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Contribution of Raja Bhoja

One Indian author so far totally ignored by foreign scholars, and neglected by Indians as well, is Maharajadhiraj Kaviraja Sista Shiromani Shri Bhojadeva, or simply Raja Bhoja of Parmara dynasty of Dhara in modern Madhya Pradesh belonging to the eleventh century.

He wrote 84 books on subjects as varied as town planning and architecture, shipping and shipbuilding, astronomy and astrology, Rajdharma and polity, Sanskrit poetry and prose, lexicography and anthology, grammar, music, medicine and philosophy. It is not known how many of his works are now available.

His book on shipping called *Yuktikalpataru* was first noticed by Professor Aufrecht in his Catalogue of Sanskrit Manuscripts. It was brought to light by Professor Radha Kumud Mookerji in *A History of Indian Shipping* published in 1912. The other book referred here is *Samaragana Sutradhara* dealing mainly with town planning and building dwelling places.

Bhoja for the first time records exhaustive details of Indian ships sailing since ancient times. He divides ships of those days in two classes – ordinary (*Samanya*) and special (*Visesha*). The interpretation of some scholars that *Samanya* type were river-going and the other sea-going, is not correct, according to Dr. A.K. Bag of the Indian National Science Academy. Bhoja himself mentions that “all *Samanya* vessels, except *Manthara* are *ambudbagati*, that is sea-going.”

The ordinary type has ten varieties depending on dimensions. The longest is 120 cubits, 60 cubits broad and having the same height. This is called *Manthara* (one cubit is equal to roughly 50 centimetres). The smallest is only 16 cubits long with the breadth and height of four cubits each, and is called *Kshudra*, that is, small.

The special class is categorised into *Dirgha* – in which length is the main feature – and *Unnata* based on height. *Dirgha* is further subdivided into ten subclasses and *Unnata* into five. In special class the longest vessel is 176 cubits long, 22 cubits broad and 17 cubits high. It is called *Vegini*, that is, having a good speed.

In *Unnata* the highest ship is 48 cubits having the same breadth, and 96 cubits long. The longest ship mentioned by Bhoja is of 176 cubits, and the greatest height and width is 60 cubits. The Indian ships had been sailing over the high seas since the Indus Valley Civilisation period but the first detailed description about their dimensions has been given by Raja Bhoja in his *Yuktikalpataru* of the eleventh century.

It is therefore worth while to mention details of both types of ships as under:

I Samanya (ordinary) vessels – Ten varieties

Name of vessels	English equivalents	Dimensions (in cubits)		
		Length	Breadth	Height
1. Ksudra	small	16	4	4
2. Madhyama	moderate	24	12	8
3. Bhima	formidable	40	20	20
4. Capala	move to and fro	48	24	24
5. Patala	with covering	64	32	32
6. Abhaya	fearless	72	36	36
7. Dirgha	tall	88	44	44
8. Patraputa	like folded or doubled Leaf in the form of a cup	96	48	48
9. Garbhara	with inner compartments	112	56	56
10. Manthara	curved	120	60	60

II. Visesa (special) vessels
(A. Dirgha (length main feature) – ten varieties)

Name of vessels	English equivalents	Dimensions (in cubits)		
		Length	Breadth	Height
1. Dirghika	tall	32	4	3
2. Tarani	moving hither and thither	48	6	4
3. Lola	...	64	8	8
4. Gatvara	perishable	80	10	8
5. Gamini	going and moving on	96	12	9
6. Tari	running swiftly	112	14	11
7. Janghala	128	16	12
8. Plavini	flowing over	144	18	14
9. Dharini	power of possessing	160	20	16
10. Vegini	move with speed	176	22	17

B. Unnata (height main feature) – five varieties

1. Urdhva	elevated	32	16	16
2. Annurdhva	non-elevated	48	24	24
3. Syamamukhi	golden faced	64	32	32
4. Garvini	power of being filled with	80	40	40
5. Manthara	curved	96	48	48

Some of these ships, mentions Bhoja, had cabins (*mandiras*). *Sarvamandira* had the largest cabin extending over the entire area of the ship used for transporting royal treasure, horses, and women. *Madhyamandira* ships had cabins in the middle meant for the kings for pleasure trips. *Agramandira* vessels had cabins towards the prows used for long voyages, or war.

According to S.R. Rao – an authority on shipping – “even Harappan ships had cabins as indicated by the seal engravings and terracotta amulet from Mohenjodaro.” Cabins can also be deciphered in Sanchi sculptures and some of the Ajanta paintings of ships.

Bhoja refers to ships with as many as four masts and recommended these should be painted with white colour. The sails of three-masts should be painted red, those of two with yellow and one-mast with blue. The prows of the ships, he says, were decorated with the faces of lion, tiger, elephant, buffalo and serpent. The body of the ships bore the pictures of the sun, moon, swan, peacock, parrot and two bees. May be these represented different guilds of merchants, or the cargo they carried.

For measurement of latitude and longitude, Hindu astronomers consistently adhered to the prime meridian extending from North Pole (*Meru*) to Lanka on the equator as the reference line.

On the subject of ship-building, Bhoja mentions four types of timber for making ships which he calls after the names of four main Indian castes : *Brahmin*, *Kshatriya*, *Vaishya* and *Shudra* class of timber. The best ships, according to him, are made of *Kshatriya* type of timber as it is light and strong. The other kinds do not last long, soon rot in water and are liable to split at the slightest shock.

Samarangana Sutradhara

The other work of Raja Bhoja, *Samarangana Sutradhara* was first published by T. Ganapati Shastri of Trivandrum in two volumes in 1924-25. He waded through the then available three manuscripts and presented an excellent edited version.

Dr. Vasudeva Sharan Agrawala re-edited that text and added another volume containing an elaborate introduction and notes with an index of technical terms. As he was preparing this volume, he passed away in July 1966. Dr. Agrawala was a learned person and scholars are denied the value of his notes and comments.

The latest available volume has been prepared by the Oriental Institute of Baroda. As a Fellow of the Indian National Science Academy, the book came to my notice and I was deeply impressed by the contents of the volume containing 6,664 verses in chaste Sanskrit spread over 83 chapters running into 662 pages. The book has been published in 2007 with verse by verse literal translation in English, at times obscure, along with Sanskrit text.

Samarangama Sutradhara is an encyclopaedic work on medieval Indian architecture and town planning. There is a pun on the word '*samana*' which means both, a battlefield and a mortal human being. Thereby Raja Bhoja wanted to signify firstly that he was the architect of the fortunes of battlefield, and secondly, who also built human dwellings.

The term *Sutradhara* literally means 'thread bearer', that is, an architect who takes measurements by means of a plumb line. Thus the title of the book itself indicates the ingenuity and originality of the author.

The material available in the present book indicates that the text is not complete. The translation in English is good but at many places further elaboration and commentary is called for. With some efforts it may perhaps be possible to retrieve the notes of Dr. V.S. Agrawala. He was a former Head of the Department of Art & Architecture, Banaras Hindu University, and later a senior officer in the Archaeological Survey of India. May be his introduction and notes shed some light on some of the difficult passages of Bhoja.

Raja Bhoja was not only a writer and a theoretician but also a practical person and a man of means to put his ideas into practice. He planned cities and built educational institutions, palaces, temples, hospitals, stepped-wells, pavilions, wharfs and lakes in Dhara and its neighbourhood.

The great educational institution, called *Bhoja Pathashala* at Dhara, was one of his most monumental buildings. Unfortunately it was demolished by Muslim invaders and turned into a mosque. From the surviving ruins it is possible to form an idea of its original grandeur. The halls of this Pathshala are embellished with numerous sculptures, and slabs are inscribed with the poetic verses.

It is a marvellous concept of an educational institution marked by visual documentation of literary quotations. The architectural beauty of the pillars and the ceiling is unique. It speaks volumes about the aesthetic taste and rare genius of the builder.

Another great monument of Raja Bhoja is the Bhoja Sagar Lake in which water is collected from the three enclosing mountain-slopes and stored into a reservoir with an embankment on the fourth side. The fame

of this wonderful lake - *Bhopal Taal* – has resounded in popular memory throughout the medieval as well as in modern times. It is around this lake that is planned the city of Bhopal – capital of Madhya Pradesh – ensuring water supply to the residents.

The art of building embankments for artificial lakes reached perfection in medieval India and the greatest show piece was planned and erected by Raja Bhoja. Later, the Raja of Chittor in Rajasthan devised the Rajasamudra lake, as big as an inland sea.

The civil and religious architecture envisaged by Bhoja was not imaginary but rooted in tradition and the State policy pursued by him. He tried to acquaint his people – and the world – with as many designs as possible. Perhaps the spirit of Vishvakarma, the Indian divine architect, found an echo in the heart of this monarch of untiring zeal.

Plan of the book

The way the author has planned the book shows his remarkable vision. A dwelling place, he says, lies in a locality which forms part of a town which is a limb of the Earth. To properly plan a part it is helpful to know something about the whole.

Raja Bhoja therefore begins from the beginning, and describes the extent of the Earth comprising seven continents and an equal number of oceans. After dealing with the universe, *mahat*, he comes to the individual, the self, composed of five basic elements – *panchamahabhutas* – earth, water, fire, air and ether – and their interplay leading to subtle *Tanmatras*.

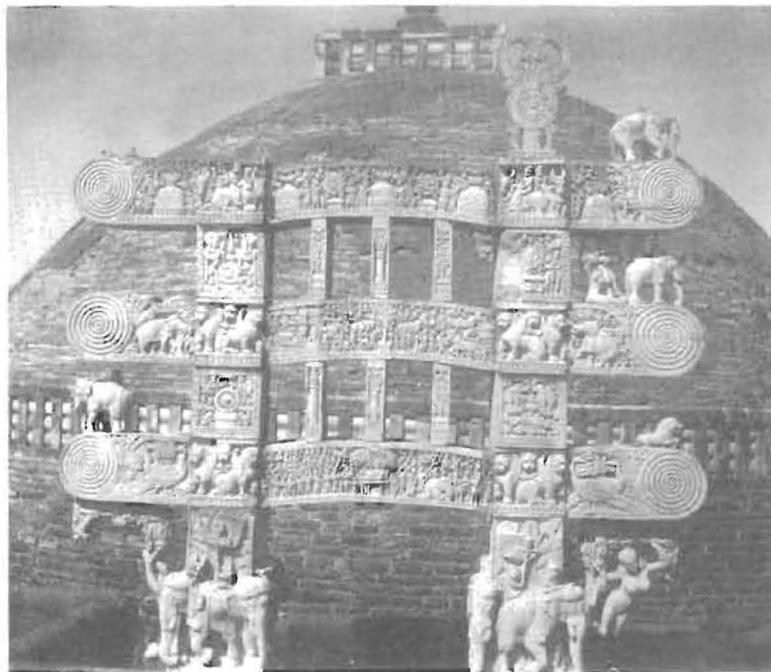
In medieval India – as in medieval Europe - art and architecture were integrated. The doors, windows, portico, pavillions, pillars, ceilings, etc were all designed artistically. The pillars were often in the form of human or animal figures, in relief or in round. The niches, cornices, brackets formed an integral part of architecture and every bit of a building exhibited the talent of the architect. Recall the flying *apsaras* at the gates of Sanchi stupa, or the *makara* motif pillars of the Madura temples. The book deals in detail with doors, lintels, jambs, pillars, etc in separate chapters.

While planning a town, he dilates upon the selection of land, its elevation, quality of clay, source of water supply, directions of the sun and the wind, and the surrounding environment. In demarcating the areas for the head of the State, his close associates, senior officers, subordinate staff, the general public and markets, he displays his administrative acumen as a king and keeps in mind convenience of accessibility and security.

Town-a Living Organism

In town planning, Bhoja treats a town like a living organism – *Vastupurusha* – having various parts exemplified in squares of the site plan. It has some vulnerable ‘organs’, that is, strategic positions – *marmavedha* – like the king’s palace, treasury and army headquarters. It also contains ‘arteries’ and ‘veins’ – *nadyadisiradi-vikalpa* – in the form of highways, roads and lanes to ensure free flow of traffic.

The architect suggests three types of site plans, divided into 64, 81 and 100 squares. *Ashtangulakhna* describes eight limbs of town planning.



Sanchi Stupa East Gate showing a flying Apsara, 1st Century B.C.



Enlargement of 'Flying Apsara' on East Gate of Sanchi Stupa,
1st Century B.C.

Vastusanthana-matrika deals with the allocation of different portions of the town for the residence of officials, professionals and artisans. The siting and orientation of the royal palace, ministers, army generals, etc. kept in mind quick approachability and security considerations.

He has devoted a lot of thought and originality in designing private dwellings of a vast variety. Keeping in mind the directions of sun and wind he brought to bear his knowledge of astronomy and astrology to allot different portions for separate purposes to ensure peace, prosperity and happiness for the residents. His plans include houses up to twelve storey, comprising two and more rooms giving their dimensions, providing for seats, beds and place of worship. He has gone into minute details of interior decoration and even explained how to prepare a wall for painting pictures.

In chapter 55, the author deals with sixteen types of dwelling places. He gives interesting literary names to each and gives exhaustive details like length, breadth, height, direction, decoration of every part in *hastas* (hand-length) or cubits then in vogue. For example, in the one named 'Kailash', he says 'the *skandha* or sidereal part may have breadth of half of the hexagonal part having a height of ten cubit norm of the roof as compared with the elevation and having the front of the 'neck' as such (vol. II, verse 19)". It is to illustrate how deeply he has gone into details to clarify his concepts.

A large number of technical terms have been used. In this connection the glossary and index of technical term prepared by late Dr. Agrawala could be of much use. The details of sixteen types of mansions have been explained by Bhoja in 160 verses.

In the following chapter, Bhoja gives the “illustrations of sixty-four *Prasadas*” or mansions. Some of these “decorated by myriad roofs and a single circular curvature or round-orbed structure some equipped with a triad of circular norms and some of five cupolas or spires, a tapering structure in the form of a tall cave or a pyramid rising above the tower” (verse 3). Cupola is a small round dome forming a roof referred to by him as *andaka*.

A house named *Vijaya* has eighty-one and *Airavata* has eighty-five *andakas*. Some others have ninety-seven and one hundred and one *andakas*. It is difficult to visualise how they would look like.

He speaks of houses with ‘internal water channels’ and ‘a water outlet being the best in the world’. In this chapter the author has mentioned the detailed construction of many houses is as many as over 300 verses. The building methods of twenty other houses are described in more than 200 verses.

The dwellings bearing specific names must have been known to those who intended to construct a house. They would mention that name to the architect and he would understand what was expected of him.

A serious author like Bhoja who has meticulously mentioned minute details of each house must have prepared ground plans with elevation for various houses. None of these are now available. On the basis of extensive details described by him it may perhaps be possible for some modern architects to prepare their drawings which might trigger a fresh line in architectural designing.

In modern times the general run of houses for the middle and lower class of people are constructed by the Government or by big builders. These are look-alike monotonous tenements sprawling over metros and big cities. Or there are plain, prosaic skyscrapers with back-up facilities generally dubbed by the people as 'concrete jungles.' The only choice available is that of storey on which one may have his house. Or there are big bungalows meant for ministers and senior officers.

The days of raja, maharajahs and nawabs have disappeared and big palaces are rarely raised. Only big business magnates can now afford to try the talents of distinguished architects. Or, multinational companies can offer opportunities to some architects to exhibit their original ideas of playing with the possibilities of space utilisation.

From utility point of view, see Hall No. VIII at the Pragati Maidan in New Delhi with a huge floor area without any pillars or beams, all supported and balanced by architectural dynamics. Among foreign architectural designs, *New Architecture* by Andreas Papadakis Publishers, mentions the Nation Building of Bangkok by Sumet Jamsai which is quite eye-catching. The Mediatheque' Sendai, Japan Model by Toyo Ito, is "an attempt to dissolve the archetype based on the relation between the conventional media and the human body and to create a completely new archetype."

Similarly, the Victoria and Albert Museum Extension (V&A), London, by Daniel Libeskind and friends includes a mixture of exhibition spaces, educational facilities and accommodation for new methods of interactive orientation. The V&A's mission to provide a gateway to the twenty-first century via its own rich and diverse collection "requires a vision that gives

new significance to its great traditions and goes beyond the purely passive relation between the arts and the public." The design is structured around three dimensions: the spiral movement of art and history; the interlocking of inside and outside; and the labyrinth of discovery, translated into a coherent ensemble of functionally related space. These examples demonstrate that the future of architecture holds enormous opportunities where a fusion of ancient and modern may trigger original ideas.

Temple Architecture

Several chapters have been devoted by Bhoja to the construction of temples, modelling of idols of deities, and the methods of installing these idols in the temple. The exact measurements of the limbs of idols are based on the instructions given in the *Matsya Purana*.

Special attention has been devoted to the images of major gods like Brahma, Vishnu and Mahesh, and some gods having four, eight and twenty arms holding various weapons symbolising their prowess.

The proper procedure of installation of idols in the temples has been explained in over 160 verses in Chapter 79. In countries like India, Nepal, Bali and other places with considerable Hindu population, the traditional instructions contained therein may be of authoritative guidance. Bhoja has the additional advantage of being well-versed in the Vedic lore and in astrology and astronomy.

Various Rasas

Chapter 82 has been devoted entirely to explaining the 'pre-requisites of sentiments' or *rasas* in paintings. Bhoja mentions eleven *rasas*. These are erotic, humour, pathos, terror, preya, love, fear, heroism, odium, marvel and calmness (verse 3). He describes in detail each sentiment.

For example, women shaking their waist, throbbing eyebrows, throwing coquettish glances, and gracefully exhibiting the body is the expression of an erotic sentiment. Or having lovely eye-corner flashing, throbbing elegantly the lower lip accompanied by sportive mannerisms is called the sentiment of humour.

In the same chapter he describes in detail various vistages or gazes (*drishtis*) as lovely, alacrious, affluent and disfigured. "Having corner of the eyes affluent or dilated and having cheek region and eyelashes broad and sportive in comic sentiment may be the dilated gaze". Briefly, Raja Bhoja has covered a large number of subjects connected with architecture, art, interior decoration, sculpture and painting. He meticulously describes the sentiments – *rasas* – and various types of glances, the way one can look at things depicting different flavours.

Mechanical Contrivances

The most interesting chapter is the one on *Yantra vidhanam*, or the preparation of mechanical devices. Bhoja has explained only the basic principles for making these machines and has not revealed the detailed procedure. The reason for holding back the details has been mentioned

by the author himself as given by Ganapati Sastri in his preface to the first edition.

Raja Bhoja is of the view that if the entire method of preparing a device falls in the hands of one not initiated in the art by the preceptor, he may misuse the technique and face trouble.

In addition to mentioning the four basic elements as earth, fire, water and air, for making mechanical contrivances, the poet also refers to *suta* or mercury as a distinct element and elaborates its qualities for use along with other elements.

Among the devices mentioned by him, some are purely for fun and frolic, a few are utilitarian like robots, door keeper machine and soldier machine (*yodha yantra*), and some imaginary as the huge flying bird powered mainly with mercury. As examples of miracles Bhoja mentions production of fire in the midst of water, and vice versa; complete disappearance of a thing and projection of something before a person not present before.

Dr. V. Raghavan in his article: 'Yantars or Mechanical Contrivances in Ancient India' published in the journal of The Indian Institute of Culture, Bangalore, in 1956, refers to some of the machines mentioned by Raja Bhoja in *Samarangana Sutradhara*.

The author speaks of a bed which may crawl by the force of air from one storey to another in a five storeyed mansion. There are many types of chronometers described, where dolls move hourly, or time is measured through water or sound. The *muhurtas* - auspicious time, *Kasthas*, that is seconds, could also be found with varying sounds, some pleasing, others terrifying (verse 54). The sounds may be of lute, cymbals or drums.

In explaining such verses Dr. Raghavan says in his article: "Machines are characterized not only by one action peculiar to each but also by the particular times when they are to operate. The speciality of some is sound, of some height, form or touch, and so on. Action is across, upward, downward, backward, forward, on either side, speeding and crawling. Another factor is the time taken for action..."

Bhoja concludes this section by saying that not only these but many more similar contrivances could be invented, even movements impossible in actual life are possible in *yantras* ...Silence on the actual mode of construction is said to be for preserving this important knowledge for giving a material advantage to the architects and for enhancing curiosity about these *yantras*.

Speaking about the male and female figures designed for automatic service - robots - Dr. Raghavan says, "Each part of their figures is made of and fitted separately, with holes and pins, so that thighs, eyes, neck, hand, wrist, forearm, and fingers can act according to the need. The material used is usually wood but a leather cover is given to complete the impression of a human being." The movements are managed by the system of holes, pins and strings attached to rods controlling each limb. Looking into a mirror, playing a flute, and stretching out the hand to touch, give betel roll, sprinkle water and make obeisance (verses 101-104) are the acts done by these figures. One such robot provides the mechanical fan. Similar robots are used for the palace guards, one such standing at the gate with a baton, sword, iron rod, spear or other weapon, to prevent the entry of outsiders. This can quickly and quietly kill thieves who break into the palace at the night (verses 106-107).

We talk of robots these days as something novel. But it would have been an interesting sight, armed robots effectively guarding the palace of Raja Bhoja in the eleventh century!

There are as many as 223 verses in the *Yantravidhanam* chapter. Only a brief idea is given of the type of numerous and varied mechanical devices described by Raja Bhoja.

Raja Bhoja Society

From the foregoing pages the reader would have got some idea about the multifaceted personality of Raja Bhoja. Of his over 80 works, only two books have been touched – *Yuktikalpataru*, dealing with shipping and shipbuilding, and *Samarangana Sutradhara* covering a vast variety of subjects revolving around architecture and town planning. These alone would have convinced the readers about the genius of this great scholar.

In Philosophy and Yoga he wrote *Rajamartanda*, a commentary on Patanjali's *Yoga Sutra* and *Siddhanta Sara Paddhati*, among other books. On Astronomy his works included *Aditya Pratapa Siddhanta*; on medicine *Ayurveda Sarvasva*; on *Dharmashastra* and Polity, *Krityasamuchaya*; on Prakrit poetry, *Kurmasataka* in 2 volumes; on Music, *Sangeet Prakasha*, and so on. The well-known scholar and educationist, K.M. Munshi thinks that in some works Bhoja might have been a general editor. At all counts, the output of Raja Bhoja is stupendous.

It is beyond the capacity of individual scholars to examine the contribution of this writer. It is therefore suggested to form a 'Raja Bhoja

Society' comprising Sanskrit scholars, architects, litterateurs, poets, astronomers, Ayurveda experts and artists. They may examine his available works and try to retrieve the remnants of whatever is available, for example, the lengthy introduction and glossary of technical terms used by Bhoja prepared by Dr. V.S. Agrawala.

The *Samarangana Sutradhara* carries minute details of nearly 200 dwelling places designed by Raja Bhoja. He has mentioned length, breadth, height of each compartment as well as the dimensions of doors, porticos, pavilions, cornices, etc. The architects of the society on the basis of these details, may be in a position to prepare ground plans and elevations. May be these designs of the medieval period may trigger a new line of thinking in architecture.

Bhoja was an expert in water conservation and building of wharfs and reservoirs. Some futurists fear that the next war may be based on water scarcity. The methods of storing water suggested by Bhoja may have some relevant points for the guidance of coming generations. Every effort should be made to learn from the past to plan a bright future.

There is a 'Aristotelian Society' which examines the thoughts of Aristotle for future guidance. A 'Kamasutra Society' was founded by Sir Richard Burton and F.F. Arbuthnot in London as early as in 1882. It continues to conduct research in that field, and adding to the existing knowledge. Why not a Raja Bhoja Society? There is no authentic biography of Raja Bhoja and the Society may also undertake that task to inspire modern generations.
