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BOOK REVIEW

Sreeramula Rajeswara Sarma, ***The Archaic and the Exotic—Studies in the History of Indian Astronomical Instruments***, Manohar, New Delhi, 2008. 319 pages,Price Rs. 795.00.

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The book, under review, is a collection of 15 articles published before by Sarma in well known scholarly journals. The name is coined since it relates to the description and analysis of two categories of instruments—the instruments as described in traditional Indian texts and miniature paintings along with his plan for the preparation of a catalogue emphasizing its importance, and the others on instruments available in original or prototypes, received from other cultures, and found deposited, studied or used in India during pre-modern times .

First article contains an excellent account of his first hand survey of these instruments, made in connection to his plan for catalogue in preparation, in private and public collections in India and also his systematic checking of catalogues on instruments in US and UK and personal visit to some of these centres for overall impression. The survey covers instruments like water clocks (out-flow and sinking bowl types), sun dials (vertical, horizontal, equinoctial , column and other types), sand clocks (calibrated in *ghaṭīs* or hours), quadrants (Sanskrit or Indo-Persian), armillary spheres (Sanskrit or Indo-Persian), astrolabes (Sanskrit or Indo-Persian for a single or more latitudes), globes (Sanskrit or Indo-Persian) and other astronomical instruments. In addition he has drawn attention to some of the important specimens of water clocks, gnomons, quadrants, astrolabes, globes etc and tried to focus on their makes, makers with family details and other features connected with the instruments.

Two articles (Nos.2 & 3) are devoted to details of astronomical instruments as described by Brahmagupta in his *Brāhmasphuṭasiddhānta* (628 AD). They contain a list of ten instruments viz. *śaṅku* (gnomon), *ghaṭikā* (clepsydra measuring 24 minutes or 1/60th part of a civil day), *cakra* (circular), *dhanuṣ* (semi-circular), *turyagola* (quadrant), *kapāla* (semi-circular instrument placed horizontally),

kartarī (conjoined semi-circular plates one along the equatorial and other the meridian planes), *yaṣṭi* (marked stick), *pīṭha* (horizontally placed *cakra*), and *ajasra-yantra* (perpetual motion device in which output is much more than the input).

One article (No.4) on Mughal Miniature paintings has identified several instruments viz. astrolabe (*yantrarāja*), water clock (*ghaṭīkāyantra*), sand clock (*kācayantra*), celestial globe (*bhagolayantra*), ring dial (*cūḍāyantra*), besides portraits of professional astrologers/astronomers with details of connected history with each of these items. Attempt is also made to identify a few astrologers/ astronomers who were recognized , honoured or rewarded. They are Mullā Chānd (at Akbar's court responsible for drawing horoscopes of Akbar and his son Jahāngīr), Fathullāh Shīrāzī (also for horoscope of Akbar), Jotik Rāj (horoscope of Akbar as per Hindu tradition), Keśava of Kalinjara (for correct forecasts for Jahāngīr), Nīlakaṇṭha (author of *Jyautiṣa-saukhya*, sections of Todarānanda, *Tājikanīlakaṇṭhī* and others, also a mediator between Hindu and Muslim traditions), Kṛṣṇa Daivajña (author of *Jātakapaddhati*, also a mediator betweem Hindu and Muslim traditions during Jahāngīr's time) etc.

Four articles (Nos.5, 6, 7 & 8) deal with sinking bowl type water clocks as described in literature and prototypes available from different museums in India and abroad. Effort is taken to trace the original manuscripts or passages for correct interpretation.

Five articles (Nos: 9, 10, 11 ,12 & 13) have given details of the antiquity, origin and the migration of astrolabe, a novel versatile astronomical instrument for observation and computation made popular during the early medieval times. The front side of the metallic instrument has a cut out or hollow circular space with a raised boarder or rim; the hollow space has two portions containing the rete (net like structure) with plates having stereographic projections of ecliptic and the star positions of some fixed stars, and the other portion a plate (tympan, often changed for different latitudes) representing the sky at observer's latitude with stereographic projection of the equator, the tropics, curves for azimuth lines, seasonal hours and prayer times. The inner side of the raised rim contains geographical details of places, their latitudes, longitude and other details Indian towns were very few).The outer side is fixed with a crown like triangular fixer with a shackle, a ring and a cord for suspending the instrument. The back portion of the instruments is divided into four quadrants for making calculation from the inset shadow or astrological tables.

The Arabic astrolabe came to India possibly with Al-Biruni (11 century AD, and other Persian astrolabes of the Lahore family came subsequently. The attempts made for manufacture by Sulṭan Fīrūz Shāh Tughluq (1351-1388) and his court astronomers—Mahendra and Malayendu Sūri in India, the Lahore family of astrolabists, and the Sanskrit astrolabes in India, in which Devanagri scripts and *kaṭapayādi* system of notation were used against Arabic/Persian numerals have been described in detail. The Lahore family made a great name not only for their versatility in design but also for manufacturing in different sizes depending on the demand of the customers. The Lahore family includes Ustād Allāhdād (2 astrolabes have survived in his name, 1537 AD) and his descendants—Isā (son, 3 astrolabes,1600-04), Qā'im Muhammad (grandson, 6 astrolabes, first half of the 16th century), Muhammad Muqim (younger brother of Qā'im, 37 astrolabes, 1609-1659 AD), Diyā al-Dīn Muhammad (son of Qā'im, designed 28 astrolabes of various types for northern, southern projections and Zarqālī or universal astrolabe for any latitude, 1645-1680 AD), Hāmid Jamāl al-Dīn (sons of Muqīm, 11 astrolabes), and Jamāl al-Dīn (sons of Muqīm,5 astrolabes, 1666-1691, restricted for limited number of places). The Indo-Persian astrolabes manufactured in India are found in the collection of Khuda Bakhsh Oriental public Library (Patna), Jaising museum (Jaipur) and other places, some of which were manufactured at the initiative of Sulṭān Fīrūz Shāh Tughluq , Nawāb Iftikār Khān and others from 14th century onwards. The Sanskrit manuals were also written by Mahendra Sū ri, his follower. Malayendu Sūri which furnishes a geographical gazetteer of 77 towns together with their latitudes of which some sixty places are Indian.

Last two articles (Nos 14 & 15) are on celestial globes, a convenient device used for mapping the star positions. It was accepted as a standard instrument for teaching astronomy in madrasās and became popular in India from Humāyū n's time. The manufacture of globe was also associated with the Allāhdād family of Lahore, and a few specimens are available in Salar Jang Museum (Hyderabad), Archaeological Museum (Delhi) and other places.

A few studies were made before by S.N.Sen on astrolabes and Y. Ohashi on textual studies on Indian astronomical instruments, but the book is, by far the most interesting, gigantic in his plan and approach to cover both textual details and available astronomical instruments. This also offers quite a comprehensive insight from the view point of both local and global cultural contexts. The study is interdisciplinary in nature and based on archival materials, published texts, data

from new scientific early instruments and analysis, studies and illustrations there on. Starting with basic questions which might be asked about the instruments by an interested non-specialists, the book has presented a composite picture of the instruments, their makers, structure and function of instruments. We are sure that his catalogue will fill up many important gaps in the story of astronomical instruments. The survey is all the more very difficult since there is almost no awareness as to the importance of the collection and systematic preservation of these early antiquities or instruments. In spite of various difficulties, Sarma has done an excellent job and weaved interesting details of theoretical and practical aspects of the problem.

Discovery of scientific instruments is a measure of achievements in science and society , displays the spirit to the historical moment of the discovery and is considered important source material in the heritage of science in a culture. Their systematic collection and preservation along with family details of instrument makers or schools with features is a matter of national pride. The developed countries like UK, USA, Germany, France have their technical national museums at different places which show their awareness in the field. In India situation is extremely hopeless. Even the instruments discovered by Sir Jagadish Bose, Sir C.V.Raman (his first phase of work in Calcutta) and of others, not to talk about the makers or their families or schools, are non-existent, and no systematic and comprehensive documents are available. It is the right time we do something positive, possibly a movement, which is very much needed to record our own heritage in science. Sarma's survey is indeed an eye opener, and adds importance to its role in our heritage. We hope that his survey and plan for catalogue of early instruments are completed in shortest possible time, and be a inspirational record for the modern period survey before the original instruments are lost. The present collection is indeed a serious attempt and must for every researcher and library.