

BOOK REVIEWS

The Peacock in Splendour: Science, Literature and Art in Ancient and Medieval India. B. M. Deb. Visva-Bharati Publishing, Kolkata. 2015. 624 pp. Price: Rs 2500.

In this book, the author has traced science, literature and art in ancient and medieval India, mainly from a historical perspective. The attempt has been to trace the origins of these in ancient and medieval periods and to draw conclusions from them. It is a rare attempt to cover such broad topics and try to interconnect them. The book contains 10 chapters, several appendices and an excellent foreword by C. N. R. Rao. It is inevitable that in a book spanning such a large panorama, historical perspectives will be interspersed with impressions of the author. However, the author has presented the history as factually as possible without taking sides. The book contains information, insights and connections between different eras spanning between 3300 BC and 1600 AD. It clearly brings out the Indian civilization during this period in a holistic manner. Much of the perspectives are supported by documents and it is clear that the author has done an impressive job of collection of citations and documents spanning 5000 years of Indian civilization. In the first chapter, the author discusses three important early civilizations of the world—Mesopotamia, Egypt and Indus valley. Though Mesopotemian civilization is known to be the oldest, the author concludes that the Indus Valley civilization (IVC) grew independently. The main conclusion of the author is based on the unique grid iron structure of two main cities in Indus Valley, Harappa and Mohenjo-daro, glazed pottery excavated at Mohenjo-daro, nature of irrigation and many others. This chapter also presents the objectives of this book and the tone of the book is based on the evolution of IVC, which the author has established based on documented evidences. The connections and difference of the IVC scripts with Tamil scripts are discussed and some of these discussions give deeper insights. A sophisticated analysis of these using modern mathematics has thrown more light in recent years.

Having set the tone for much of the book in chapter 1, the author goes into the detailed description and analysis interconnecting the various forms of

literature, science and art in subsequent chapters. Chapter 2 presents many verses from the Vedas and their significance clearly pointing out the richness of the Indian civilization in comparison to the contemporary civilizations globally. The connections between the number of syllables with the numbers rooted to early Indians, in particular the prime numbers, bringing out holistic features, are presented.

In chapter 3, methods used for description and analysis of the past have been elaborated. The author presents a description of how the methods have been used to analyse various materials, locating heritage beneath the surfaces of land and sea, excavation of sites and recovery of archaeological materials. Scientific methods of use of electricity, magnetism and sound, satellites for remote sensing, detection by radios to periscope and video cameras, light detection and ranging, isotope technique, Fourier transform infra-red spectroscopy, electron spin resonance, etc. have been used for analysis of the past. Chapter 4 describes the knowledge that ancient Indians possessed about human biology, medicine, plant and animal science, etc. The chapter describes what was known in different phases of Indian civilization in the above disciplines. The chapter goes to show that ancient India had quite significant knowledge in human biology as well as on other plants and animals. India has been very rich in medicinal plants and this chapter captures how various plants used to be known for therapeutic uses from the early days. It is quite interesting to read the depth of knowledge that existed in the past Indian civilization.

On similar lines, the author captures the knowledge on chemistry in ancient and medieval India in chapter 5. He describes chemistry known in different phases of India and hints at the concept of atom enunciated by Kapila around 600 BC. The author writes how philosophically the formation of bulk matter from atoms was hinted in early days. Specifically, dyes and pigments, chemical processes practiced, cosmetics and perfumes have been mentioned. Dyes, pigments and cosmetics have been known in many early civilizations due to natural human interest in these subjects. In this chapter the author has attempted briefly a comparison of similar knowledge existing in other civilizations of the past. In this respect, alchemy has been an

important subject practiced in many contemporary civilizations and probably started as early as 2nd century BC in Greece. Similarly, knowledge on glass has been quite ancient. In the appendix of this chapter, scales of measurement of atoms have been described and it shows how sensitive measurements were done in early civilizations.

Chapter 6 brings out the volume of knowledge in the area of metallurgy. Metallurgical achievements of ancient and medieval India in copper, bronze, silver, gold, iron, steel and zinc are discussed in this chapter. Metallurgy is an old subject in many civilizations and this chapter shows India's heritage in this. The chapter begins with the process of extracting gold and silver as existing in 16th–18th century AD. Then it highlights the ancient use of copper and bronze from Pre-Harappan era. Bronze was, in fact, the first alloy prepared by ancient Indians. The section documents the excellent structures of copper found in post-Vedic and classical period. Detailed procedure for copper extraction is given here. There are more extensive coverages of iron and steel. Iron age followed the Bronze age in India and iron metallurgy took more time presumably due to higher melting point of iron. Several iron works in ancient and medieval India have been captured in this book with special mention of Delhi Iron Pillar. The use of steel (Wootz steel) and later zinc metallurgy are discussed. This part also documents the end of zinc metallurgy due to several factors, among which cadmium poisoning is quoted as an important reason.

Chapter 7 chronicles India's glorious past in mathematics, starting with Harappan, Vedic, Jaina, Bakhshali period to the classical period. This chapter shows that algebra and geometry existed from the Vedic era and the classical era being dominated by Aryabhata I, Varahmitra, Bhaskara I, Brahmagupta, Sridhara, Bhaskara II, etc. The Kerala school of mathematics emerged as an important school. Many important models and series for Sine and Cosine have been mentioned in detail. The appendix shows the discovery of zero and decimals, value of π existing in ancient and medieval India and many other methods existing in early India. The quality of early Indian mathematics has been chronicled in the appendices following this chapter. Through various appendices, the author shows the high standards of mathematics that

existed in different eras of ancient and medieval India. In particular, appendices consist of the history of the value of π in ancient and medieval India and an interesting note on the Kuttaka procedure of linear solution of equations of Aryabhata I and Bhaskara I, indeterminate equations of second and higher degree, zeros and decimal system. Interestingly, one of the appendices contains a computer program in C language using the Cakravala method, which shows how advanced mathematics was in early and medieval India.

Chapter 8 provides a brief history of physics existing in India in the periods covered. Very early India saw the development of measurement of length, time and mass and the units used. The concepts of atomism, motion, sound, heat and light as well as the atmosphere, in particular, the prediction of monsoon rains, existing in the ancient and medieval India have been covered.

Chapter 9 is the largest chapter and rightly so, dwelling on the vast and diverse literature existing in India from ancient days. In this chapter the richness of India's literature has been highlighted in full glory. Pali, Prakrit, Buddhist hybrid Sanskrit, Sanskrit and Tamil literature are described in detail quoting verses, prose and drama. The author quotes that the earliest known literature existed in Vedas. Hymns from *Rig Veda* are quoted as examples of literature with passion and boldness. An interesting point noted is that much of the classical Indian literature is based on eroticism or adult content, but packaged in 'description which is distant, impersonal and formal and yet enjoyable'. The main body of the chapter starts with Jataka tales of Pali literature and the parallels with the *Ramayana*. The author then highlights the parallels with the *Mahabharata* and shows that the Jataka tales have more similarity with *Mahabharata*. Similarly, the parallels of these tales with other stories are also mentioned. Subsequently, Prakrit literature, Buddhist Hybrid Sanskrit, Sanskrit and Tamil literature are covered. Quite understandably, the Sanskrit literature gets a broader and more in-depth coverage. Poetry, drama, prose and epics from Sanskrit literature are covered well. Many verses have been quoted in the book. Works of the famous writers Asvaghosha, Kalidasa, Kalhana, Sudraka, Banabhatta and others are quoted. Of course, it is only natural that *Ramayana*

and *Mahabharata*, the great epics of India, have been described in detail with the debate on the dates in which these are written. Different versions of *Ramayana* and the inconsistencies have been highlighted. An interesting point of *Ramayana* being inspired by *Iliad* may be debatable. *Mahabharata* has been covered in depth as well. The encyclopedic nature of *Mahabharata*, including knowledge from *Vedas* and *Puranas*, instructions of ethical and religious nature, stories, myths and legends are highlighted. An interesting subsection deals with a comparison between Sita and Draupadi. Some similarities between these epics have been highlighted. The end of this chapter has an overview of Tamil literature and is mainly based on available translations of early and middle period Tamil literature. A sub-section on the influence of Indian literature on western countries is interesting.

The final chapter 10 deals with classical Indian art. In the beginning of this chapter, the author admits to the difficulty of defining art in a concise manner and how art depends on response. History of ancient and medieval Indian art has been covered quite well. Monumental architecture of Indus Valley Civilization, Stupas and temples can be mentioned in a special way as symbols of Indian art. The chapter also deals with art forms in different regions of the country and in particular north and south India. At the end, the author brings out connection from the past to present, by referring to the art form of Satyajit Ray. Some of his art forms are reflection of ancient and medieval art. The author returns to the main theme of the book, how science, literature and art are entangled with particular reference to ancient and medieval India.

Each chapter contains a lot of facts, citations and documents in the diverse areas, which are hard to find in a single book. Several appendices presented in the book have shown the detailed collections by the author and would be extremely valuable. The objective of the book is to interconnect the areas of science, art and literature and provide insights into understanding how one could have been inspired by the other. The author makes some comments on these from the point of view of a scientist, but mainly concentrates on presenting facts and implies such connections. Anyone reading the book will be able to make one's own

conclusions on such interconnections from the vast documents presented. The task of presenting ancient and medieval India in such vast areas of knowledge is a big challenge and I thank the author for taking up this challenge and doing a wonderful job. This is a rare exercise done by the author, whose own knowledge of civilization has clearly come out so well in this book.

In summary, this book may be recommended to students and teachers of Universities and can be a basis for a course on history of science. In fact, as the author wrote in the preface, the inspiration to write this book grew out of a course taught by the author. This is an excellent book on a rare subject. The author has taken up this challenge and written a book, which can be kept as a valuable collection.

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If we look at the new technologies that have driven genetics research in the recent past, two of them are particularly highlighted. First, development of a better gene editing technology CRISPR/Cas9, and second, advent of third-generation sequencing technology. Till recently, knocking out a gene was a difficult task. That too, it was standardized in a few model organisms. Development of clustered regularly interspaced short palindromic repeats (CRISPR/Cas9) for use in gene knockout has changed this significantly. Researchers are now trying to knockout genes in non-model organisms. What is fascinating in this technology is its portability. It has been tried in so many different organisms; it seems the technology works in most of the organisms. Third-generation sequencing technology addressed two