

Fathi Habashi



**My Trips in
India**

2015

My Trips in India

Volume derived from



Fathi Habashi

Department of Mining, Metallurgy, and Materials Engineering
Laval University, Quebec City, Canada

2015

The Book

The present volume is derived from *De Re Metallica. A Metallurgist on the Move*, which is a diary of the trips the author has undertaken during his professional career. He visited many industries, universities, research centres, and museums and participated in many conferences. The book therefore reflects the state of extractive metallurgy since he left his home country Egypt and went to study in Vienna. *De Re Metallica* is in seven volumes fully illustrated mainly by coloured photographs. It includes a short history of the place visited and its main sightseeing sites. Volume 1 Egypt, Volume 2 Canada, Volume 3 United States, Volume 4 Latin America, Volume 5 Asia [in two parts], Volume 6 Europe [in two parts], and Volume 7 Russia & other countries. Total number of pages was 5500.

Since these volumes could not be separated and therefore they will not be available to many readers, I decided to split the book into selected 29 small units, each representing one country or a group of countries closely related geographically. The present volume is one of these volumes.



The Author

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*To Nadia,
Hani, and Hatem
with love*

Other Books by the Author

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Technical

- F. Habashi, *Principles of Extractive Metallurgy*:
- Volume 1: General Principles (422 pages), 1969 (reprinted 1980) (out of print), Gordon & Breach Science Publishers.
 - Volume 2: Hydrometallurgy (468 pages), 1970 (reprinted 1980) (out of print), Gordon & Breach Science Publishers.
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- F. Habashi, D. Hendricker, C. Gignac, *Mining and Metallurgy on Postage Stamps*, 1999, 335 pages.
- F. Habashi, *Extractive Metallurgy Today. Progress and Problems*, 2000, 325 pages.
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Preface

De Re Metallica. A Metallurgist on the Move is a diary of the trips the author has undertaken during his professional career. He visited many industries, universities, research centres, and museums and participated in many conferences. The book therefore reflects the state of extractive metallurgy since he left his home country Egypt and went to study in Vienna. The book is in seven volumes fully illustrated mainly by coloured photographs. It includes a short history of the place visited and its main sightseeing sites. Volume 1 Egypt, Volume 2 Canada, Volume 3 United States, Volume 4 Latin America, Volume 5 Asia [in two parts], Volume 6 Europe [in two parts], and Volume 7 Russia & other countries. Total number of pages was 5500.

Since these volumes could not be separated and therefore they will not be available to many readers, I decided to split the book into selected 28 small units each representing one country or a group of countries closely related geographically as shown below.

1	Arab Countries	Jordan, Kuwait, Morocco, Syria, Tunis
2	Austria	
3	Australia & Southeast Asia	Australia, Cambodia, Indonesia, Malaysia, Philippines, Thailand, Vietnam
4	Balkans	Albania, Bosnia, Bulgaria, Croatia, Greece, Romania, Serbia, Slovenia
5	Baltic Countries	Latvia, Lithuania, Poland
6	Brazil	
7	Canada	
8	Caribbean	Cuba, Puerto Rico, Venezuela
9	Caucasus	Armenia, Azerbaijan, Georgia
10	Central Asia	Afghanistan, Kazakhstan, Mongolia, Uzbekistan
11	Central Europe	Czech Republic, Slovakia, Hungary, Switzerland
12	Chile and Argentina	
13	China	
14	Egypt	
15	England and France	
16	Germany	
17	Iberian Peninsula	
18	India	
19	Italy and Vatican	
20	Japan and Korea	
21	Low Countries	

22	Mexico	
23	Middle East	Iran, Turkey
24	Peru and Bolivia	
25	Russia	
26	Scandinavia	
27	South Africa	
28	USA	

I hope in this way the book will available to a large number of readers.

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Historical Introduction

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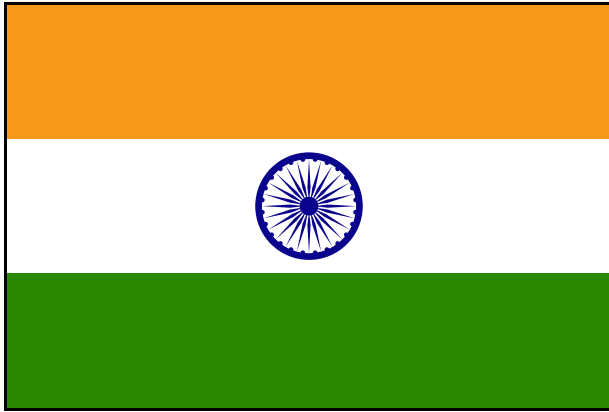


Figure 1.1: Flag of India.

EARLY CIVILIZATION

The first centres of Indian civilization were the cities of Harappa and Mohenjo-Daro, which arose along the valley of the Indus River (Figure 1.2). The ruins of these cities, as well as later examples of Indian literature, reveal a highly cultured people who had mastered engineering techniques and developed an effective system of government. The fertile Indus attracted a succession of invaders. The Aryans crossed the mountains around 1500 BC into northwest India and developed a Brahmanic civilization of the Vedic period in which they combined their own culture with that of the lands they conquered. It expressed itself in the great poetic and philosophical literature in their language known as Sanskrit. In Sanskrit the word “Arya” means gentleman.



Figure 1.2: The beginning of civilization in India along the valley of the Indus River.

The Aryans displaced the early inhabitants of India who were dark-skinned people known as Dravidians and prevented intermarriage. This is supposed to be the origin of the so-called caste system — the division of society in classes. There are four main groups. The highest cast was made of priests and scholars, next are the rulers and warriors, then merchants and artisans, and unskilled workers. Lowest of all were the untouchables, who had to do the dirtiest jobs.

The first millennium BC saw important developments in northern India. Two great religions appeared, beginning as movements of emancipation from the older Hindū religion: one was Jainism, the other was Buddhism, founded by Gautama the Buddha. In 516 BC, the Persians under Darius invaded the Indus valley, thus establishing channels of communication through which Persian influences came into India in the following centuries. In 327 BC, Alexander the Great (356–323 BC) (Figure 1.3), having conquered the Persian Empire, led his army into the Indus valley and established control over the territories now called the Punjab and Sind.

The Mauryan Empire flourished from 322 BC, when its founder Chandragupta united north India. The reign of Ashoka (273–232 BC) (Figure 1.4) saw the height of the Mauryan Empire, and is one of the great periods of Indian history. Asoka was converted to Buddhism, and devoted himself to the welfare of this people.



Figure 1.3: Victory silver coin of Alexander the Great minted in Babylon in 322 BC after his Indian campaign. Left: Alexander crowned by the Greek Goddess of victory Nike. Right: Alexander attacking King Porus on his elephant [British Museum].



Figure 1.4: King Ashoka (273–232 BC).

GUPTA EMPIRE

The fourth and fifth centuries AD saw the ascendancy of the Gupta Empire, which occupied the whole Ganges plain, reached west to the sea, Nepal and other regions to the north and east (Figure 1.5). This was a period of great development of Hindū philosophy and of artistic and literary

achievement. The Guptas united and ruled northern India from 320 to 480 AD and gave India a glorious period of civilization. Students from all over Asia went to India to study. The Empire, however, declined at the end of the fifth century after invasion by the Huns from central Asia. Of particular importance to metallurgists is the Delhi iron pillar and later the production of zinc.



Figure 15: The Gupta Empire.

MUSLIM INVASION

Since the sixth century India was fragmented into small feudal states. At the end of 12th century India was invaded by Turkish Muslim rulers from Afghanistan, who formed Delhi Sultanate. During the 15th century the country was fragmented again. Many small kingdoms often ruled by Muslim rulers. Babur of Farghana (1483–1530) (Figure 1.6), also known as Babar, a far descendant of Genghis Khan invaded India from Central Asia and conquered Delhi Sultanate about 1526 AD, starting the Moghul dynasty (Moghul — an adaptation of Mughul, the Persian word for Mongol) in Hindustan [India].

His grandson Akbar would be the greatest Mughal ruler of all. He extended the empire as far south as the Krishna River. Akbar (1542–1605) (Figure 1.7) tolerated local religions and married a Hindū princess, establishing a tradition of cultural acceptance that would contribute greatly to the success of the Mughal rule.



Figure 1.6: Zahir-ud-Din Mohammad Babur of Farghana (1483–1530).



Figure 1.7: Jalal-ud-Din Muhammad Akbar (1542–1605).

Akbar's grandson Shah Jahan (1592–1666) (Figure 1.8) came to power in 1627. He spent much of his time subduing Hindū kingdoms to the south and left behind the Tāj Mahal, the Royal Mosque, and the Red Fort. Jahan's campaigns in the south and his flare for extravagant architecture necessitated increased taxes and distressed his subjects. His son Aurungzebe (1618–1707) (Figure 1.9) imprisoned him, seeking power for himself in 1658.

Aurungzebe's intolerance prompted fierce local resistance. Though he expanded the empire to include nearly the entire subcontinent, he could never totally subdue the Mahrattas of the Deccan. Aurungzebe's three sons disputed over succession, and the Mughal Empire crumbled, just as the Europeans were beginning to colonize the subcontinent.



Figure 1.8: Shahab ud-din Muhammad Shah Jahan (1592–1666).



Figure 1.9: Abul Muzaffar Muhiu'd-Din Muhammad Aurangzeb (1618–1707).

The majority of Muslims in India are of Hindū descent. Massive conversions occurred mainly among the lower castes who were attracted by the creed of an equal brotherhood. The two religions are opposite to each other and some attempts were made to bridge the gap, e.g., the Sikhs (Hindūs who adopted some Muslim ideas) and the Ismailis (Muslims, followers of Aga Khan who absorbed some Hindū customs. Aga Khan claims to be a descendant of Prophet Muhammad).

EUROPEAN COLONIZATION

The Portuguese had traded in Goa (Figure 1.10) as early as 1510, and later founded three other colonies on the west. In 1610, the East India Company created its outpost at Surat north of Bombay. This small outpost marked the beginning of a remarkable presence that would last over 300 years and eventually dominate the entire subcontinent. Once in India, the British began to compete with the Portuguese, the Dutch, and the French. Through a combination of combat and alliances with local princes, the East India Company gained control of all European trade in India by 1769.

British colonization was a highly effective and organized system called the Raj. Treaties and agreements were signed with native princes, and the Company gradually increased its role in local affairs. The Raj helped build infrastructure and trained natives for its own military. In 1784, after financial scandals in the Company, the Crown assumed half-control of the Company. In 1858, a year-long rebellion against the British ensued. Although the Indian Mutiny was unsuccessful, it prompted the British government to seize total control of all British interests in India.

Infrastructure had been developed and an entire structure of governance erected. India had become a profitable venture, and the British did not allow the Indian population any power. At the beginning of the 20th century dawned there were increasing movements towards self-rule. Along with the desire for independence, tensions between Hindūs and Muslims had also been developing over the years. In 1915, Mohandās Gāndhī (1869–1948) (Figure 1.11) came onto the scene, calling for unity between the two groups that would eventually lead the country to independence at the end of World War II.

Independence came at great cost. While Gāndhī was leading a largely Hindū movement, Mohammed Ali Jinnah (1876–1948) (Figure 1.12) advocated the division of India into two separate states: Muslim and Hindū. When the British left in August 1947, they created the separate states of Pakistan and Bangladesh (known at that time as East Pakistan), and violence erupted when stranded Muslims and Hindū minorities in the areas fled in opposite directions.



Figure 1.10: Map of India today.

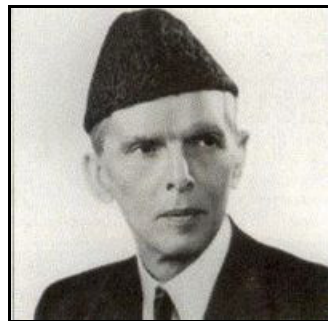
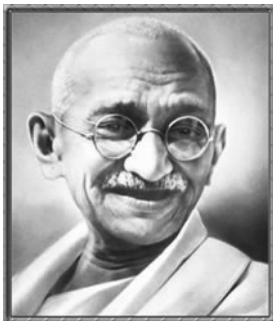


Figure 1.11: Mohandas Gāndhī (1869–1948). Figure 1.12: Mohammed Ali Jinnah (1876–1948).

ZINC FROM INDIA

It was from the East that metallic zinc became known to the West. The production of metallic zinc was described in the Hindū book *Rasarnava*, which was written around 1200 AD. From India, zinc manufacture moved to China where it developed as an industry to supply the needs of brass manufacture. Zinc production expanded and the metal began to be exported to Europe by Dutch, Portuguese, and Arab traders. The metal was made by indirectly heating calamine with organic matter in a covered crucible fitted with a condenser. Zinc vapour was evolved and the vapour was air cooled in the condenser located below the refractory crucible.

WOOTZ IRON

The so-called wootz iron produced in southern India two thousand years ago was recognized as the best material for this purpose. The Arabs traded in this material for many centuries. In Damascus, they made fine swords from the imported metal. It was also transported by the Moors to Andalusia in the eighth century. Swords made in Damascus and in Toledo became known as Damascus steel that had a characteristic pattern when etched that attracted the attention of European metallurgists.

The manufacture of the Indian wootz involved heating a mixture of iron ore and charcoal in a stone hearth, the product wrought iron, has a low carbon content. Small pieces of the metal were then mixed with charcoal in a small sealed clay crucible and heated to a high temperature. At this temperature iron takes up carbon at the surface lowering the melting point of the metal, thus a thin molten layer of iron forms on each of the pieces. At that point the crucible was taken out of the furnace and cooled slowly over a period of few days. During cooling a homogeneous distribution of carbon throughout the steel takes place. Some of the carbon precipitated out of solution, forming a network of cementite around the austenite grains. Because the slow cooling allowed the grains to grow, the cementite network was coarse. It was this coarse network that ultimately led to the visible markings on Damascus swords. Damascus steels were hammered into blades at a fairly low temperature. After forging, the blades were hardened by heat treatment.

VISITS TO INDIA

Table 1.1: Visits to India

Dates	City	Purpose of visit
1977	Vārānāsī	Banares Hindū University
	Kharagpur	Indian Institute of Technology
	Calcutta	Bengal Engineering College

Dates	City	Purpose of visit
1991	Delhi	Cultural visit
	Āgrā	Cultural visit
	Bombay	Atomic Energy Conference
	Delhi	Cultural visit
2008	Āgrā	Cultural visit
	Delhi	Transit
	Vārānasī	Banares Hindū University
	Jamshedpur	National Metallurgical Laboratory
	Kharagpur	Indian Institute of Technology
	Bhubanneswar	ICSOBA conference

Chapter 2

India 1977

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I arrived at New Delhi Airport from Tashkent on November 24, 1977 evening and was obliged to take a 17-hour train trip from Old Delhi Railway Station to Vārānasī because of unavailability of a seat on the plane.

VĀRĀNASĪ

Banaras or Vārānasī in state of Uttar Pradesh (Figures 2.1–2.2) is an old city is situated near the city of Allahabad. According to legend, the city was founded by Shiva, Lord of the Universe, which makes it one of the most important pilgrimage sites in India. Situated on the banks of the sacred Ganges River, the city has been a centre of learning and civilization for over 2 000 years. Vārānasī derives its present name from the two tributaries of the Ganga: Varuna and Asi, between which it is situated.

Vārānasī's principal attraction is the numerous bathing ghats (Figures 2.3–2.4) which line the west banks of the Ganges. It is also there that dead bodies are burned and the ash thrown in the holy river.

Banaras Hindū University

The International Conference on Metal Sciences: The Emerging Frontiers (Figure 2.5) was organized by members of the metallurgy Department of Banaras Hindū University (Figure 2.6). The Conference was attended by about 400 persons and it was a good chance to meet Indian colleagues. My Keynote Address was entitled "Hydrometallurgy — Its Past, Present, and Future." It was published in *Trans. Indian Inst. Metals* 31 (4), 231–238, 279 (1978).

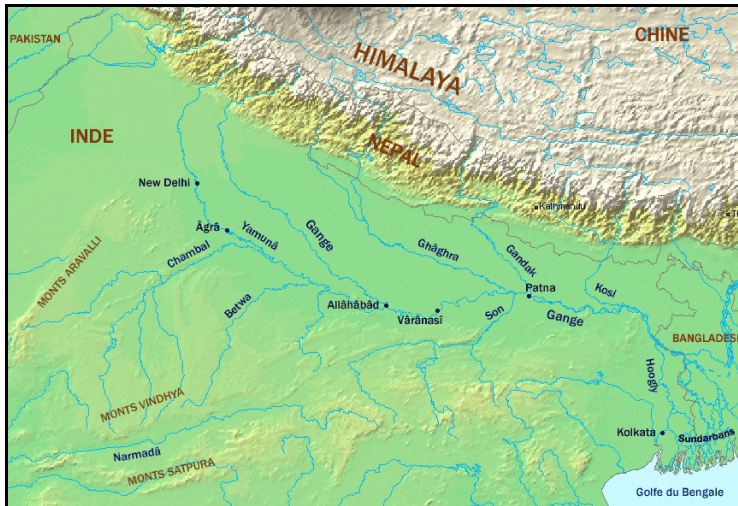


Figure 2.1: Vārānāsī on Ganga River, Delhi and Āgrā on Yamuna River. Ganga River starts from Himalaya and ends in Bay of Bengal.

The department of Metallurgy is a large department having 40 members of teaching staff, 200 undergraduates, and 50 graduate students. The previous Head was Prof. T. R. Anatharaman who became Rector recently, and was succeeded by Prof. S. L. Malhotra. Extractive metallurgy is conducted by Dr. P. M. Prasad and Mr. Tilak Raj Mankhand. Reduction of sulfides in presence of calcium oxide is being studied, a topic that has been under study at Laval in the past few years. Dr. B. Prakash is doing work on agglomeration of iron ores, calcium oxide, and the reduction of iron oxide-calcium oxide mixtures.

The Physical Metallurgy research includes among other things, a study of very rapidly cooled alloys called metallic glasses because under such circumstances they are amorphous to X-rays. Interest in such alloys stems from the fact that they have a much higher strength than when slowly cooled. That is why Prof. Pol Dowez from Berkeley who was the first to develop this idea was invited at the conference to talk about this new class of materials.



Figure 2.3: Burning dead bodies on the ghat.



Figure 2.4: Bathing in the Ganga.

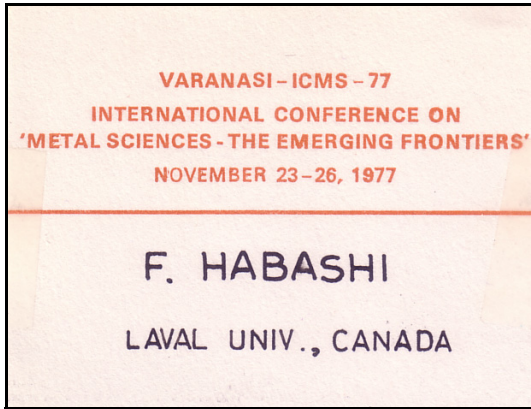


Figure 2.5: Vārānāsī, 1977.



Figure 2.6: Banaras Hindū University.

SĀRNĀTH

Sārnāth is located 13 km north-east of Vārānāsī, where Gautama Buddha first taught the Dharma, and where the Buddhist Sangha came into existence. The Dhamek Stupa is 40 m high and 30 m in diameter (Figure 2.7). A stupa is a Sanskrit word meaning a heap. It is a simple hemispherical

brick structure built over the relics of Buddha or his followers used by Buddhists as a place of worship. The stupa is a characteristic monument of Buddhist India.



Figure 2.7: A stupa in Sarnath.

KHARAGPUR

English colonialists captured the port in East Bengal in 1687 defeating Hindū and Mughul defenders. After the war a treaty was signed and the Mughul Emperor continued to rule the Province. From there the British settled in Kōlkata [Calcutta] for establishing their business. This was the start of East India Company in India. Kharagpur was reached by train from Vārānasī (Figure 2.8).

Indian Institute of Technology

The Indian Institute of Technology in Kharagpur was established in 1951 as the first institute of technology in India. A visit was organized after the conference in Vārānasī. Head of Department: Prof. P. Banerjee.



Figure 2.8: Kharagpur railway station.

CALCUTTA

Kolkātā or Calcutta is the capital of the Indian state of West Bengal. Under East India Company and later under the British Raj, Calcutta served as the capital of India until 1911. It was reached by train from Kharagpur (Figure 2.9). Howrah bridge (Figure 2.10) links the city of Howrah to Calcutta.



Figure 2.9: Calcutta railway station.



Figure 2.10: Howrah bridge.

Tagore Museum

Rabindranath Tagore (1861–1941) (Figure 2.11) a great Bengal poet and the first non-European Nobel laureate in 1913. His family home is kept as a museum.

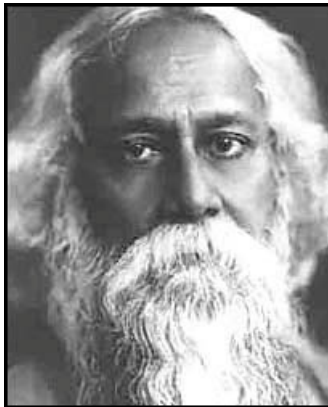


Figure 2.11: Rabindranath Tagore (1861–1941).

Indian Museum

The Indian Museum is the largest museum in India and has rare collections of antiques, armour and ornaments, fossils, skeletons, mummies, and

Mughal paintings. It was founded in 1814 and has six sections comprising thirty five galleries of cultural and scientific artefacts. It is one of oldest museums in the world.



Figure 2.12: Indian Museum.

Victoria memorial

The Victoria memorial (Figure 2.13) was built in 1921 to honour the Queen. It houses a museum containing a large collection of memorabilia relating to Queen Victoria and the British presence in India.



Figure 2.13: Victoria memorial.

Bengal Engineering College

Bengal Engineering College is located in Howrah, about 40 km north-east of Calcutta. After touring the Metallurgy Department on December 1, 1977 and meeting the faculty members, I gave a lecture entitled “Hydrometallurgy — present status and future outlook.” Head of Department: Prof. A. K. Seal.

DELHI

Delhi had served as the capital city for several empires of ancient sultanates and for the Mughal Empire. In 1911, the British administration shifted the capital of the British Indian Empire from Calcutta to Delhi because of its central location. Hence Old Delhi and New Delhi (Figure 2.14).



Figure 2.14: Map of Delhi showing location of Qutab Minar in the south.

Chapter 3

India 1991

Bombay	20	Parliament building	28
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Bhābhā Atomic Research Centre	20	India Gate	33
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BOMBAY

Bombay (Figures 3.1–3.2), now known as Mumbai, is the most populous city in India and a commercial and entertainment centre. It is built on what was once an archipelago of seven islands. The Portuguese occupied the islands in 1536. In 1661 the marriage Charles II of England and the daughter of King John IV of Portugal placed the islands in possession of the British Empire as part of the dowry by Charles. These islands were in turn leased to the British East India Company in 1668. In 1687, the British East India Company transferred its headquarters from Surat to Bombay. By 1845, the seven islands were coalesced into a single landmass via large scale land reclamation project. The opening of the Suez Canal in 1869 transformed Bombay into one of the largest sea ports on the Arabian Sea. Bombay has the worst slums in the country.

Gateway of India

The Gateway of India (Figure 3.3) was built during the British Raj on the waterfront overlooking the Arabian Sea. It is a basalt arch 26 m high erected to commemorate the landing on the Apollo Bunder of their Majesties King George V and Queen Mary when they visited India in 1911.

BHĀBHĀ ATOMIC RESEARCH CENTRE

Physicist Homī Bhābhā (1909–1966) (Figure 3.4) conceived the Indian Nuclear Programme and along with a handful of scientists initiated the

nuclear science research in India in 1944. This was only 16 months after a self-sustaining nuclear fission reaction was achieved in December 1942 by Enrico Fermi and his group at the University of Chicago — a fact that was tightly held secret. He approached Sir Dorabji Tata Trust for starting nuclear research in India leading to the establishment of Tata Institute of Fundamental Research in Mumbai which was inaugurated on December 19, 1945. Atomic Energy Act was passed in 1948 and Atomic Energy Commission was constituted to intensify the studies related to the exploitation of nuclear energy for the benefit of the nation (Figure 3.5).



Figure 3.1: The seven islands that formed Bombay. Trombay is on the eastern side.



Figure 3.2: Taj Palace Hotel.



Figure 3.3: Gateway of India.



Figure 3.4: Homi Jahangir Bhabha (1909–1966).



Figure 3.5: Bhabha Atomic Research Centre.

Exhaustive survey for rare minerals and Uranium deposits started by Atomic Minerals Division and in 1959 Indian Rare Earths Limited was set up for the chemical processing and recovery of rare earth compounds and thorium–uranium deposits. The International Conference on Advances in Chemical Metallurgy was held in Bombay in January 1991 and was organized by scientists at the Bhabha Atomic Research Centre in Trombay (a suburb of Bombay) and the Indian Institute of Metals (Figure 3.6). It was held at the Centre.

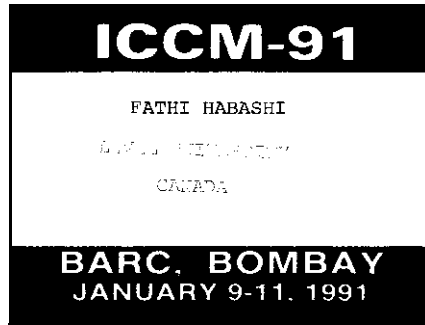


Figure 3.6: International Conference on Advances in Chemical Metallurgy 91.

Participants at the conference were about 300 of whom about 60 came from abroad many of them were Indians. With the convening of this conference, Indian metallurgists have pointed out to a new area of metallurgy which they called “Chemical Metallurgy.” It is a border area between extractive metallurgy and material science. It covers topics such as oxidation of metals, preparation of new materials, e.g., carbides, nitrides, etc., modelling and optimization in metallurgical processes, thermodynamics of alloys, slags, and others. However, this conference was leaning more towards extractive metallurgy. My Keynote Address was entitled “Recent Advances in Pressure Hydrometallurgy” and was published in the *Proceedings of International Conference on Advances in Chemical Metallurgy*, Bombay, 1979, **1**, 18/1–18/34 (1979).

Indian Institute of Metals

Bombay is the industrial capital of India. It was there in 1945 that the Bombay Metallurgical Society was founded, one year before the Indian Institute of Metals which was founded on the eve of the Independence Day. The Head Quarters of the Institute is in Calcutta, India’s largest city. The Institute has 47 Chapters in different parts of India. Its chief publication is the *Transactions*. In 1979, it started *Metal News* featuring technical and general interest articles, news items, and abstracts of proceedings of important conferences. In 1983, the Institute started *Journal of Alloy Phase Diagrams*.

Atomic Energy in India

India is among the seven or eight countries in the world to have the complete fuel cycle from uranium exploration, mining, extraction and reduction, through fuel fabrication, heavy water production, construction of reactors, to reprocessing and waste management.

The Atomic Energy Establishment was renamed as Bhābhā Atomic Research Centre in honour of its founder, who died in an aircraft accident in 1966. The Centre has grown over three years to become the foremost institution of science and technology in the country with a staff of around 10 000 of whom 3 000 are scientists. A Training School is set up at the Centre for training young university graduates before joining the Centre.

India has six research reactors and four nuclear power reactors. There is no uranium enrichment facility; enriched UF_6 is imported from USA and processed into fuel elements at the Nuclear Fuel Complex in Hyderabad. In formulating the strategy for nuclear power development, India took into account that while the uranium reserves are modest, she has the largest reserves of thorium in the world. A three-stage nuclear fuel cycle was conceived as follows: First phase: installation of natural uranium reactors. Second phase: installation of fast breeder reactors using plutonium from the first generation reactors with either uranium 238 or thorium in the blanket. Third phase: installation of reactors based on self-sustaining thorium–uranium 233 cycle.

Nuclear power plants

With the exception of the reactors at Tarapur, all Indian nuclear power reactors use heavy water both for neutron moderation and for heat transfer. There are four heavy water plants in India and three more are under construction [1991]. Nuclear power in India has been demonstrated as an economically competitive source of energy and played an important role for the scientific and technical development of the country.

DELHI

After the conference in Bombay, a few days were spent in Delhi and its neighbourhood (Figure 3.7). The main attractions are as follows.

Red Fort

The Red Fort (Figure 3.8) is a 17th-century fort complex constructed by the Mughal emperor Shah Jahan in the walled city of Old Delhi. It served as the residence of the Mughal Emperors and as the capital of the Mughals until 1857. It has massive red sandstone walls 18 m high on the river side and 33 m high on the city side.

Humayun tomb

The tomb of the Mughal Emperor Humayun (Figures 3.9–3.10), who ruled from 1508 to 1556, was commissioned by Humayun's wife in 1562,

completed in 1570 and is located near the Old Fort. Numerous subsequent Mughals were buried there.



Figure 3.7: Hotel guard. Photo by Fathi Habashi, 1991.



Figure 3.8: Red Fort.



Figure 3.9: Humayun tomb, 1570.

Delhi mosque

The mosque (Figure 3.11) was commissioned by the Mughal Emperor Shah Jahan, builder of the Taj Mahal, and was completed in 1656. It is the largest mosque in India.



Figure 3.10: Humayun's tomb. Photo by Fathi Habashi, 1991.



Figure 3.11: Delhi mosque.

Parliament building

The Indian parliament is a 170-m diameter circular building with 144 pillar colonnaded verandah inaugurated in 1927 (Figure 3.12).



Figure 3.12: Indian parliament.

Qutub Minar

The construction of Qutub Minar (Figures 3.13–3.16) was commenced by Qutb-ud-din Aibak [literary “Axis of the Faith”] (?–1210) in 1192, who destroyed Hindū temples and re-used the building materials for construction of Quwwat-ul-Islam mosque [literary Might of Islam], and the Qutub Minar. The minaret is 72.5 m high, contains stairs to reach the top, and the diameter of base is 14.3 m. It is surrounded by several other ancient and medieval structures and ruins including tombs of the Moguls and Delhi Pillar.



Figure 3.13: Ruins of Quwwat-ul-Islam mosque at Qutub Minar and Delhi Pillar.

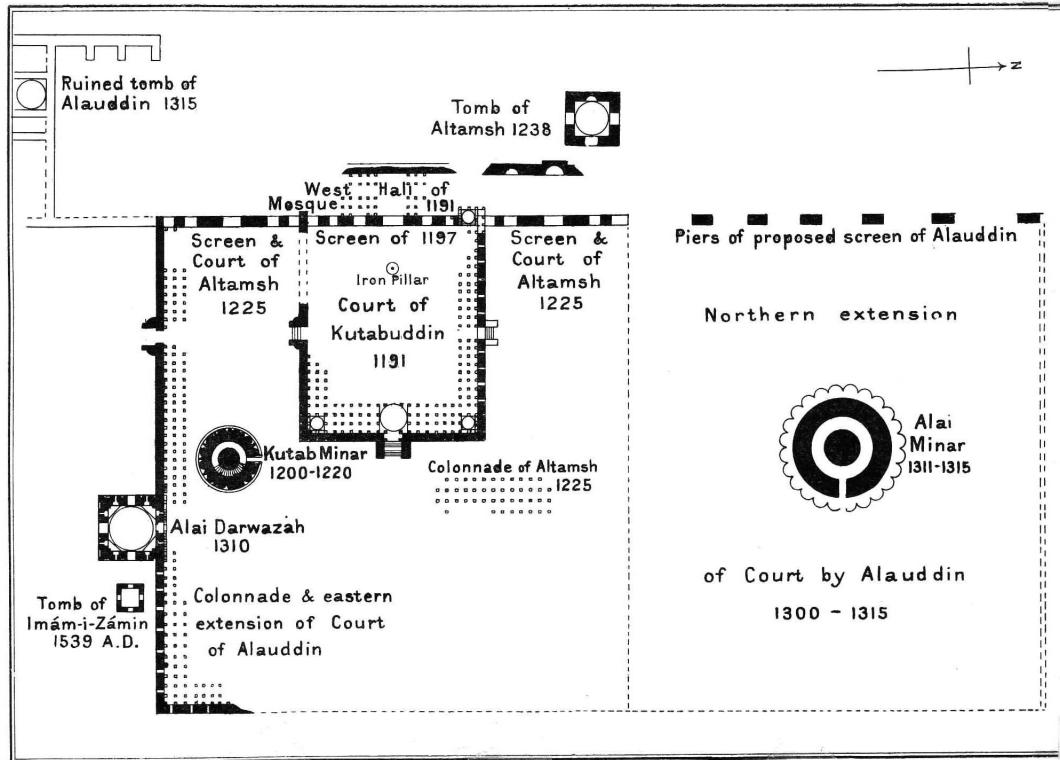


Figure 3.14: Qutub Minar and Iron Pillar.



Figure 3.15: Arabic inscriptions at the ruins of at Qutub Minar. Photo by Fathi Habashi, 1991.



Figure 3.16: Qutub Minar.

The pillar (Figure 3.17) dates back to the 4th century AD. It has the Sanskrit inscriptions “The triumphal pillar of Rajah Dhava, AD 310 who wrote his immortal fame with his sword.” It was made during the time of Samandragupta (330 to 380 AD). According to Johannsen, the German historian of iron metallurgy, that “The Indians were the only non-European people who manufactured heavy forged pieces [of iron], and the pieces were of a size that the European smith did not learn to make until more than one thousand years later.” The pillar weighs seven tons, has a total height of 7.5 m of which one metre is underground; its largest diameter is 40 cm. It is nearly pure iron, containing 0.08% C, 0.11% P, 0.006% S, and traces of manganese and silicon). A committee from the Iron and Steel Institute of Britain inspected the pillar in 1872 and came to the conclusion that it was made by welding together lumps of iron about 36 kg each; these were heated to high temperature and forged by hammering manually as the water-driven hammer was not yet known in India. The weld lines can be clearly seen.

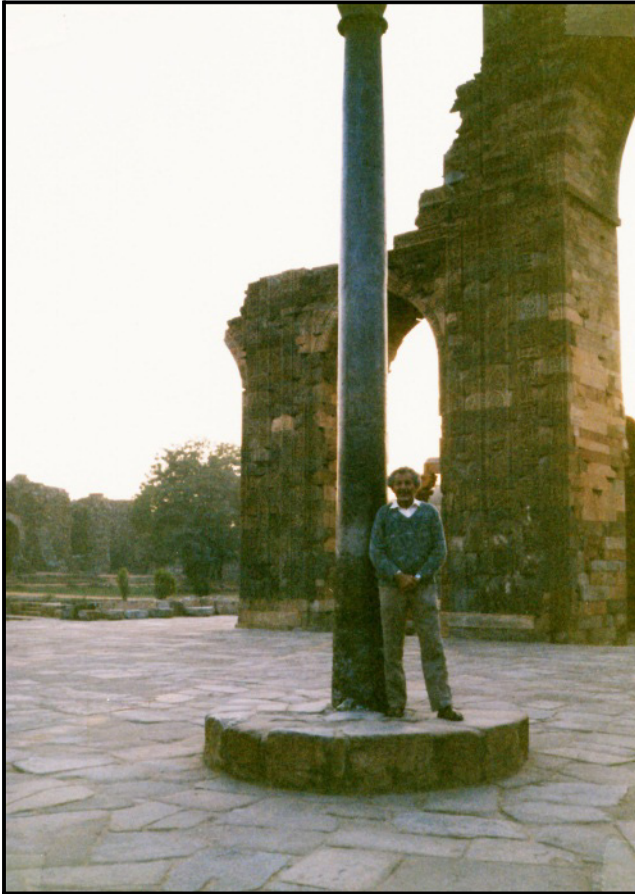


Figure 3.17: Delhi Pillar. Photo by Nadia Habashi, 1991.

India Gate

India Gate (Figures 3.18–3.19) was built in 1931 to commemorate the soldiers of the Indian Army who lost their lives while fighting in World War I and the Third Anglo-Afghan War. Following India's independence, the India Gate became the site of the Tomb of the Unknown Soldier.

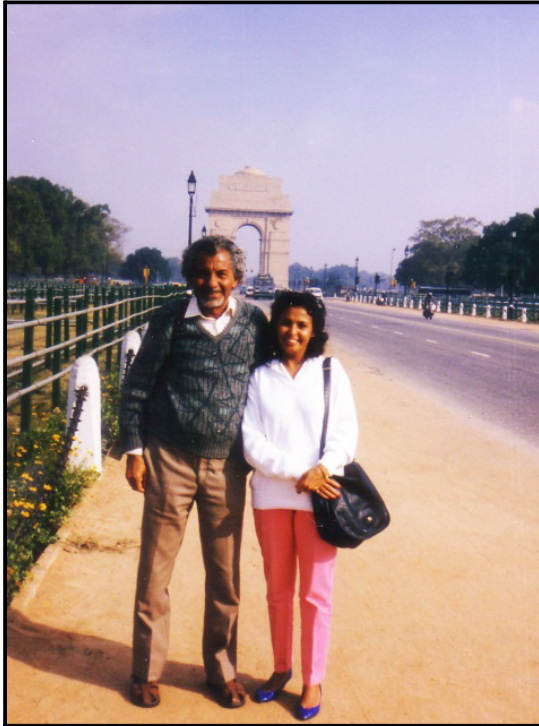


Figure 3.18: India Gate, Delhi, 1991.



Figure 3.19: India Gate.

Salt March monument

The Salt March took place in response to the Salt Tax imposed by the British that made it illegal to make salt in India. This march was one of the many non-violent protests Gāndhī aimed at undermining British Imperialism in India. On March 12th 1930 he and some friends began a 390-km march across the country towards a village called Dandi off the coast of the Arabian Sea. After a 23-day-long journey, Gāndhī and his friends reached their destination. After collecting salt on the beach he was arrested. The campaign had a remarkable effect on changing the world's opinion, and British attitude toward Indian independence and caused large numbers of Indians to actively join the fight for the first time. A monument commemorates this event in Delhi (Figure 3.20).



Figure 3.20: Gāndhī's Salt March monument. Photo by Fathi Habashi.

Lotus Temple

Due to its lotus flowerlike shape the Bahá'í House of Worship is a prominent attraction in Delhi. It was completed in 1986. The Bahá'í Faith is a monotheistic religion founded by Bahá'u'lláh (1817–1892) in 19th century Persia, emphasizing the spiritual unity of all human kind. There are an estimated six million Bahá'ís around the world but banned in Iran. Bahá'u'lláh claimed to be a messenger from God. He was persecuted by the Persian and Ottoman authorities, and died in prison.

Observatory

Maharaja Jai Singh II of Jaipur was given the task of revising the calendar and astronomical tables by Mughal emperor Muhammad Shah. An

observatory in Delhi was therefore constructed in 1724 to compile astronomical tables, and to predict the times and movements of the sun, moon and planets (Figure 3.23).



Figure 3.21: Bahá'í Lotus Temple in Delhi.



Figure 3.22: Bahá'í Lotus Temple in Delhi. Photo by Fathi Habashi, 1991.

ĀGRĀ

Āgrā (Figures 3.24–3.25) was the capital of the Mughal emperors from 1526 to 1658 and remains a major tourist destination because of its many splendid Mughal-era buildings, most notably the Taj Mahal, Āgrā Fort, and Fatehpur Sikri.



Figure 3.23: Remains of Delhi's observatory, 1725.



Figure 3.24: Location map of Āgrā.

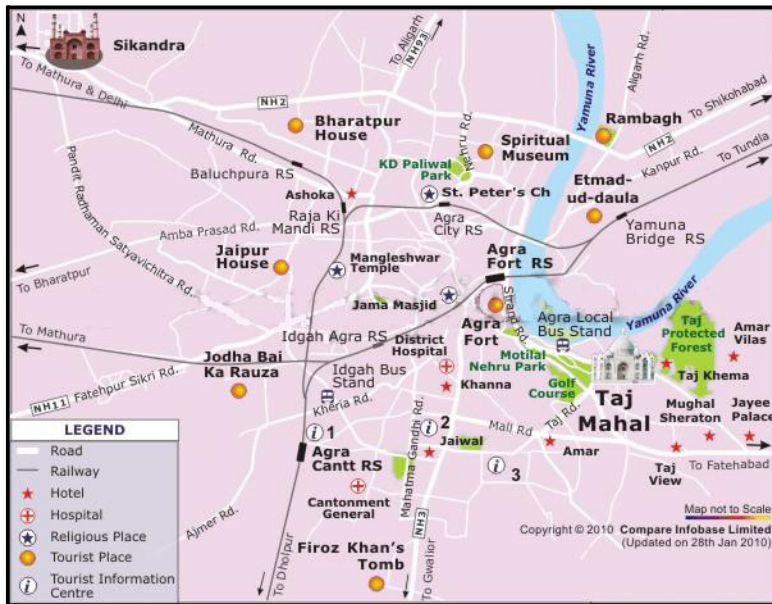


Figure 3.25: Map of major monuments in Āgrā.

Taj Mahal

The Taj Mahal is one of Mughal's India masterpieces — it has no equivalent in western civilization. In 1631, Emperor Shah Jahan (1592–1666), during the Moghul Empire's period of greatest prosperity, was grief-stricken when his third wife, Mumtaz Mahal (1593–1631) (Figure 3.26), died during the birth of their fourteenth child.

Construction of the Taj Mahal began (Figures 3.27–3.45) in 1632, one year after her death. The Taj Mahal was constructed by a labour force of about twenty thousand workers recruited from northern India. Sculptors from Bukhara, calligraphers from Syria and Persia, inlayers from southern India, stonecutters from Baluchistan, a specialist in building towers and another who carved only marble flowers were part of the thirty-seven men who formed the creative unit. They worked for 20 years using materials from all over India and Asia. Over 1,000 elephants were used to transport the building materials. The translucent white marble was brought from Rajasthan and twenty eight types of precious and semi-precious stones were inlaid into the marble.



Figure 3.26: Mumtaz Mahal (1593–1631).



Figure 3.27: Entrance to Taj Mahal.



Figure 3.28: Entrance to Tāj Mahal. Photo by Fathi Habashi, 1991.

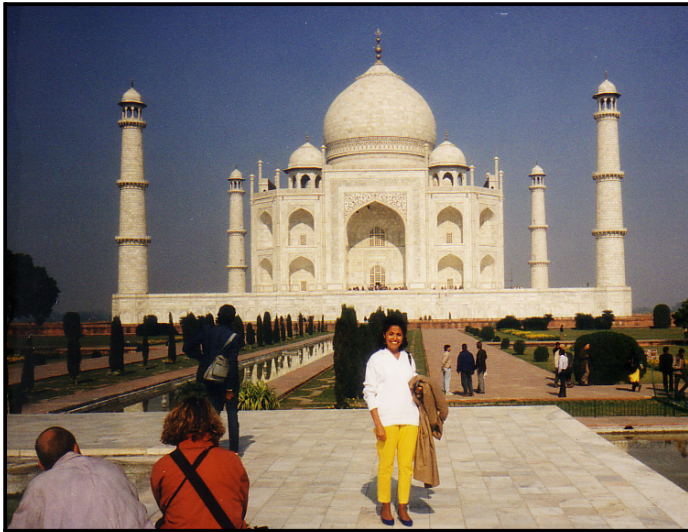


Figure 3.29: Tāj Mahal. Photo by Fathi Habashi.



Figure 3.30: Tāj Mahal.

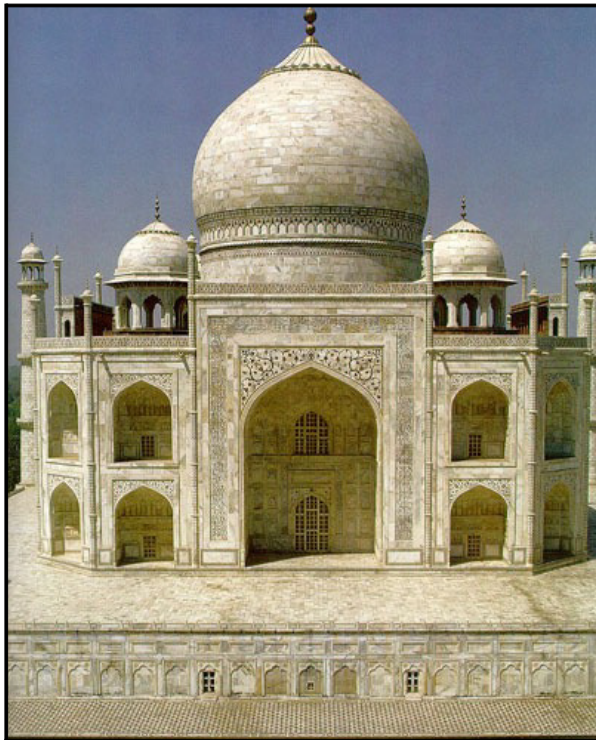


Figure 3.31: Tāj Mahal.

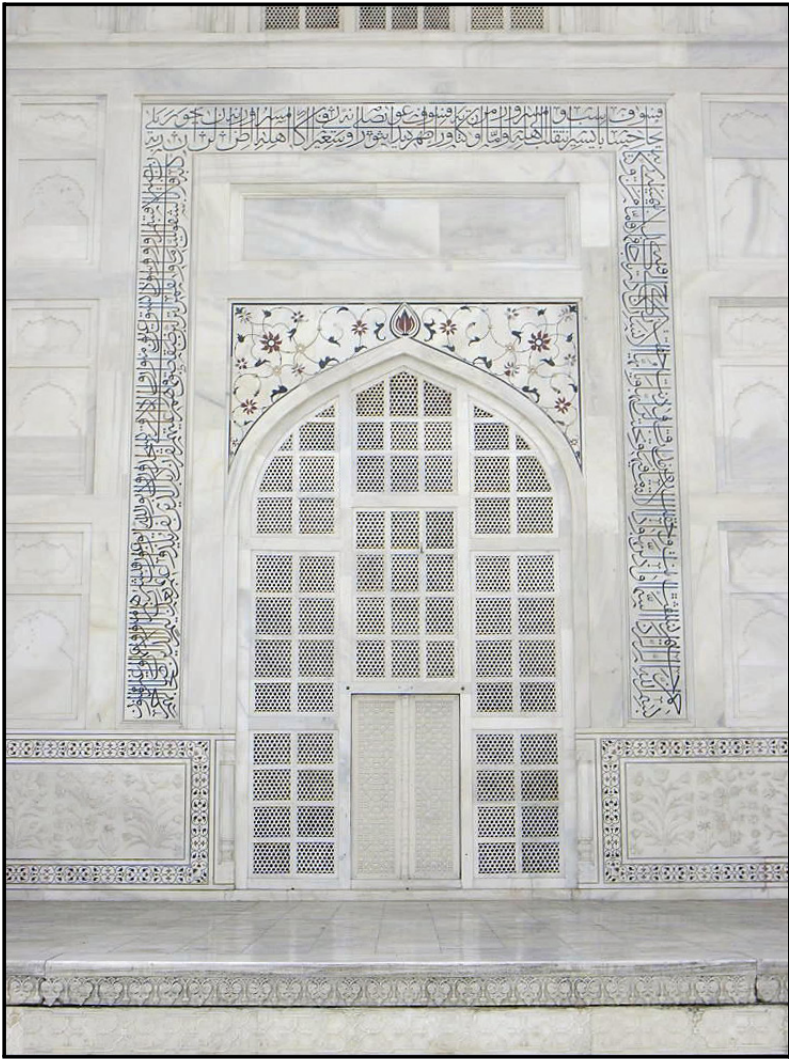


Figure 3.32: Taj Mahal, details.

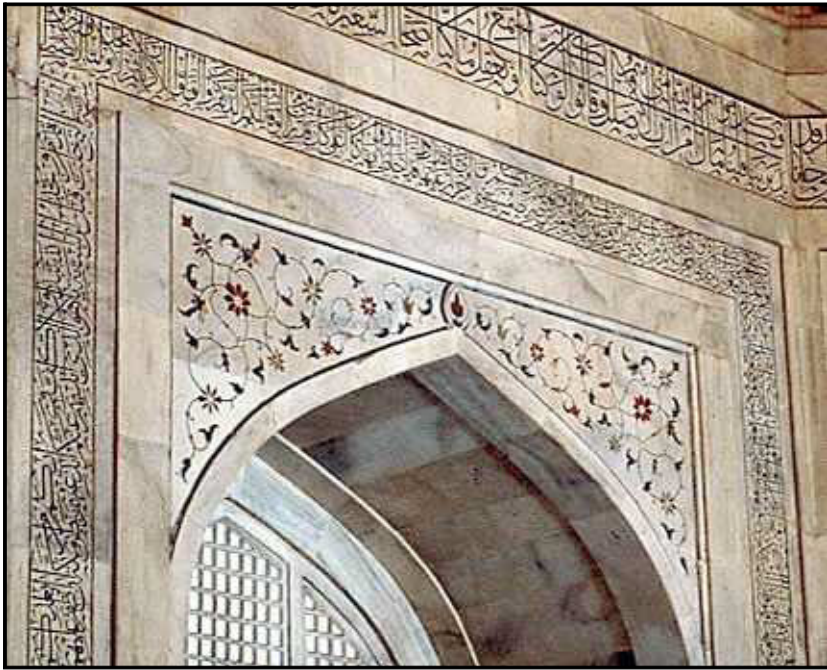


Figure 3.33: Taj Mahal, details.



Figure 3.34: Taj Mahal, details.



Figure 3.35: Tāj Mahal, the tombs of the emperor and his wife.



Figure 3.36: Tāj Mahal, details.

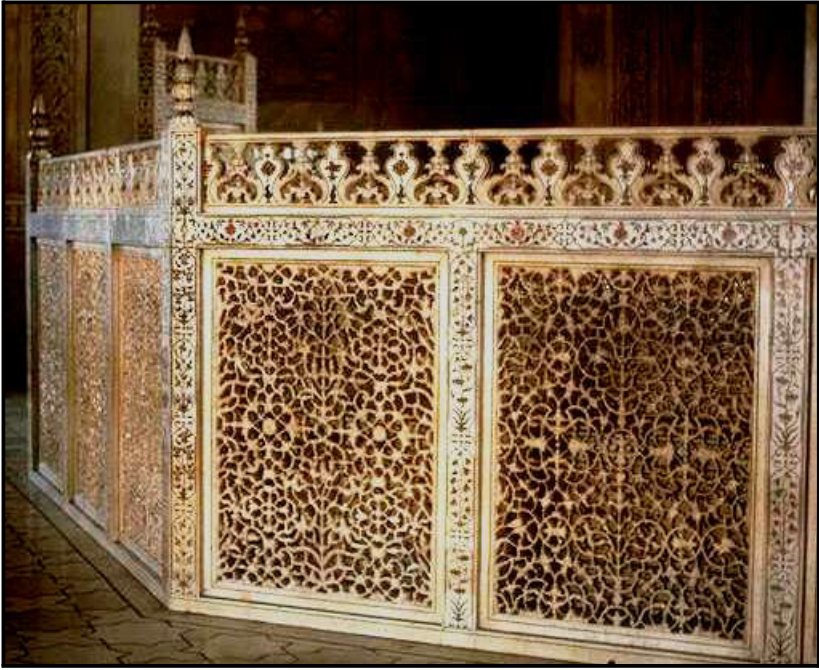


Figure 3.37: Taj Mahal, details.

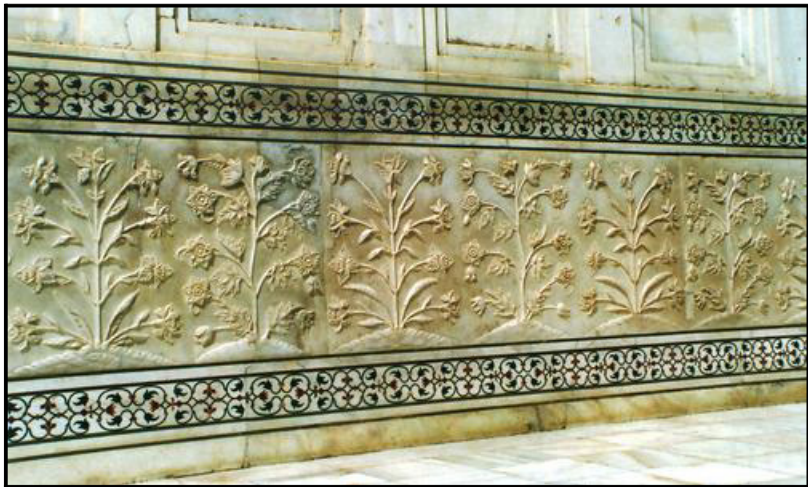


Figure 3.38: Taj Mahal, details.

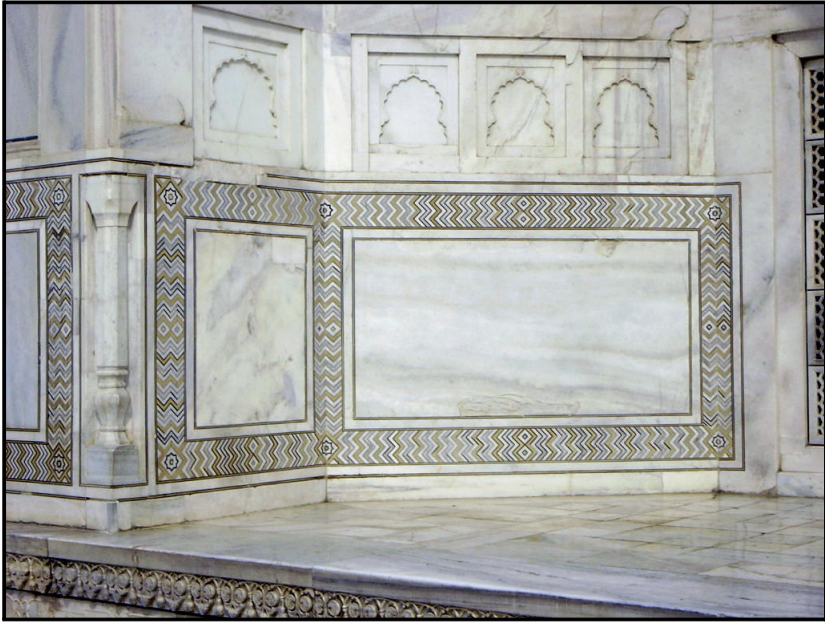


Figure 3.39: Taj Mahal, details.



Figure 3.40: Taj Mahal, details.



Figure 3.41: Taj Mahal, details.



Figure 3.42: Tāj Mahal, details.



Figure 3.43: Tāj Mahal, details.



Figure 3.44: Taj Mahal, details.



Figure 3.45: Details of sculpture.

Āgrā Fort

The Āgrā fort is a walled city built of bricks was originally held by the Hindū King Sikarwar Rajputs. It was captured in 1526 by the Mughals. Akbar made it his capital in 1558. It was in a ruined condition and Akbar had it rebuilt with red sandstone and was completed in 1573 (Figures 3.46–3.49). At the end of his life, Shah Jahan was deposed and restrained by his son Aurangzeb in the fort.



Figure 3.46: Entrance to Āgrā Fort.



Figure 3.47: The Palace.

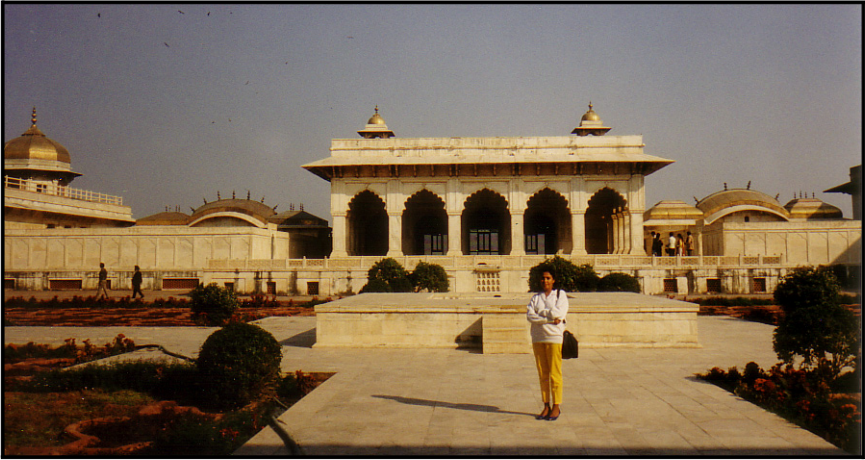


Figure 3.48: The Marble Palace inside the Fort. Photo by Fathi Habashi, 1991.



Figure 3.49: Inside the Marble Palace [Diwan-i-Khas].

Fatehpur

Fatehpur (Figure 3.50) is the Diwan-i-Khas, i.e., Hall of Private Audience built by Mughal Emperor Akbar. The Imperial complex was abandoned in 1585, shortly after its completion, due to lack of water and its proximity with the Rajputana areas in the North-West, which were increasingly in turmoil. Thus the capital was shifted to Lahore before moving back Agra in 1598.



Figure 3.50: Fatehpur.

Akbar's tomb

Mughal Emperor Akbar, who ruled from 1556 to 1605, began building his tomb during his lifetime and his son Emperor Jahangir completed it (Figure 3.51). Some of its design features are similar to the design of the Taj Mahal built later.

Itmad-Ud-Daulah's Tomb

Itmad-Ud-Daulah's Tomb (Figure 3.52) was built between 1622 and 1628, commissioned by the wife of Emperor Jahangir, Nur Jahan for her father Mirza Ghiyas Beg, who had been bestowed with the title of Itimād-ud-Daulā meaning the pillar of the state.

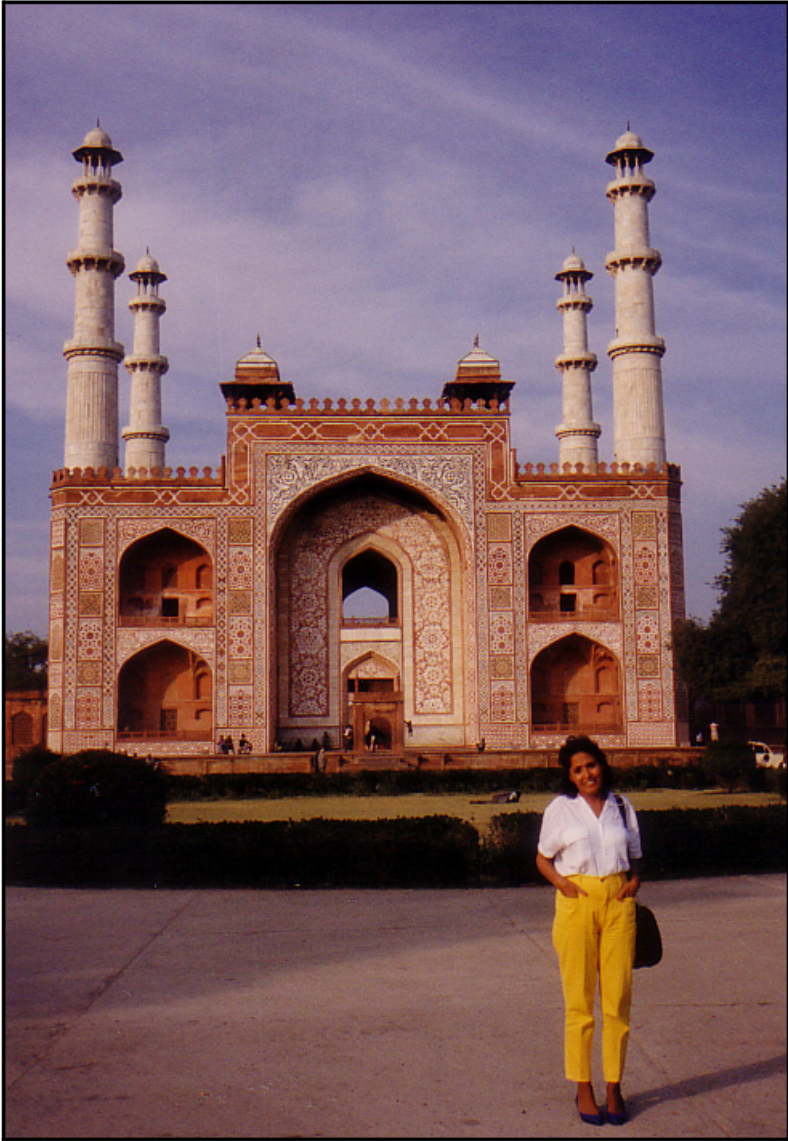


Figure 3.51: Akbar's tomb. Photo by Fathi Habashi, 1991.



Figure 3.52: Itmad-Ud-Daulah's tomb.

Chapter 4

India 2008

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A lecture tour was organized in November 2008 that took place in Vārānasī, Jamshedpur, Kharagpur, and Bhubaneswar (Figure 4.1).

VĀRĀNASĪ

Relations with Banaras Hindū University in Vārānasī was maintained since my first visit in 1977 mainly through graduate student Tilak R. Mankhand, who successfully obtained his doctorate and eventually became Chairman of the Metallurgy Department. He was my guide during my 2008 visit (Figures 4.2–4.8).

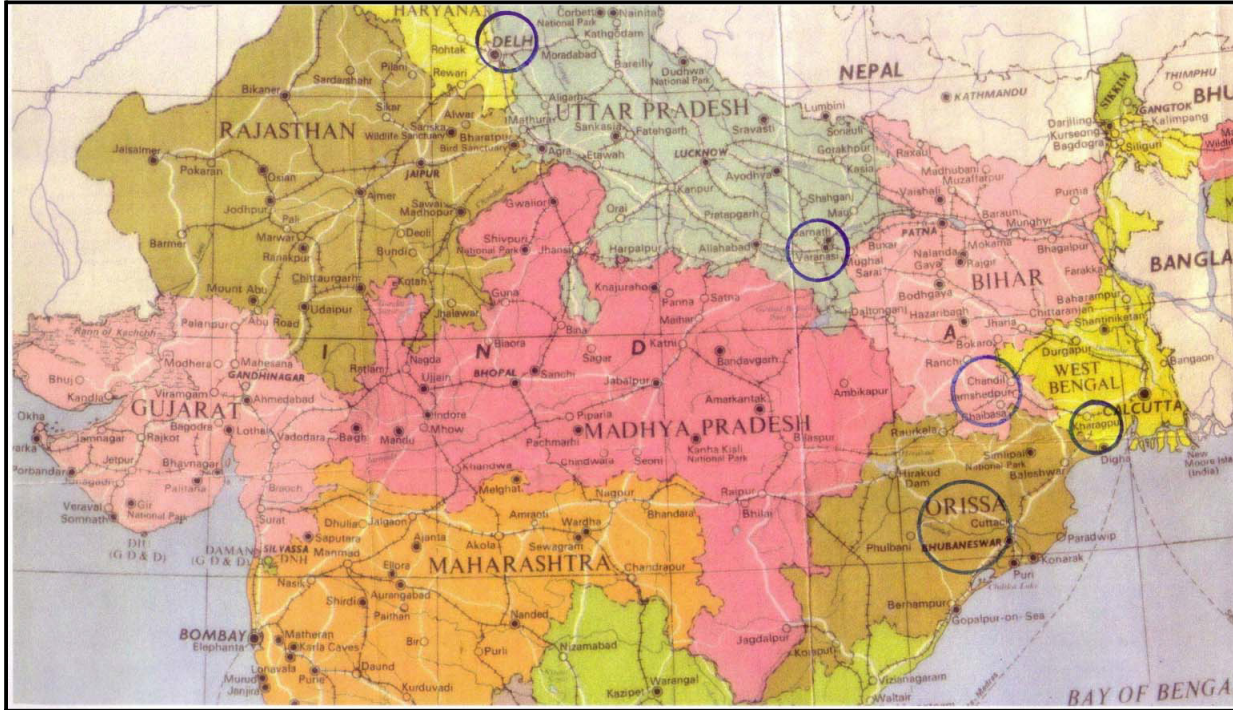


Figure 4.1: Lecture tour in 2008.



Figure 4.2: Gift shop in my hotel.



Figure 4.3: Professor Mankhand at the entrance to Banaras Hindü University.



Figure 4.4: Founder of Banares Hindū University Pandit Madan Mohan Malviya in 1916.



Figure 4.5: Founder of Banares Hindū University Pandit Madan Mohan Malviya in 1916.



Figure 4.6: Temple in Vārānasi.

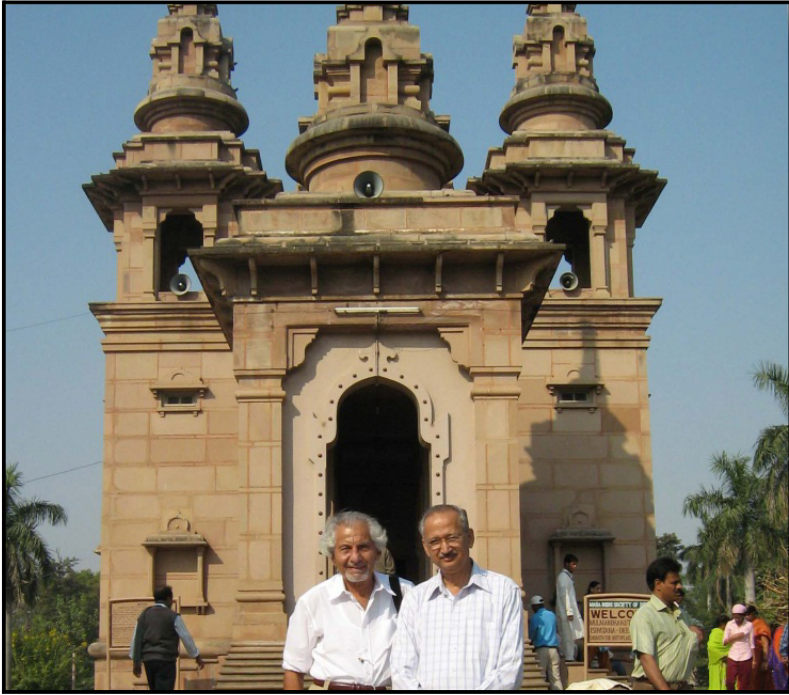


Figure 4.7: Temple in Vārānasi.

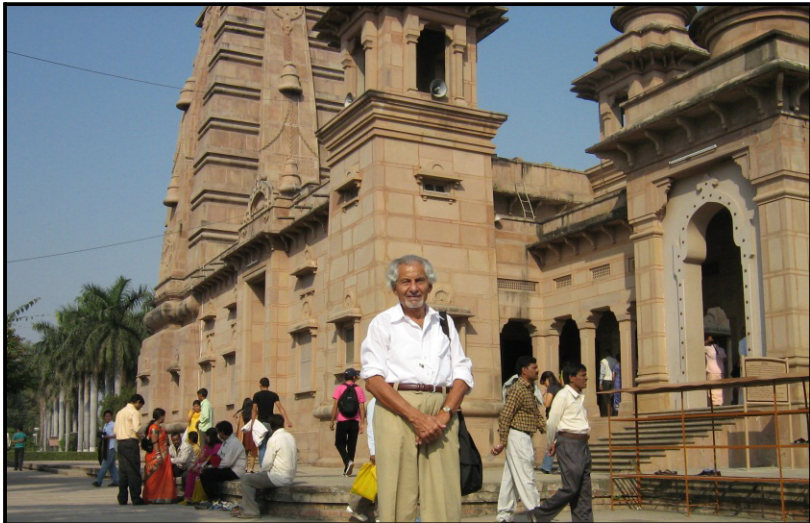


Figure 4.8: Temple in Vārānasi.

Vārānasī Museum

Vārānasī Museum possesses the sculpture that has been used since 1950 as the national symbol. The symbol is the great Dharma Chakra (wheel of law) used by Emperor Ashoka. The sculpture has four lions on a pillar with an elephant, horse, bull, and lion separated by a lotus on the base (Figure 4.9).



Figure 4.9: The national symbol of India in Vārānasī Museum.

Banaras Hindū University



Figure 4.10: Professor Mohammad Shamsuddine, Chairman Department of Metallurgy in 2008.



Figure 4.11: Seminar at the Metallurgy Department.



Figure 4.12: At the Metallurgy Department.

JAMSHEDPUR

Jamshedpur (Figure 4.13) is the first planned industrial city of India, founded by the late Jamshedji Nusserwanji Tata (Figure 4.14). It is also known as Steel City. It is a major industrial centre of East India, houses companies like Tata Steel, Tata Motors, Tata Power, Lafarge Cement, and others.



Figure 4.13: Location map of Jamshedpur.



Figure 4.14: Founder of Jamshedpur.

National Metallurgical Laboratory

The National Metallurgical Laboratory was founded in 1946 after India's independence. It is a large laboratory with pilot plants that focuses on minerals, metals, and materials. Director: S. P. Mehrotra, Guide: Dr. P. D. Pandey (Figures 4.15–4.19).



Figure 4.15: National Metallurgical Laboratory.



Figure 4.16: Director S. P. Mehrotra, 2nd from left, 2008.



Figure 4.17: A replica of Delhi Iron Pillar at NML.



Figure 4.18: Seminar at National Metallurgical Laboratory.



Figure 4.19: Seminar at National Metallurgical Laboratory.

Council of Scientific and Industrial Research (Figure 4.20), established in 1942, is an autonomous organization composed of:

- The National Physical Laboratory situated in New Delhi, is the measurement standards laboratory of India.
- The National Chemical Laboratory is based in Pune, in western India established 1950.
- National Metallurgical Laboratory in Jamshedpur.

KHARAGPUR

Kharagpur is in West Bengal, 116 km south of Calcutta (Figure 4.21). It was reached by train from Jamshedpur although it would have been better to go via Calcutta. First visit to Kharagpur was in 1977. Guide: Dr. Sahu.



Figure 4.20: Logo of Council of Scientific and Industrial Research.



Figure 4.21: Map of West Bengal showing location of Kharagpur and Calcutta.

Indian Institute of Technology

Second visit was on November 26, 2008. Metallurgy Department Chairman: Prof. Nirupam Chakraborti (Figures 4.22–4.26).



Figure 4.22: Indian Institute of Technology.



Figure 4.23: Indian Institute of Technology.



Figure 4.24: Indian Institute of Technology.



Figure 4.25: Prof. Nirupam Chakraborti, Chairman Department of Metallurgical Engineering.



Figure 4.26: Faculty and students at Department of Metallurgical Engineering.

BHUBANESWAR

Bhubaneshwar is the capital of State of Orissa, officially known as Odisha. Historically known as Kingdom of Kalinga, it is the destination of many pilgrimages for Buddhists and Hindus. Bhubaneshwar was reached from Kharagpur by train. The 10th-century Lingaraja temple is dedicated to Shiva (Figure 4.27) is about 175 m high. There are at least one thousand temples in the State. The great Kalinga war took place here between Emperor Ashoka and the old empire of Orissa in 261 BC.



Figure 4.27: Tenth-century Lingaraja temple.

Almost one-third of Orissa is covered by forests. The State has large deposits of iron ore, bauxite, and chromite. About sixty tribal groups of indigenous people inhabit Orissa and constitute more than one-quarter of the state's total population of 62 million. The official language in the State is Oriya. The Tribal Research Institute Museum created by the tribal craftsmen offers a bird's eye view of the State's tribal heritage.

ICSOBA conference

The International Committee for the Study of Bauxite and Alumina known as ICSOBA held its annual meeting in 2008 at Hotel Mayfair Lagoon in Bhubaneswar (Figures 4.28–4.35).



Figure 4.28: ICSOBA 2008.



Figure 4.29: Delegates from F. L.Smidth.



Figure 4.30: Hotel Mayfair Lagoon.



Figure 4.31: Hotel Mayfair Lagoon.



Figure 4.32: Hotel Mayfair Lagoon.



Figure 4.33: Hotel Mayfair Lagoon.

Institute of Minerals & Materials Technology

This institute was known earlier as Orissa Regional Research Laboratory. It was set up in 1964 by Council of Scientific & Industrial Research to provide R&D support for process and product development (Figures 4.36–4.39). Hosts: R. K. Paramguru and Sarveswara Rao.



Figure 4.34: Hotel Mayfair Lagoon.



Figure 4.35: Hotel Mayfair Lagoon.



Figure 4.36: Institute of Minerals & Materials Technology.



Figure 4.37: Engineers from Institute of Minerals & Materials Technology.



Figure 4.38: Presentation to engineers.



Figure 4.39: Presentation to engineers.

Kalinga Institute of Industrial Technology

Kalinga Institute of Industrial Technology (Figures 4.40–4.41) was established in 1997 by Dr. Achyuta Samanta (Figure 4.43) as a modest industrial training institute and declared as University in 2004. The Institute also takes care of young boys and girls (Figures 4.44–4.45). Host: Dr. Mishra Krushna.



Figure 4.40: Touring Kalinga Institute of Industrial Technology.



Figure 4.41: Touring Kalinga Institute of Industrial Technology.



Figure 4.42: Presentation to faculty members and students.



Figure 4.43: Dr. Achyuta Samanta, founder of Kalinga Institute of Industrial Technology.



Figure 4.44: Teaching young boys and girls handwork.

Dhaulagiri temple

Dhaulagiri temple is situated on top of a hill and is an important landmark in Bhubaneshwar because of the battle that took place in the 4th century AD, when Gupta invaded the region.



Figure 4.45: Teaching young boys and girls handwork.



Figure 4.46: Dhaulagiri Temple.



Figure 4.47: Dhaulagiri Temple.



Figure 4.48: Dhaulagiri Temple.



Figure 4.49: Dhaulagiri Temple.

Chapter 5

Indian Culture

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GREETINGS, BINDĪ

Indians have a special way of greetings (Figure 5.1). Bindī is also a traditional decoration (Figure 5.2). A bindī, from Sanskrit bindu, meaning “a dot,” is a forehead decoration. Traditionally, the area between the eyebrows (where the bindī is placed) is said to be the seat of “concealed wisdom.” According to followers of Hinduism, the bindī is said to retain energy and strengthen concentration. It is also said to protect against demons or bad luck. Red represents honour, love and prosperity.



Figure 5.1: Greeting the Indian way.



Figure 5.2: A red bindi decoration.

SARI

Sari is the traditional India ladies' dress (Figure 5.3).

TURBAN

Colourful turbans are mainly worn by Sikhs who do not cut their hair (Figures 5.4).

RELIGIONS

Buddhism originated in India at Sārnāth near Vārānasī and from there it spread to China, Japan, and other countries in Asia. Buddhism preaches equality while Hinduism preaches the superiority of the upper caste.

CEREMONIES

Praying to gods and lighting candles are the usual ceremonies for opening a conference (Figure 5.5).

MYTHOLOGY

There is a variety of mythologies such as Vedic, Hindū, and Buddhist mythology, and others (Figures 5.6–5.25).



Figure 5.3: Typical saris.

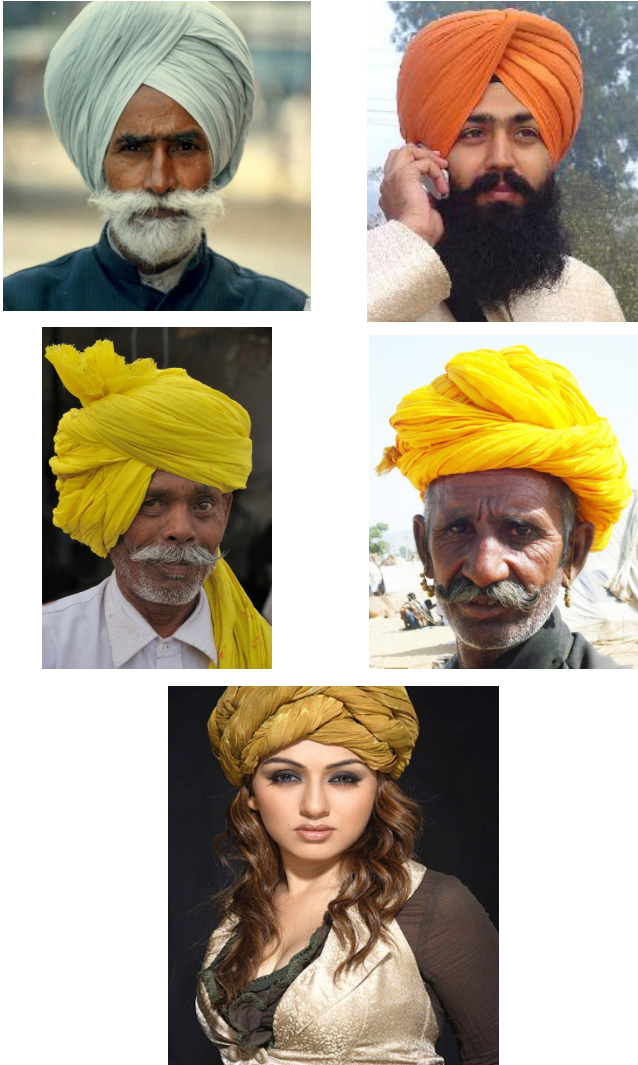


Figure 5.4: Different types of turbans.



Figure 5.5: Opening ceremony by lighting candles.



Figure 5.6: Painting depicting a scene from ancient mythology.



Figure 5.7: Painting depicting a scene from ancient mythology.



Figure 5.8: Painting depicting a scene from ancient mythology.



Figure 5.9: Painting depicting a scene from ancient mythology.



Figure 5.10: Painting depicting a scene from ancient mythology.



Figure 5.11: Painting depicting a scene from ancient mythology.



Figure 5.12: Painting depicting a scene from ancient mythology.



Figure 5.13: Painting depicting a scene from ancient mythology.



Figure 5.14: Painting depicting a scene from ancient mythology.



Figure 5.15: Painting depicting a scene from ancient mythology.



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Figure 5.17: Painting depicting a scene from ancient mythology.



Figure 5.18: Painting depicting a scene from ancient mythology.



Figure 5.19: Painting depicting a scene from ancient mythology.



Figure 5.20: Painting depicting a scene from ancient mythology.



Figure 5.21: Painting depicting a scene from ancient mythology.



Figure 5.22: Painting depicting a scene from ancient mythology.



Figure 5.23: Painting depicting a scene from ancient mythology.



Figure 5.24: Goddess of wealth.



Figure 5.25: Goddess of dawn.

Rāma and Sītā



Figure 5.26: Rāma and Sītā.

Radha Krishna

Radha is acknowledged as the Supreme Goddess, for it is said that she controls Krishna with her love (Figures 5.27–5.31).



Figure 5.27: Radha Krishna.

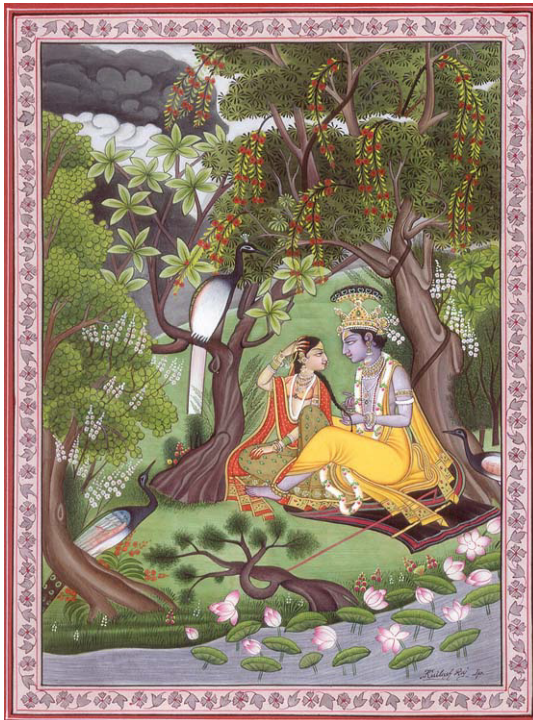


Figure 5.28: Radha Krishna.

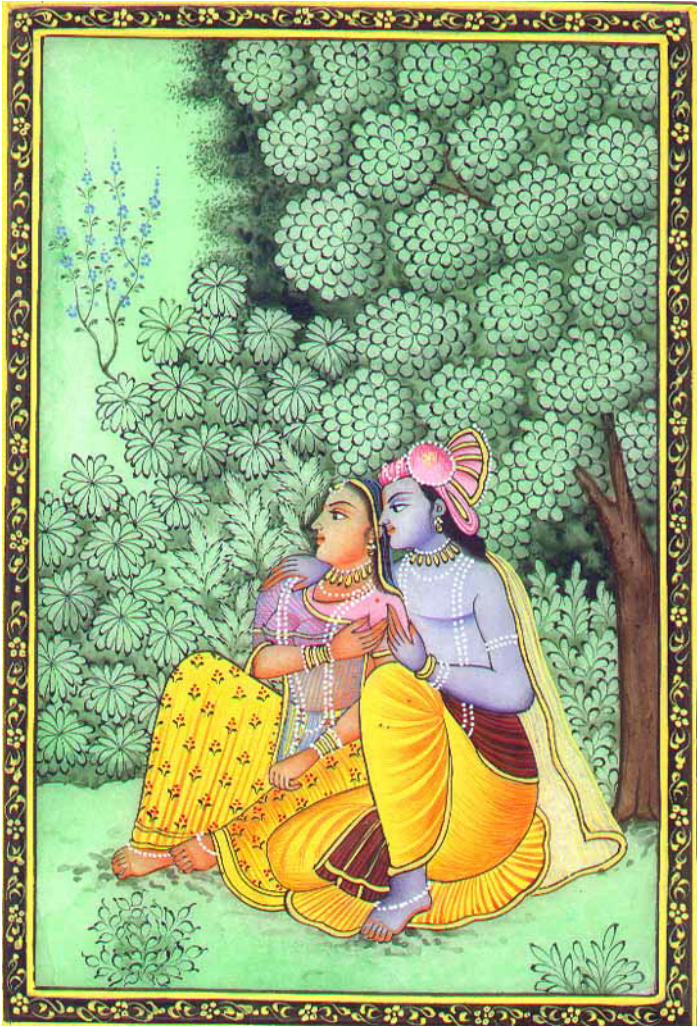


Figure 5.29: Radha Krishna.



Figure 5.30: Radha Krishna.



Figure 5.31: Radha Krishna.

Lord Ganesh

In Hindū mythology, Lord Ganesh is the son of Lord Shiva and the Divine Mother Parvati. The Hindū deity in a human form but with the head of an elephant — represents the power of the Supreme Being that removes obstacles and ensures success in human endeavours (Figure 5.32). Besides being used for transportation and for ceremonies the elephant is also utilized to move heavy objects (Figures 5.33–5.35).



Figure 5.32: Lord Ganesh.



Figure 5.33: An elephant for transportation.



Figure 5.34: Elephants for ceremonies.



Figure 5.35: The elephant used for moving heavy objects.

Dancing Shiva

Goddess Shiva the cosmic dancer who performs his divine dance to make preparations for God Brahma to start the process of creation; it is represented in different forms (Figures 5.36–5.39).



Figure 5.36: Dancing Shiva.



Figure 5.37: Dancing Shiva.

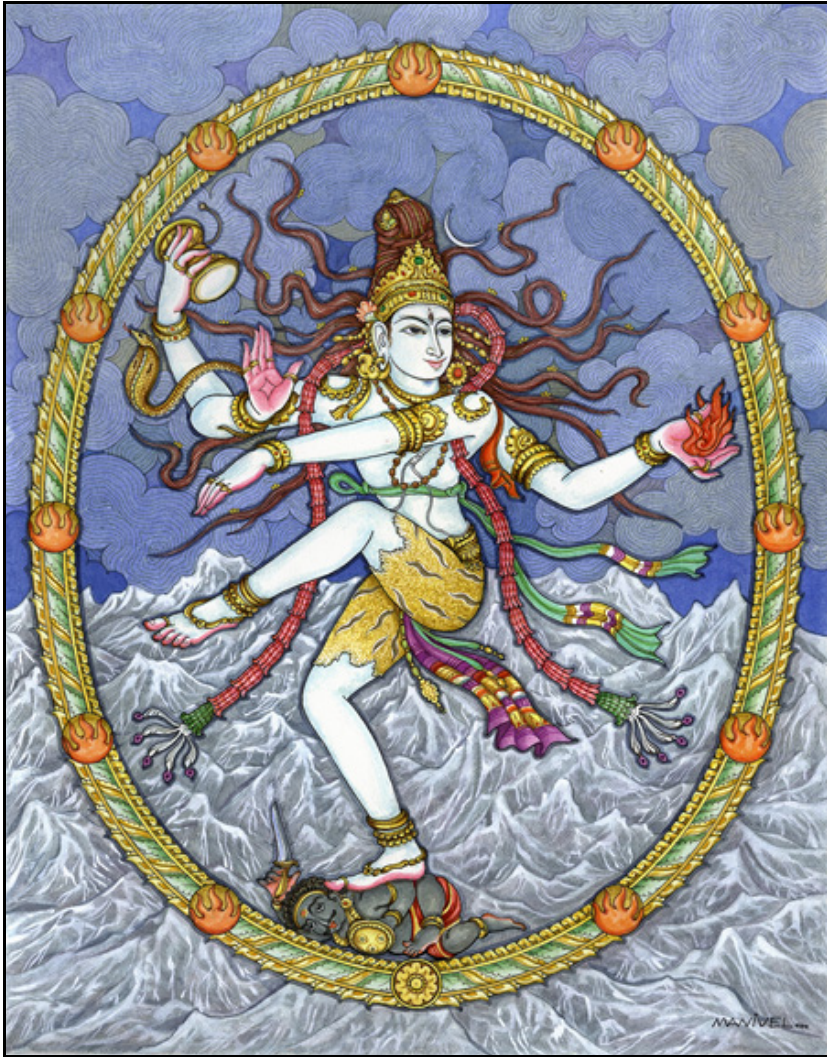


Figure 5.38: Dancing Shiva.



Figure 5.39: Dancing Shiva.

DANCES

There are at least eight distinctive traditional dances which might have origin in religious activities of distant past. Folk dances are numerous in number and style, and vary according to the local tradition of the respective state, ethnic or geographic regions (Figures 5.40–5.52). Some of these dances are related to Dancing of the Goddess Shiva.



Figure 5.40: Typical Indian dances.

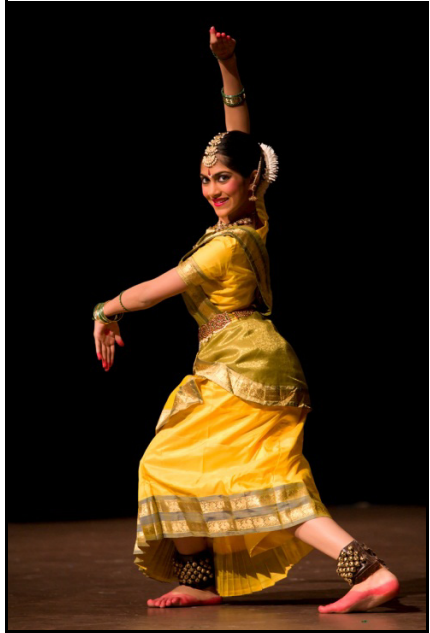


Figure 5.41: Typical Indian dances.



Figure 5.42: Typical Indian dances.



Figure 5.43: Typical Indian dances.



Figure 5.44: Typical Indian dances.



Figure 5.45: Typical Indian dances.



Figure 5.46: Typical Indian dances.



Figure 5.47: Typical Indian dances.



Figure 5.48: Typical Indian dances.



Figure 5.49: Typical Indian dances.



Figure 5.50: Typical Indian dances.



Figure 5.51: Typical Indian dances.



Figure 5.52: Paintings showing typical Indian dances.

THE SACRED COW

Cattle are considered sacred in various world religions, most notably Hinduism, Jainism, Buddhism, Zoroastrianism as well as the religions of Ancient Egypt, Ancient Greece, and Ancient Rome. In some regions, especially India, the slaughter of cows is illegal in some states. The cow (Figure 5.53) was possibly revered because the largely pastoral Vedic people and subsequent generations relied heavily on it for dairy products and for tilling the fields, and on cow dung as a source of fuel and fertilizer. The cow is as useful dead as when she is alive. Every part of her body — her flesh, her bones, her intestines, her horns, and her skin are used.



Figure 5.53: Cow in the street.

LANGUAGES

Hindustānī is the language used by most of Indians. It is written in two scripts: Hindi and Urdu. Sanskrit, the original language of the Aryans, became intermixed with Persian. Hindī is the dialect with more Sanskrit and is written in Devanāgarī characters like Sanskrit. Urdu is the dialect with more Persian and is written in script similar to Farsi. Hindi is spoken mainly by Hindūs while Urdu by Muslims. Streets in New Delhi are marked in English, Hindi, and Urdu. At present there are 22 official languages aside from English (Figure 5.54).

SPICMACAY

The Society for the Promotion of Indian Classical Music and Culture Amongst Youth, known by the acronym (SPICMACAY), is a non-profit organization which promotes classical Indian music, dance, and culture. The parent organization is based in India, with chapters in over 200 towns and cities in India. SPICMACAY USA was formed in 1989 and now it is present in Canada and Germany. SPICMACAY was established by Dr. Kiran Seth in 1977 at Indian Institute of Technology in Delhi. It seeks to foster the exchange of traditional Indian values and to generate awareness of the cultural traditions and heritage of India. In order to achieve its goals, SPICMACAY organizes concerts, lectures, demonstrations, and seminars.

The Jātaka Tales refer to a voluminous folklore-like literature concerning the previous births of the Buddha. Many of the stories found in the Jātaka have been found in numerous other languages and media. The standard Pali collection of jātakas has been translated and others published in six

volumes by Cambridge University Press, 1895–1907. There are also numerous translations of selections and individual stories from various languages.

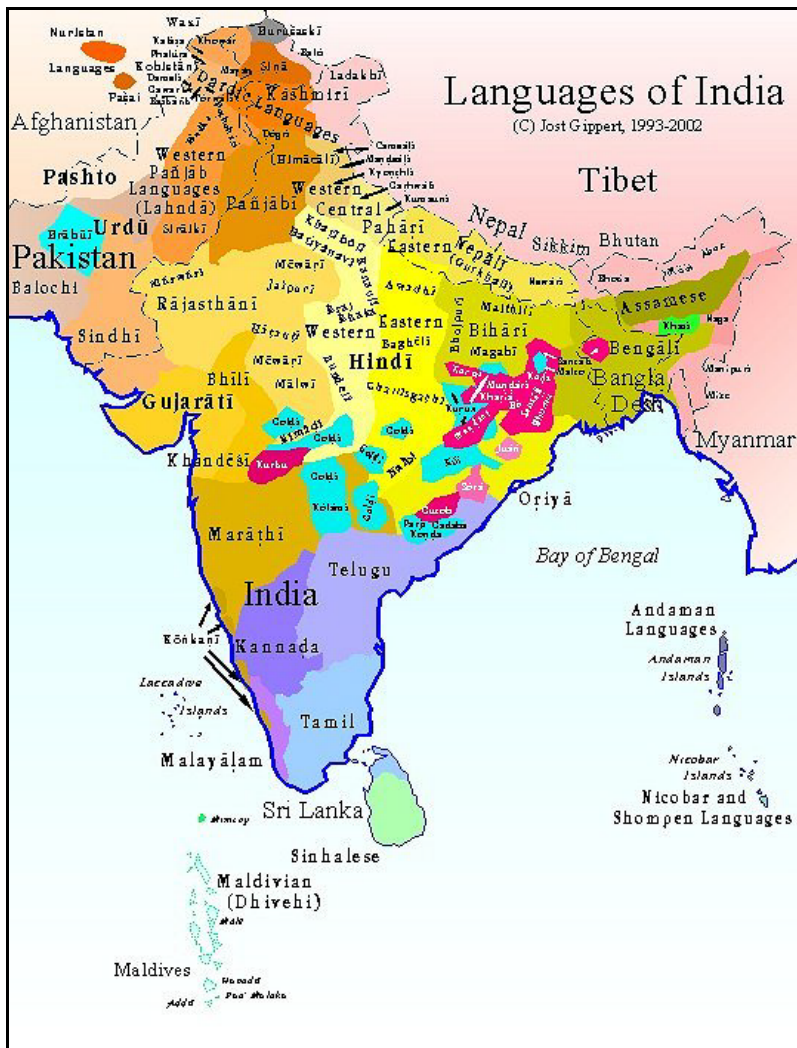


Figure 5.54: Languages in India.

Teejan Bai (Figures 5.55–5.58) was born in 1956 in Ganiyari, 14 km north of Bhilai. At an early age, she heard her maternal grandfather recite Mahabharata, written by Chattisgarhi writer Sabal Sinh Chauhan in Chattisgarhi Hindi, she instantly took a liking of it and soon memorized much of it. At age 13, she gave her first public performance in a neighbouring vil-

lage. Contrary to tradition, Teejan Bai performed standing singing out loud voice. Within a short time, she became known in neighbouring villages and invitations received to perform at special occasions and festivals.



Figure 5.55: Teejan Bai performing at Kalinga Institute of Industrial Technology in Bhubaneswar. Photo by Fathi Habashi, 2008.



Figure 5.56: Attending the performance of Teejan Bai at Kalinga Institute of Industrial Technology in Bhubaneswar, November 2008.



Figure 5.57: Closing ceremony of Teejan Bai performance at Kalinga Institute of Industrial Technology in Bhubaneswar, November 2008.



Figure 5.58: Closing ceremony of Teejan Bai performance at Kalinga Institute of Industrial Technology in Bhubaneswar, November 2008.

Teejan Bai break through came when a famous theatre personality from Madhya Pradesh, noticed her talent, and she was called to perform for then Prime Minister Indira Gāndhī. Later she received national and international recognition in 1988 and travelled all over the world as a cultural ambassador. Today she lives with her fourth husband, her five children, in Bhilai, where she employed at the Bhilai Steel Plant, though she travels all over the world most of time, for her performances.

DEVADASI

The term Devadasi originally described a Hindū religious practice in which girls were dedicated to a deity (deva). In addition to taking care of the temple and performing rituals, they learned and practiced classical Indian arts. Later the practice degenerated. Adherents of this movement considered Devadasis immoral since they engaged in sex outside marriage. By the end of 10th century, the total number of Devadasis in many temples was in proportion to the wealth and prestige of the temple. For example, there were 400 Devadasis attached to the temples at Tanjore and Travancore. Local kings often invited temple dancers to dance in their courts.

Devadasi system is a religious practice in parts of southern India whereby parents marry a daughter to a deity. Devadasis meaning female servants of God. They were degraded after the temples were taken over by the Brahmins during the times of their resurgence after the fall of Buddhism. The Devadasi system was set up as a result of a conspiracy between the feudal class and the Brahmins. The latter, with their ideological and religious hold over the peasants and craftsmen, devised a means that gave prostitution their religious sanction. Poor, low-caste girls, initially sold at private auctions, were later dedicated to the temples. Pressure from the colonial reform movement led to suppression of the practice.

JEWELLERY

India is a large consumer of gold and produces very elaborate jewellery (Figures 5.59–5.66). Piercing the nose is quite common.



Figure 5.59: Typical Indian jewellery.



Figure 5.60: Typical Indian jewellery.



Figure 5.61: Typical Indian jewellery.

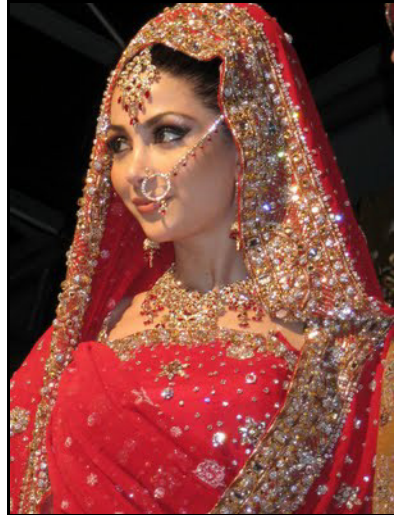


Figure 5.62: Typical Indian jewellery.



Figure 5.63: Typical Indian jewellery.



Figure 5.64: Typical Indian jewellery.



Figure 5.65: Typical Indian jewellery.



Figure 5.66: Typical Indian jewellery.

HINDŪ TEMPLES

There are many temples in India. Chitragupta is a Hindū god assigned with the task of keeping complete records of actions of human beings. Upon their death, he has the task of deciding heaven or hell for the humans, depending on their actions on Earth. There are numerous temples for Chitragupta, the most important is at Kanchipuram in Tamil Nadu State in south of India.

Khajuraho, in State of Madhya Pradesh about 620 km southeast of Delhi (Figure 5.67), contains about 85 temples built by multiple rulers from about 950 to 1050 (Figure 5.68). Khajuraho continued its religious importance until the 14th century when it was no longer capital city. It was afterwards largely forgotten. Its remoteness probably saved it from the desecration that Muslim conquerors generally inflicted on Hindū monuments. In 1838 the temples were re-discovered by a British army officer.

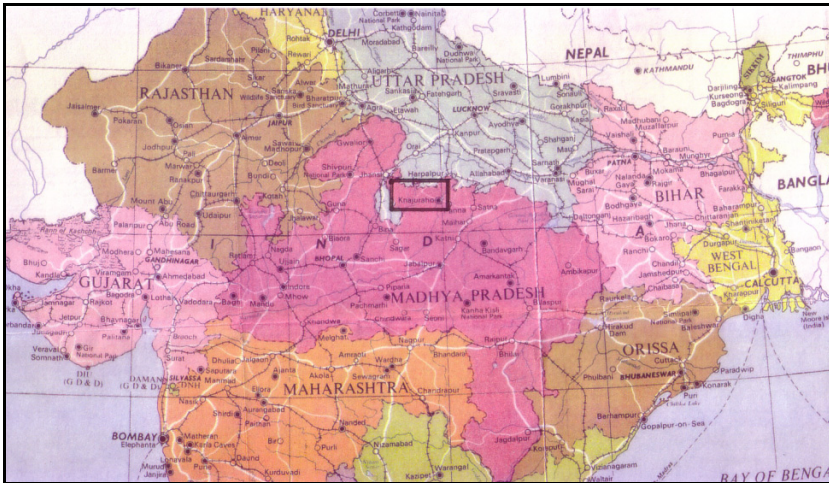


Figure 5.67: Location of Khajuraho in State of Madhya Pradesh.

The temples were made of sandstone put together without mortar. The columns and architraves built with megaliths that weighed up to 20 tons. Both internally and externally the temples are richly carved with excellent sculptures that are frequently sensual and, at times, sexually explicit.

- *Lakshmana Temple* (Figures 5.69–5.76), the oldest, was built between 930–950 and dedicated to Vishnu.
- *Matangeshvara Temple* is the only temple that still has active worship and is dedicated to the god Shiva (Figure 5.77).
- *Caturbhuj Temple* is of simple design (Figure 5.78).

- *Duladeo Temple* is dedicated to Shiva, whose image is enshrined in the inner sanctum (Figures 5.79–5.81).
- *Jain Temples* (Figures 5.82–5.86) date from the late 11th century. The temples' primary images are not Hindū deities, but to human beings who have discovered the way to enlightenment.

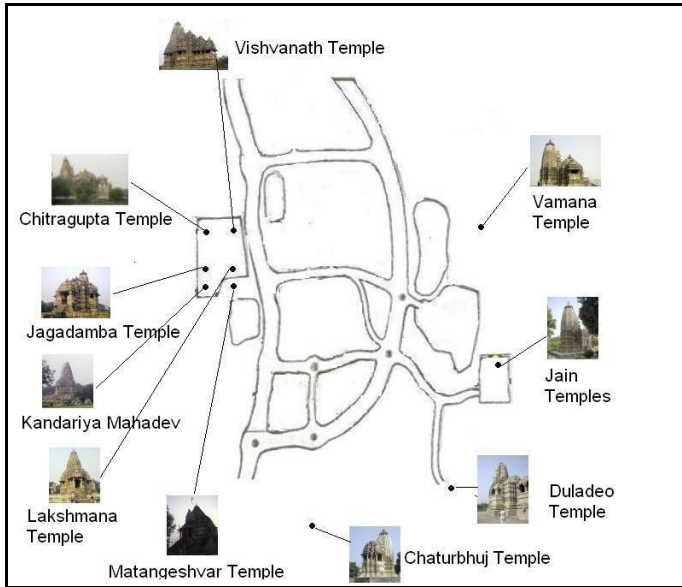


Figure 5.68: Map of main temples in Khajuraho.



Figure 5.69: Lakshmana temple.

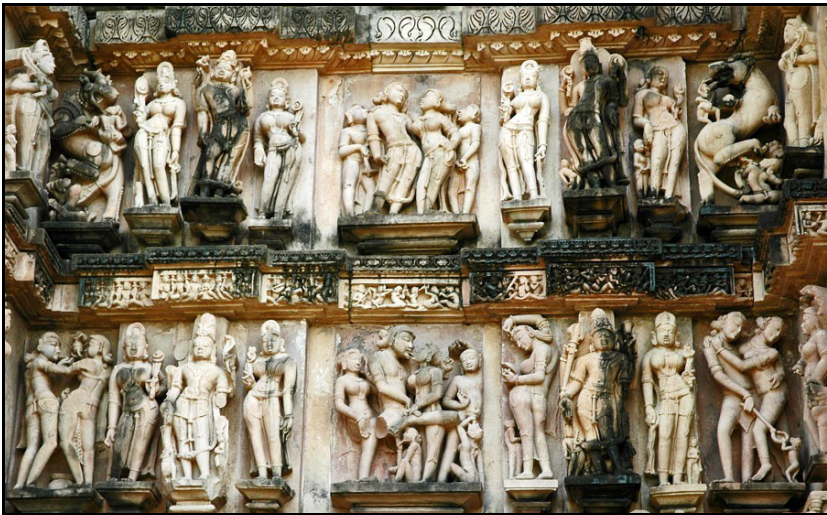


Figure 5.70: Lakshmana temple, details.

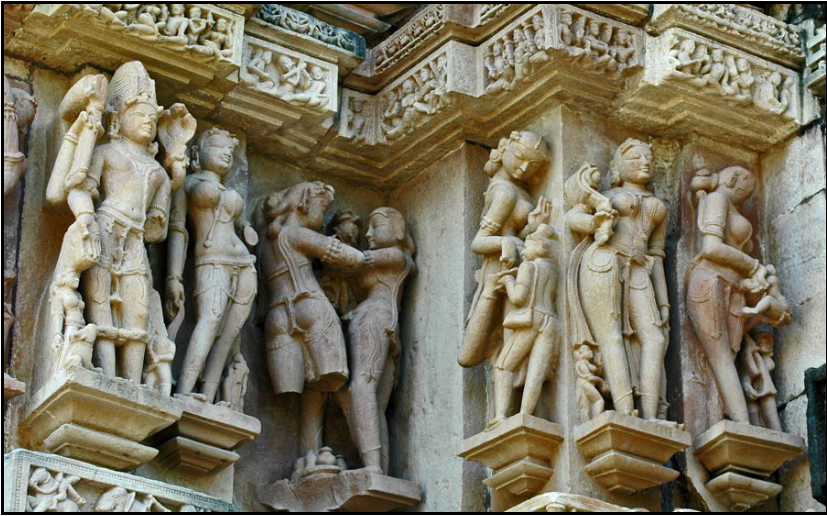


Figure 5.71: Lakshmana temple, details.



Figure 5.72: Lakshmana temple, details.



Figure 5.73: Lakshmana temple, details.

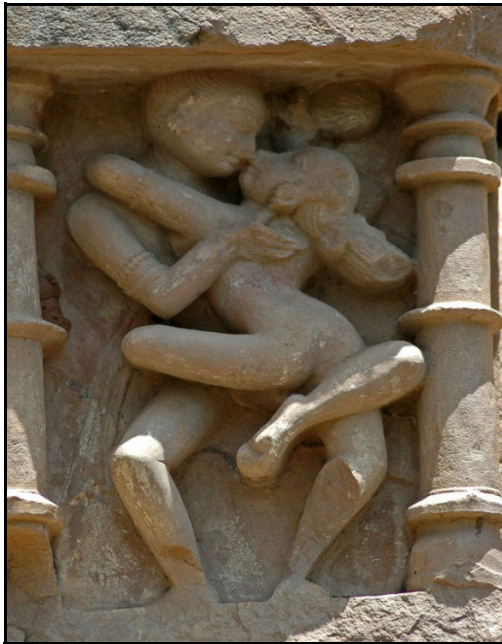


Figure 5.74: Lakshmana temple, details.



Figure 5.75: Lakshmana temple, details.



Figure 5.76: Lakshmana temple, details.



Figure 5.77: Matangeshvara Temple.



Figure 5.78: The Caturbhuj Temple.



Figure 5.79: Duladeo Temple.



Figure 5.80: Duladeo Temple details.



Figure 5.81: Duladeo Temple, details.



Figure 5.82: Jain temple 1.

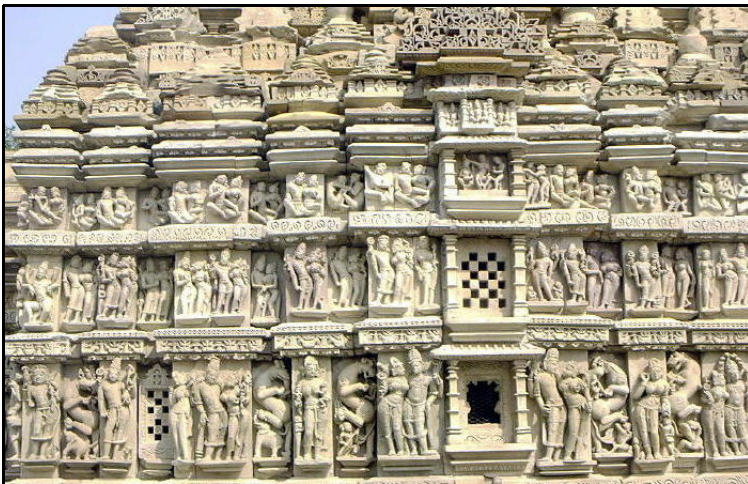


Figure 5.83: Jain temple 1, details.



Figure 5.84: Jain temple 1, details.

- *Adinath Temple* (Figures 5.87–5.89), built in 950–1150, one of the three Jain temples built by rulers of Chandel Dynasty.
- *Vamana Temple* (Figure 5.90) is dedicated to Vishnu; it dates from 1075.
- *Vishvanath Temple* (Figures 5.91–5.93) was dedicated to Shiva as Lord of the Universe, built about 1000.
- *Nandi shrine* (Figure 5.94), opposite the temple.
- *Chitragupta Temple* (Figures 5.95–5.106) is dedicated to Surya (the Sun) and built between 1000 and 1050.
- *Jagadamba Temple* (Figures 5.107–5.108) was originally dedicated to Vishnu but now named for the Goddess Jagadamba, the Mother of the Universe.
- *Kandariya Mahadev* (Figures 5.109–5.113), built between 1025–1050, was dedicated to Shiva. It has some of the richest, most sexually explicit carvings.



Figure 5.85: Jain temple 1, details.



Figure 5.86: Jain temple 2.



Figure 5.87: Adinath Temple.

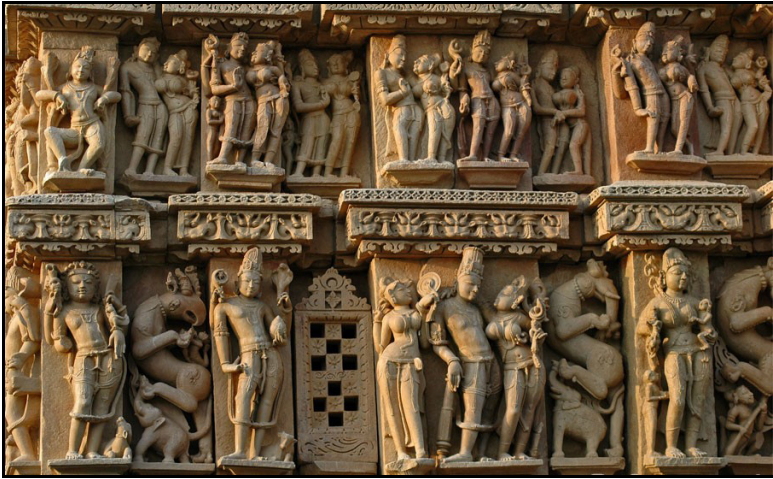


Figure 5.88: Adinath Temple, details.

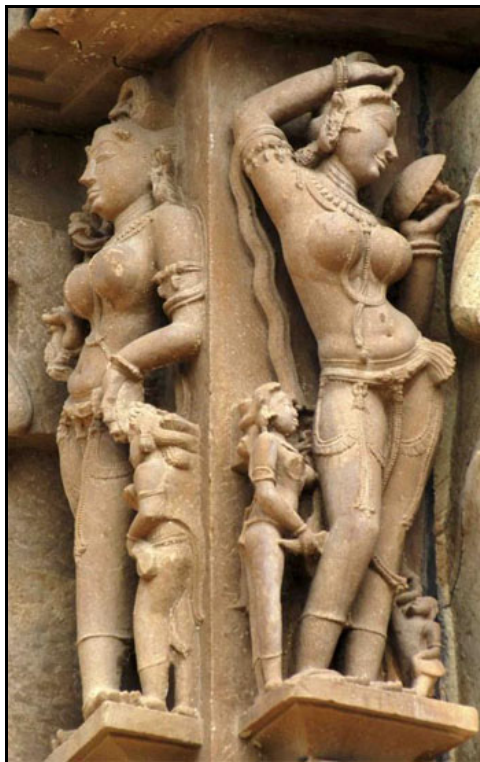


Figure 5.89: Adinath Temple, details.



Figure 5.90: Vamana Temple.



Figure 5.91: Vishvanath Temple.

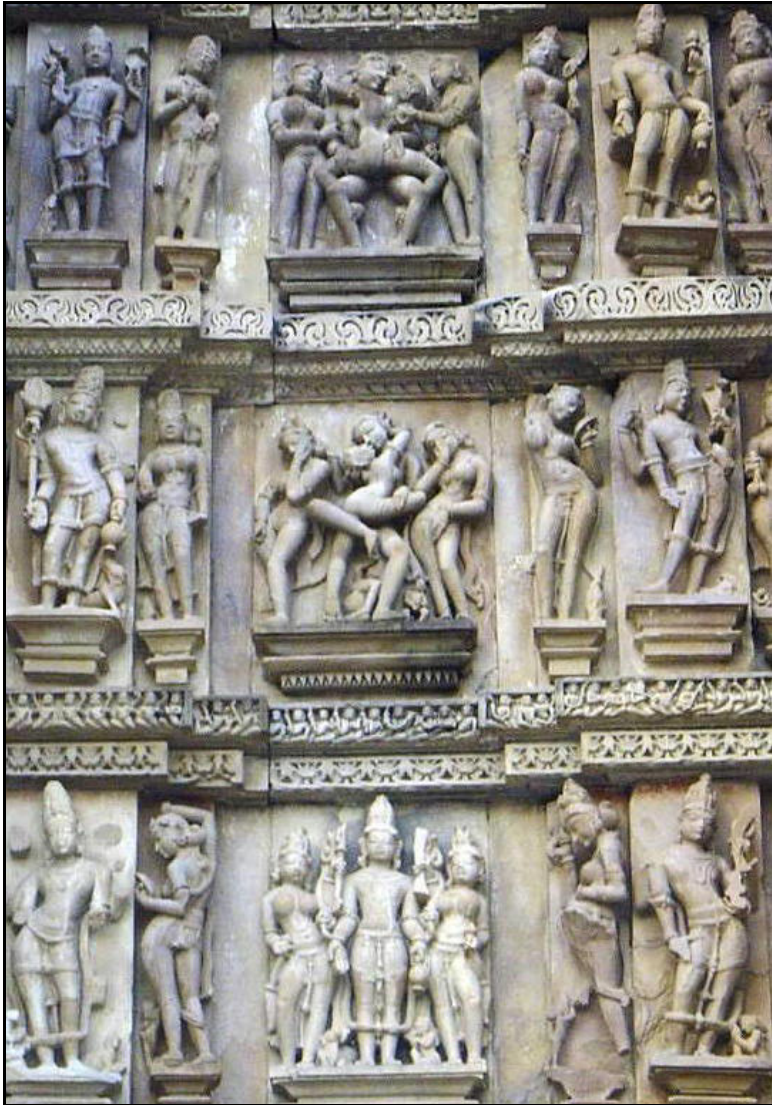


Figure 5.92: Vishvanath Temple, details.

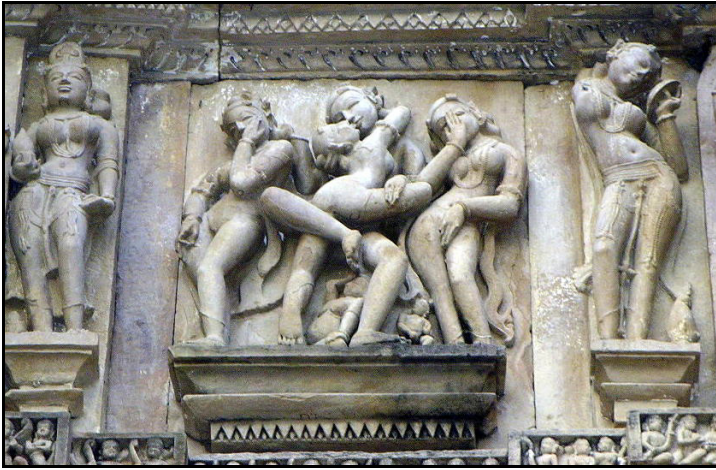


Figure 5.93: Vishvanath Temple, details.



Figure 5.94: Nandi shrine.



Figure 5.95: Chitragupta Temple.

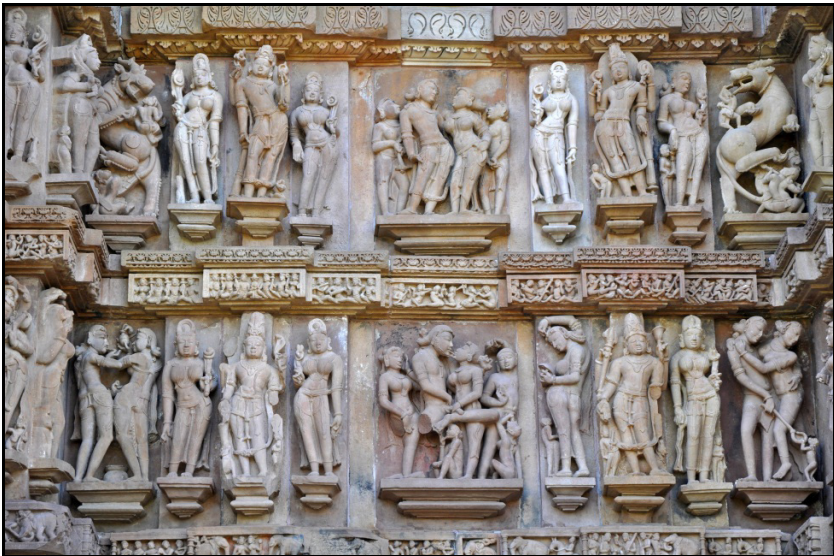


Figure 5.96: Chitragupta Temple, details.



Figure 5.97: Chitragupta Temple, details.



Figure 5.98: Chitragupta Temple, details.



Figure 5.99: Chitragupta Temple, details.



Figure 5.100: Chitragupta Temple, details.



Figure 5.10i: Chitragupta Temple, details.



Figure 5.102: Chitragupta Temple, details.

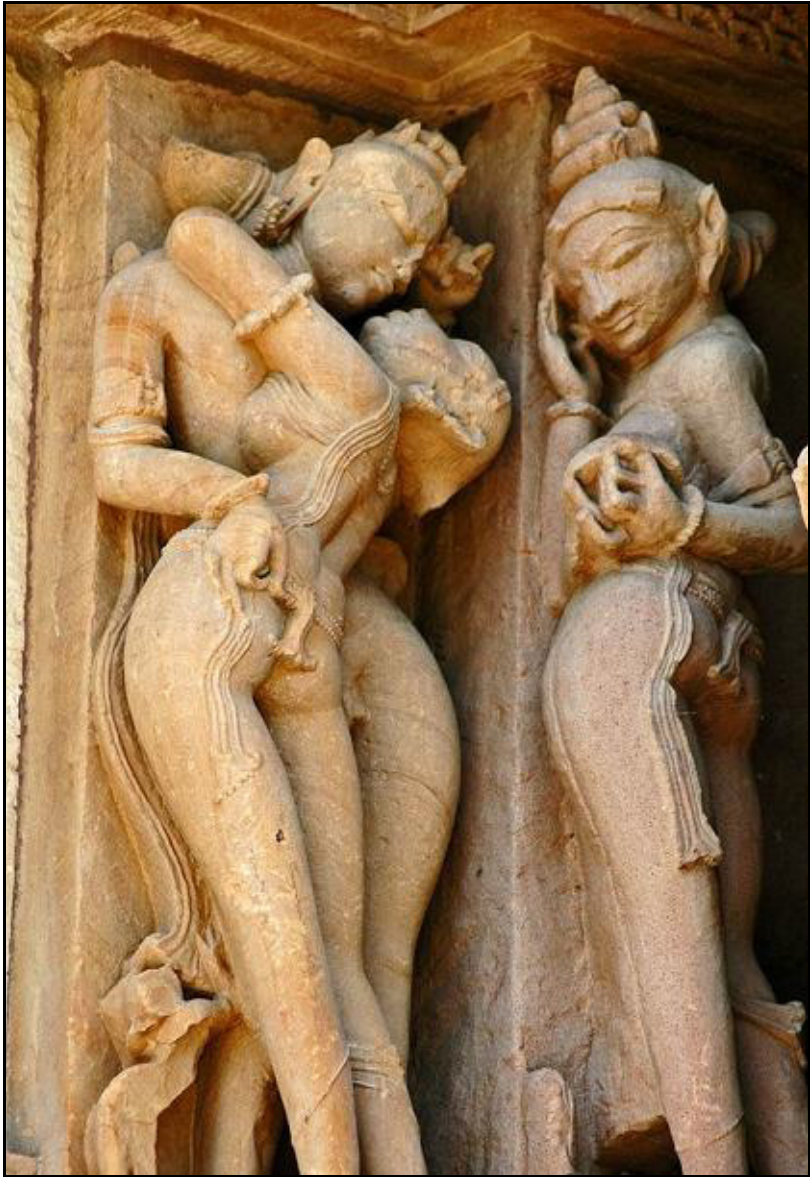


Figure 5.103: Chitragupta Temple, details.



Figure 5.104: Chitragupta Temple, details.



Figure 5.105: Chitragupta Temple, details.

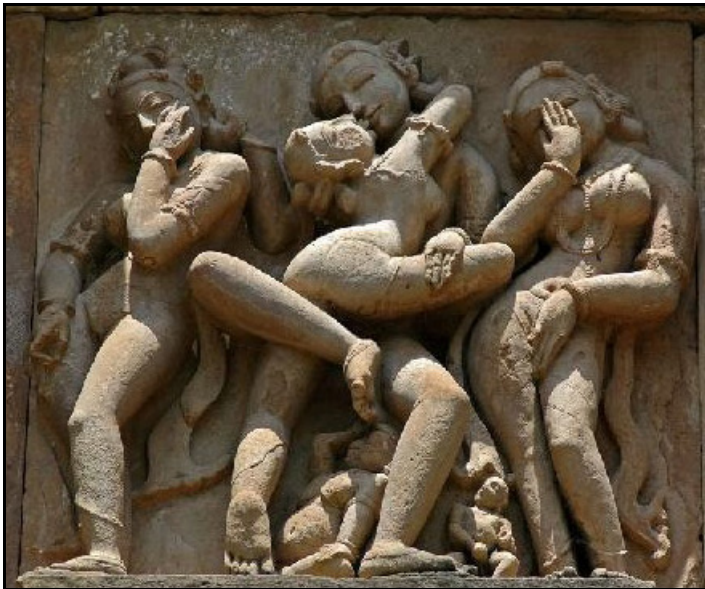


Figure 5.106: Chitragupta Temple, details.



Figure 5.107: Jagadamba Temple.



Figure 5.108: Jagadamba Temple, details.



Figure 5.109: Kandariya Mahadev Temple.



Figure 5.110: Kandariya Mahadev Temple.



Figure 5.111: Kandariya Mahadev Temple.



Figure 5.112: Kandariya Mahadev Temple.



Figure 5.113: Kandariya Mahadev Temple, details.

MUGHAL LOVE SCENES

During the Mughal epoch, the emperors and the high court were immersed in luxury and extravagance as can be seen in the paintings of this time (Figures 5.114–5.145).



Figure 5.114: Mughal painting.

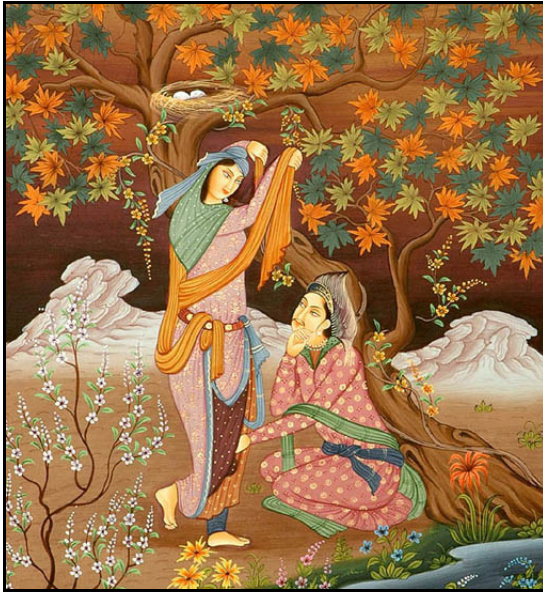


Figure 5.115: Mughal painting.

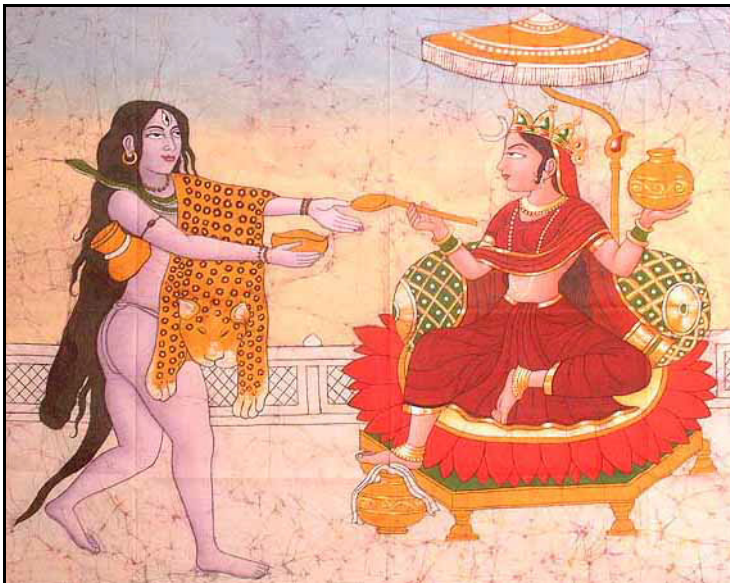


Figure 5.116: Mughal painting.



Figure 5.117: Mughal painting.



Figure 5.118: Mughal painting.



Figure 5.119: Mughal painting.



Figure 5.120: Mughal painting.



Figure 5.121: Mughal painting.



Figure 5.122: Mughal painting.



Figure 5.123: Mughal painting.



Figure 5.124: Mughal painting.



Figure 5.125: Mughal painting.

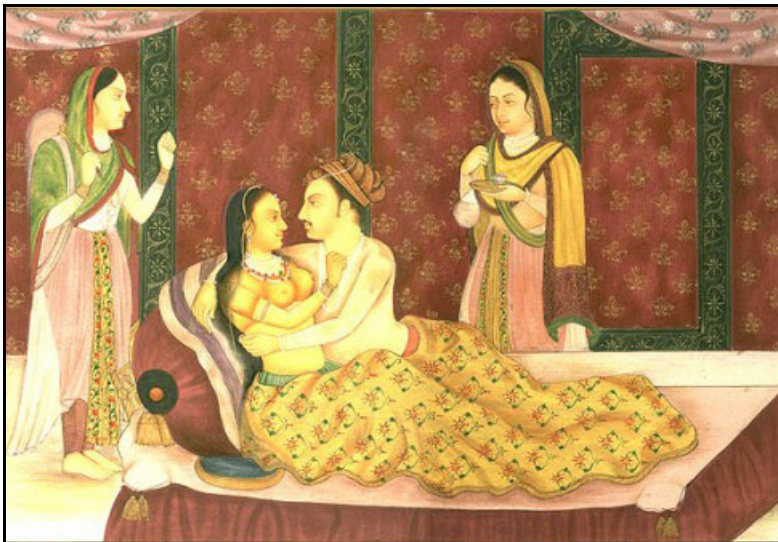


Figure 5.126: Mughal painting.



Figure 5.127: Mughal painting.



Figure 5.128: Mughal painting.

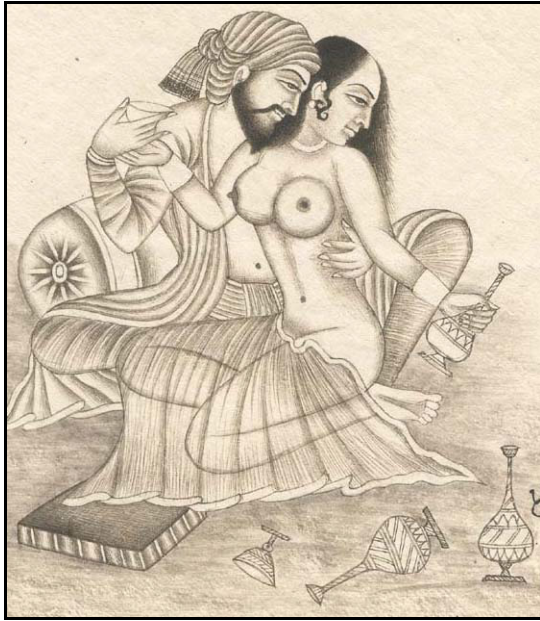


Figure 5.129: Mughal painting.



Figure 5.130: Mughal painting.



Figure 5.131: Mughal painting.



Figure 5.132: Mughal painting.



Figure 5.133: Mughal painting.

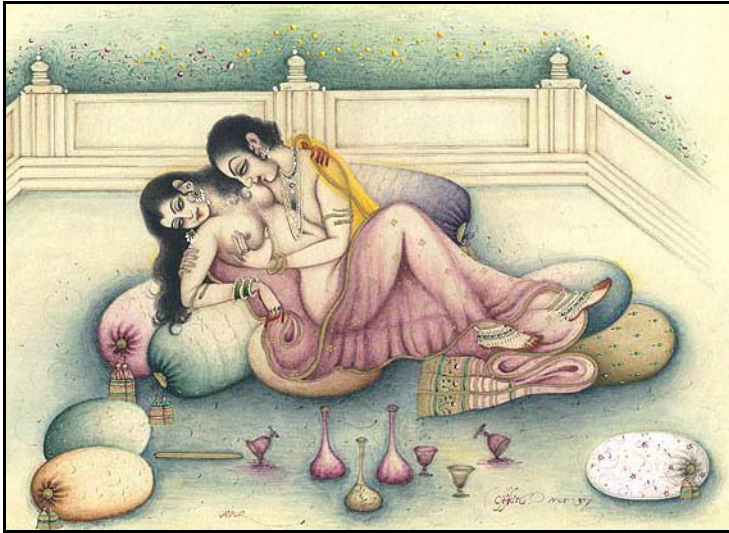


Figure 5.134: Mughal painting.

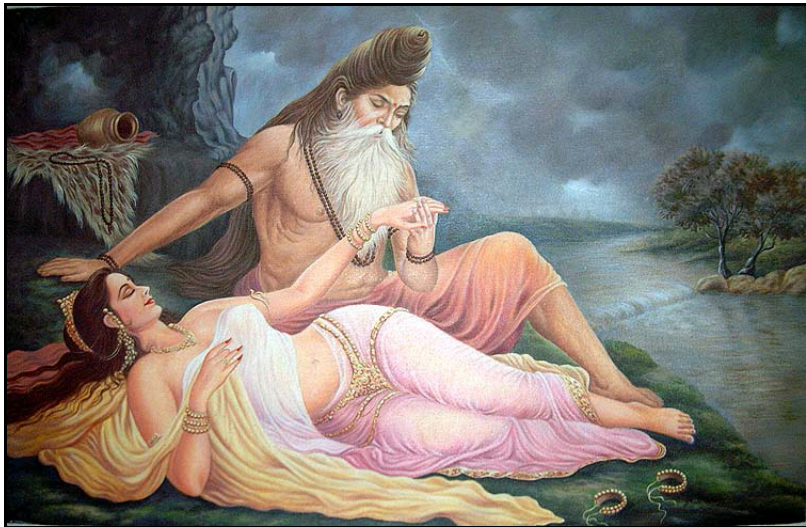


Figure 5.135: Mughal painting.



Figure 5.136: Mughal painting.



Figure 5.137: Mughal painting.



Figure 5.138: Mughal painting.



Figure 5.139: Mughal painting.



Figure 5.140: Mughal painting.



Figure 5.141: Mughal painting.



Figure 5.142: Mughal painting.



Figure 5.143: Mughal painting.

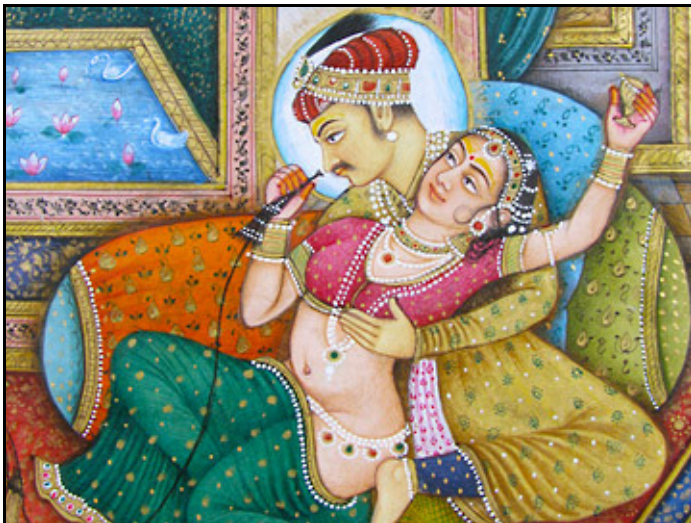


Figure 5.144: Mughal painting.



Figure 5.145: Mughal painting.

MUSIC AND MUSICIANS

The instruments are different from Western instruments (Figures 5.146–5.159).



Figure 5.146: Painting illustrating Indian musicians playing.



Figure 5.147: Painting illustrating Indian musicians playing.



Figure 5.148: Painting illustrating an Indian musician playing.



Figure 5.149: Painting illustrating an Indian musician playing.



Figure 5.150: Painting illustrating Indian musicians playing.

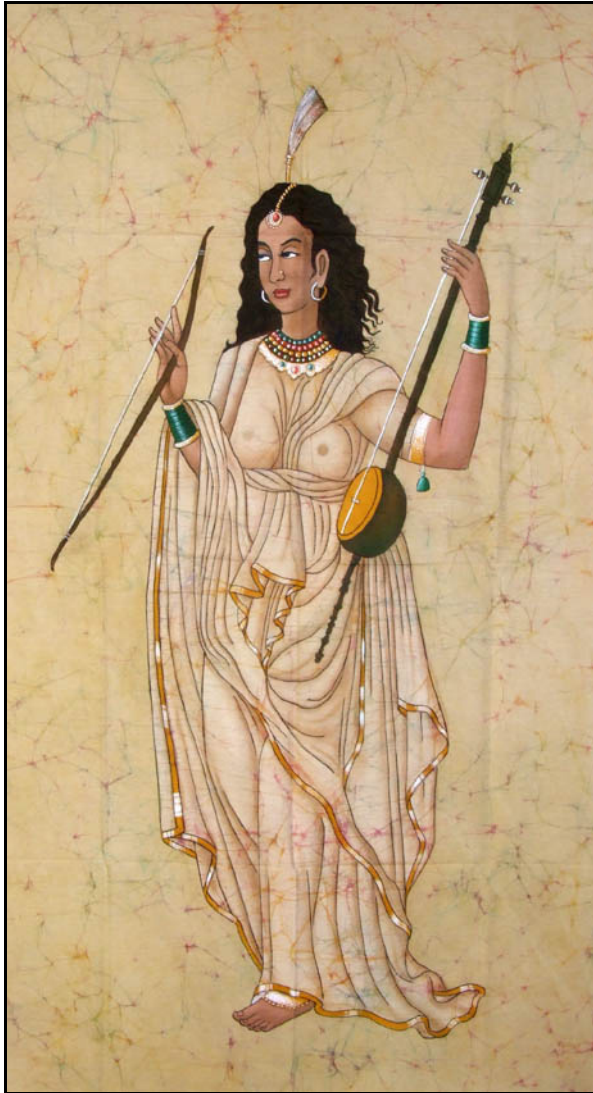


Figure 5.151: Painting illustrating an Indian musician playing.



Figure 5.152: Painting illustrating an Indian musician playing.



Figure 5.153: Painting illustrating an Indian musician playing.



Figure 5.154: Painting illustrating an Indian musician playing.



Figure 5.155: Painting illustrating an Indian musician playing.



Figure 5.156: Painting illustrating an Indian musician playing.



Figure 5.157: Painting illustrating an Indian musician playing.



Figure 5.158: Painting illustrating an Indian musician playing.



Figure 5.159: Painting illustrating an Indian musician playing.

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