



***Essays in History of Sciences in India: Agriculture, Medicine, Alchemical and Chemical Practices* by Mira Roy, Sanskrit Pustak Bhandar, 38, Bidhan Sarani, Kolkata, 2019, xxvii + 830 pp, Price—Rs. 2500/-**

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The above book was published by Sanskrit Pustak Bhandar in 2019. The work is a compilation of essays written by Dr Mira Roy, who needs no introduction to the serious student of ancient Indian scientific literature. These essays are basically articles written over many years and published in various books and journals earlier. It is a great privilege to have them all compiled in a single book, and its great volume is a tribute to the wide range of the author's knowledge.

The essays reflect the evolution of Indian Scientific literature starting from Harappan times down to the nineteenth century. They have been placed in various parts according to subject matter. Hence these parts are self-sufficient. These are: Part I: Agriculture, Plant and Ecology, wherein we find various chapters on agricultural practices in olden times—the Vedic period, the Mauryan period; agriculture and meteorology, plants in the Atharvaveda, environment and ecology in ancient times.

Here, the author commences with a discussion of the various aspects of agricultural practices in ancient India, over a period from 3500 BCE to 1200 CE. The factors dealt with are: soil, land and village settlement; manure and manuring; crop husbandry; agricultural implements; irrigation and drainage; animal husbandry and meteorological observations in relation to crop prospects. Chronologically, these come under several ages: pre-history which includes Mesolithic or Late Stone Age (c.6600 BCE–c.1000 BCE), proto history which includes the Chalcolithic period, comprising the Pre-Harappa, Harappa Chalcolithic, Mid-Chalcolithic and Vedic Chalcolithic (i.e. age of *Rgveda* and *Yajurveda*). These topics bring to light how a civilization advances towards a higher

level of agricultural practices, from a primitive grouping for finding the best way to find nourishment for all. How our ancestors gradually moved towards a more settled lifestyle, how villages were formed, how more sophisticated instruments evolved, how the people utilized the weather conditions and how they learned to irrigate the land, how animal husbandry became a part of life—all these are elaborated in the chapters entitled: “Agricultural Practices in Ancient India”, “Agriculture in the Vedic Period”, as well as later times in “Agricultural Practices in Kauṭilya's *Arthaśāstra*” which presents us with an insight into agriculture during Maurya times, and “Agriculture and Meteorology in Ancient India” which stresses the importance of weather conditions.

From this, it is a small step to delineate the particulars of “Rice through the Ages—where the author shows us how the cultivation of rice started, which particular species is cultivated at which place, and in which season, as well as the ancient and modern names of the various species of rice.

Next, we have a treatise of the family relations among various plants, as we find in the Atharvaveda. It must be remembered that the Atharvaveda is the first text which deals with diseases and medicines. It also attempts to classify them into genus and species (family).

Lastly, we come to environment and ecology. Most scientists of today are skeptical about these concepts, as they argue that there was no term equivalent to ‘environment’ or ‘ecology’ in ancient times. While this is true to an extent, we cannot say that no knowledge of environment or ecology existed, nor that their relevance in life was denied. In the chapter entitled “Environment and Ecology in the Ramayana”, the author takes great pains to point out how these aspects affect lives—not just human life, but that of the entire living world. The same is true of the last chapter in this particular section, “Ecological Concept in Ayurveda”, for Ayurveda deals not just with diseases or medicines, but

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the lifestyle necessary for a healthy balance, in which ecology plays an essential part.

The part II deals with Medicine, wherein we find detailed discussions of medicine in Vedic times, Ayurvedic principles and techniques, comparison of Unani and Ayurvedic systems. The previous section ends with a chapter on Ayurveda. Hence, it is easy to step into the complex world of ancient Indian medicine. From early Vedic times, there was an aim at attaining worldly happiness through appeasement of gods. There was also a tendency to honour each deity with an exaltation that this particular deity was all powerful. As a result, this tendency evolved into a protective measure against all evil and danger, which necessarily included diseases, and their cure or prevention. In this way, diseases came to be regarded as sin, to be averted by following a certain lifestyle. At first, there were merely religious rites to be observed, as we find in the *Rgveda* and the *Yajurveda*. But later come the herbs and thence the medicines which cure diseases, a great number of which come into the *Atharvaveda*.

When we come to the evolution of medicine in ancient times, we have to deal with several aspects of the science of medicine as we know it today. Anatomy is perhaps the earliest and most essential part of the science. We find clear evidence of anatomical knowledge in Vedic literature, from the *samhitās* through later Vedic texts. Later, this evolved into medical treatises such as *Caraka Samhitā*, *Suśruta Samhitā*, *Aṣṭāṅga Saṁgraha*, *Aṣṭāṅga Hṛdaya* etc. Here we find various discussions on the structure of the human body, and the relation each part bears to another and the whole.

The part III deals with Alchemy, Chemistry and Technology. *Rasaśāstra* was a prominent branch of ancient Indian sciences, and this comprises both chemistry and alchemy. This part also deals with gems and minerals, not to speak of pyrotechnics.

The term *rasa* principally refers to mercury, but also indicates metals and minerals and their assimilation with mercury. The term *rasa* is again suggestive of the assimilation of mercury with body products, when used in preparing medicines. So, mercury is crucial to alchemy in ancient and medieval times. Alchemy is basically the art of creating gold—it had two aims; to transmute base metals into gold and to use this transmuted gold to prolong life and bestow immortality. The principal end of *jīvanamukta* or salvation in a living state is closely connected to *tantra* practice. The concepts on Indian *Rasaśāstra* are very much akin to the Chinese alchemy. The author has dealt with several texts on alchemy or *Rasaśāstra* and elaborated on the principles of alchemic experiments, also discussing in detail its effects on minerals and gems. Here we likewise find a correlated study of astronomy and alchemy as practiced in India.

This detailed discussion of the alchemic principles is followed by an exposition of the dyes used in ancient and medieval India. As we know, India was particularly famous

for the growth and production of very developed dyes. As early as 500 BCE, their importance in the world market is testified to by the references to indigo. Lexicons describe the various colouring agents around sixth century CE to seventeenth century CE. The specialty of the use of dyes lies in the process of extraction and preparation of dyes. The author has also dealt with the fermentation technology in ancient India, which includes fermentation of Soma juice, honey etc. There are also details of fermenting and distilling wine.

Pyrotechnics or fireworks take up a large part of this section. China and India are believed to have been pioneers in this craft. From Vedic times, fire rituals and festivals existed, and fire festivals in autumn were in practice for centuries. In 1443 CE, Abdur Razzaq, the Persian ambassador to the court of the Vijayanagara kingdom, was most impressed with the fireworks on *Mahānavamī*. Fireworks were also used in warfare, as we find from Kauṭilya's accounts.

Lastly, this section presents a fascinating account of the oral tradition gradually transforming into written communication. Starting with plant material such as palm leaf and birch bark, our ancestors graduated to cotton cloth, leather and silk. They also manufactured ink out of various material like charcoal, lamp black and pipal resin. Of course, paper came later, and the author describes the various stages in writing.

One may say in conclusion, that this section is the most complex and the most interesting of all the sections in the book.

The part IV entitled Miscellaneous, contains various aspects of ancient Indian scientific thought, e.g. concept of the world, man and spirit, etc. Particularly interesting is an article on the concept of *yantra* in King Bhoja's magnum opus, *Samarāṅgaṇa sūtradhāra*.

The first of the chapters in this section, entitled "Concept of World in Vedic Thought", is an attempt to reveal how the entire Vedic literature, from the *Samhitās* to the *Upaniṣads* reflects how the ancient seers involved themselves in understanding the exact nature of the world or *loka*. This leads us into the depths of cosmology. From this one leads into the idea of Man and Spirit in Vedic Thought, which deals in detail with the Creation of Man, Man and Environment, Evolution etc.

In the following chapter, much scientific material from the *Rāmāyana* is gone over, including astronomy/astrology, chemistry/alchemy, meteorology and so on. Another chapter deals with chemical, biological and other such texts, and in the chapter entitled "Some Aspects of Sanskrit Texts", where more of chemistry and Ayurveda are detailed.

As mentioned before, a chapter on the *Samarāṅgaṇa sūtradhāra* written by King Bhoja offers a refreshingly novel insight into mechanics in ancient times. We find here Bhoja explaining *bījas* or active principles in the composition of *yantras* or mechanics.



As a concluding chapter, “Village Settlements in Bengal” brings us to a discourse on the status of villages in the area later defined as Bengal—the findings dependent on epigraphical evidence, carrying to us the geographical, environmental and social history of rural Bengal from as early as the 5th Century CE down to medieval times.

In the introduction to the book, it is stated clearly that “the Vedas were indeed a pioneer as the starting point of the literary era, which was succeeded by different culture-eras. Their inner core continued to reside the Vedic thoughts, Philosophy, *Dharmaśāstra*, *Epics*, *Purāṇa* and *Tantra* represent the principal divisions of time in this respect (Intro. p. 1).”

The work deals with many aspects, as we have already mentioned. There are aspects of agriculture, some of which

are still relevant in today’s world; aspects of ancient Indian medicine, starting from the Atharvaveda, to Ayurvedic principles, down to Unani practices; harmony in the activities of nature, macrocosm and microcosm, cosmic ideas; astronomy, geography, alchemy/chemistry and technological sciences etc. It is a true wonder that a single author was capable—and easily capable of traversing such wide territories. I have always had the deepest respect for the author. But this respect was increased a thousandfold upon going through this book, and I would strongly recommend that every scholar engaged in the study of ancient Indian scientific thought should most definitely read it.

