranda and in the number of bhūmis.

A radical change is seen in the mukhaśālā. In the progressive course, a simple oblong structure with a double-tier roof having a top gradually changed into a cube surmounted by a stepped pyramidal roof.

In the niches of the rāhās of the Orissan deuls we see the pārśvadevatā, an image subsidiary to the main deity to
whom the temple is dedicated, yet closely related to that deity. In the early temples, dedicated basically to Śiva, we see that the inclination is to have the Śiva parivāra that is Pārvatī or Mahiṣamardini, and their two sons Gaṇeṣa and Kārttikeya. Usually we see Gaṇeṣa is placed on the south, Kārttikeya on the west or on the back and either Pārvatī or Mahiṣamardini on the north. Similarly, in a Viṣṇu temple we normally find figures of the three incarnations of Viṣṇu i.e. Varāha, Naṣasimha and Trivikrama, while in a Devī or Śākta temple or a Sūrya temple we see that the pārśvadevatās are the three different forms of the enshrined deity. The pārśvadevatās were independently sculpted out of large slabs of stone and then inserted into the niches. This is evident from the Parasurāmeśvara, Svarṇajaleswara, Śiśireśvara and Markandeśvara temples at Bhubaneswar. And this is again indicated in the Śilpa Prakāśa.  

The complete absence of all the niche figures in the Mukteśvara temple probably implies that as these images were carved out of independent stone, they could be easily removed. However, in some temples the pārśvadevatās have been or carved in situ after the temple had been constructed, and this we conclude when we see that the image reveals the joints of the various blocks of stone of which the temple wall is comprised.

On the doorway, leading into the shrine of most of the Orissan temples we see a row of grahas or planets. In most
of the early temple we see that there are eight grahas, while in the later temple we see the inclusion of one more making it nine or nava-graha. According to Hindu astrology the nine grahas are Sūrya (Sun), Chandra (moon), Maṅglā (Mars), Budha (Mercury), Brihaspati (Jupiter), Śukra (Venus), Śani (Saturn) and the ascending and descending nodes of moon - Rāhu and Ketu. In the early temples, like the Paraśurāmeśvara and Markaṇḍeśvara the lintel has the image of the eight seated grahas. And from the lintels of temples like Tīrtheśvara, Gaurī and Mukteśvara we see for the first time that the grahas are no longer eight but nine - nava-graha, with the addition of ketu. It is not clearly known as to why the early temples depict only eight of the grahas, starting with sūrya and ending with rāhu, when the theory of the nine grahas was already known to the people.

It is fascinating to see that in the Kaliṅga style, the astylar corbelling method has been consistently employed for all its structures, be it rekhā, khākhara or pīdhā unlike in other places of India where we see, the pillar has been the main technical formula for the carriage of load at any given point. By using this astylar method in the temples the result was, in the out and out vertical course of building of the gandi and a curvature only at the bisama level and the firmly well-inset positioning of the mastaka. The baranda on the bada does not project outside as it would affect the balance of the astylar gandi build which had an inward thrust.
In contrast to this, we see in other parts of India, both south and north, the presence of bold *chajjās*.

One of the effects of the steady growth of the astylar Kaliṅga style was the total lack of any development of the pillar style. This pillar style which we see widely used in the south did not find meaningful employment in the prevailing astylar Kaliṅga architecture. Thus, whenever we see the pillars, if at all, as in the *jagamohana-maṇḍapa* of the *khākharā* order, they are of a highly simplified square section cuboidal build without any scope for its composite parts evolving. This principle of astylar is strikingly indigenous of Kaliṅga, which it was able to retain and find ways and means of developing it.

Temples can be divided into *Sāndhāra* and *Nirandhāra* types. In the former there is provision for *pradakṣhiṇā-patha* for the devotees. Normally, in Orissan temples this *pradakṣhiṇā-patha* is absent. In Orissan temple circumambulation was seldom a concern for the architects. The interior of the Orissan temple is extremely dark and devoid of any decoration. In the early temple like the Paraśurāmeśvara we have two doors and four windows, but as the temples developed into a more mature state, we find that they have just one door facing the deity and two windows - lattice or bulustraded type in the *mukhaśālā*. The *deul* proper is devoid of any window excepting the linking door to the *mukhaśālā*. These factors along with the thick wall prevent the entry of much light.
The Orissan temple though devoid of any internal carving, makes up the deficit in its exterior walls decorative outlay. In the outer walls the objective of the architect was to give a powerful visual impact, on its onlooker. Stella kramrisch notes that one of the most distinctive features of the Orissan temple is the overall clarity of the total design in plan and elevation. Each individual architectural unit is clearly defined as a self-contained element in the overall decorative programme. Here in the carving we see the secular urge of the craftsmen, when he shows his flair for and sensitive response to the gamut of life around him.

The decorative relief on the temples exterior wall can be broadly categorised into:

1. cult divinitis including dikpālas, with their typical iconographical features in conformity with what was prescribed in the texts, which itself was not static through ages.

2. human beings in domestic scenes, acrobatic feats and solemn ritualistic worship, relaxing in music and revelry, listening to Gurus, on a pilgrimage, fighting with the enemy, processions, rural scenes, alasā-kanyās or indolent damsel's with an abandon of emotions and without any serious work but in an ecstatic joy of living and showing their voluptuous beauty in a wide variety of postures

and suggestive actions like fondling a child or sporting with pet birds, waiting for her husband's return with the door kept ajar, removing her anklets playing on musical instruments, and amorous dalliance.

3. birds, beasts, aquatic animals and composite and mythological figures including nāgas and the beautiful nāgīnīs, viḍālas etc.

4. architectural motifs like pidhā-muṇḍis, khākharā-muṇḍis (Fig 6) vajra-muṇḍis, pilasters, mouldings, chaitya windows etc.

5. purely decorative patterns woven out of floral, plant and geometrical motifs.

6. erotic sculptures, which by their character, cannot fail to draw the onlookers attention.

In kālīṅga art, flexibility and elasticity have been the hallmark and the multiplicity of iconographic usages had been weighed and their continuance was encouraged without any commitment. This helps one to trace the gradual changes in iconographic features of the images through the ages - from the early stage to the mature period.