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THREE 19TH CENTURY CALCUTTA ASTRONOMERS

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A scientific temper arose among the natives of Calcutta soon after introduction of modern western sciences through the Hindu College, Calcutta, from the very beginning of the 19th century. In the present paper contributions of three Calcuttans of 19th century in the field of astronomy are discussed. They are Raja Radhakanta Dev, Radhanath Sikdar, and Pratap Chandra Ghosh, although the first named scholar contributed mainly to history of Hindu astronomy.

Key words : Bengali Pancaṅga, Calcutta Gazettes, Calcutta Review, Geographical Maps, Gopi Mohan Dev, Great Trigonometrical Survey of India, Hindu Calendar, Mount Everest, Pratap Chandra Ghosh, Radhakanta Dev, Radhanath Sikdar, Śabdakalpadruma.

The foundation of the Hindu College in 1817 at Calcutta was an epoch-making event in as much as the local natives of Calcutta got the opportunity of learning modern western sciences through the curriculum of this College. Many of the civilians of the East India Company were mathematicians of high order both in pure and applied branches of the subject, and they were drawn to the College as teachers. They took equal interest in initiating the native students in science studies and pursuing their own researches on modern science and also on history of Hindu sciences.

It is not that Bengal inherited any high tradition of scientific studies, in fact academic activities had reached a stalemate in pre-Company Bengal. Still, within such limitations, this College successfully created a scientific temper, or, a science consciousness among the local natives in a short period so much so that many students of this College became successful scientists in future.

We propose to discuss in the present paper the contributions of three natives of Calcutta of the 19th century in the field of astronomical studies.

I

The Raj family of Sovabazar, Calcutta, had a cultural heritage for three generations. But for our present purpose we shall discuss here two names only in this context.

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Gopimohan Dev, the adopted son of Raja Nabakrishna Dev, was born in 1761. He was, like his father, a scholar in Sanskrit and Persian, and, through his connections with the British civilians of the Company, he developed interest in modern astronomy. With the help of local native artisans, he constructed some models of the starry sphere, the terrestrial globe, and devices to demonstrate eclipses, phases of the moon etc. We infer that he learnt how to use a telescope, although we have no records ready at our hands to this effect, because a telescope is necessary to construct a model starry sphere. Telescopes were then easily available at the Calcuttá market. We have seen advertisements of telescope-makers in old copies of *Calcutta Gazettes*. His biographer has not mentioned anything to this effect, and so we cannot assert with certainity if Gopimohan was the first native of Calcutta to have used telescope for astrononomical purposes.

He also made an unsuccessful attempt to construct a perpetual Bengali calendar. Readers may perhaps have seen perpetual Gregorian calendar consisting of two or more circular discs of different sizes pinned at the common centre so that one disc may be rotated over the other about this common centre. The rims of the discs are graduated in months' names, datings etc. and by properly adjusting one disc over another, the system can set to any year's calendar.

The system works for Gregorian years, because, number of days in the various months in this calendar is fixed, and also, by convention, a year there gains just one weekday over the preceding year and two week-days after a leap year. But, in Indian system of calendar, months do not have the same number of days in all years and so Gopimohan's attempt was not successful.

These are known from the biographical notes on Dev family compiled by Rangalal Bandyopadhyaya in collaboration with Radhakanta Dev, son of Gopimohan. We do not know if these models are still preserved as curios or are now altogether lost. Gopimohan has not left behind any astronomical works of his own either in manuscript or printed form.

Gopimohan's only son, Raja Radhakanta Dev, born in 1784 is a celebrated name in the field of studies in Sanskrit and Hindu religion and philosophy. It is not that he was an astronomer and made any contribution to astronomical studies. It is also not that he had any scientific temper or science consciousness, on the contrary, he was the leader of the group of conservative persons which opposed all the reformation movements launched at that period.

Still we mention his name because of the wealth of informations he has left behind for a compilation of history of Hindu astronomy.

He was a scholar in Sanskrit, and made an extensive study of puranic and religious literature and, assisted by a group of pundits, he compiled and edited the well known Sanskrit lexicon *Śabdakalpadruma*. The annotations of the entries in lexicon are fully documented by profuse quotations form different sources. The notes on astronomical terms entered in the lexicon similarly contain a rich collection of quotations and references which throw a new light on Hindu astronomy. We shall cite here one example only.

The Greeks divided a day into 24 hours, and then an hour into minutes, minutes into seconds in the *sexagesimal scale*, but the Hindu units of day's subdivisions like *nāḍī, vināḍi* etc. are all in the sexagesimal scale. This may seem to be a departure from the Greek system, but, in fact, the Greek division of day was also used in Hindu astronomy.

Āryabhaṭa, in his *Āryabhaṭīya*, Kāla-16, divided a day in 24 hours (hora in text, a corrupt form of hour) and assigned these 24 hours to the 7 planets in a certain order which is purely a Greek convention, but did not use this division as a unit of practical time-measure.

Radhakanta showed that this unit of hour is found in Puranic literature also. Radhakanta, in this lexicon, has quoted a verse from *Agnipurāṇā* (*ganamedādhyāya*) which states that the day-night period is divided into 24 *horās* (hours).

It is a separate course of study as to why and how this *purāṇa* recorded this Greek convention, a subunit of day which is uncommon in Indian tradition, and historians of astronomy may find it interesting to trace out how this subunit of time was handed down to the *purāṇa-makers*.

Many of the astronomical terms in this lexicon furnish the reader with such new line of thought.

Radhankata himself was not any historian of astronomy, but he has left behind a wealth of references for scholars in this field.

Varāhamihira borrowed extensively from Greek sources, particularly in his astrological works. Even later astrological works in India have quoted Varāha and Greek or Ionian (*Javana*) astrologers in the same breath. Radhakanta's researches have shown that Greek conventions were adopted in *purāṇic* traditions as well.

Radhakanta died in 19.4.1867. We quote below an extract from the obituary notice published in the *Proceedings of Asiatic Society, 1867;*

> Raja Radhakanto was born in 1784. The Czar of Russia and King of Denmark sent him medals and the Imperial Academy of St. Petersburg, the Royal Academy of Berlin, the Royal Asiatic Society of Great Britain and Ireland and similar national Societies of Vienna, Paris, North America had sent him their Diplomas. ......, our own Gracious Soverign bestowed on him the Star of India in recognition of his exalted Merit.

II

The second name that deserves to be mentioned is Radhanath Sikdar, who made some original contributions to modern science. He devised his own works on land surveying through astronomic observations, and formulated modified rules for map projections.

Born in 1813, Radhanath joined the Hindu College in 1824 and left it in 1832 to join the Great Trigonometrical Survey of India (GTSI) technician as a computer technician and went to Dehradun on posting. He was a brilliant student, and always, secured top positions and scholarships in his class examinations in the College. The mathematical genius of Radhanath is evident from the following records:

George Everest, the Surveyor General of India, wrote about him:

> In his (Radhanath's) mathematical attainments, there are few in India whether European or Native that can at all compete with him and it is my persuasion that even in Europe those attainments would rank very high.

The GTSI submitted the following report to the Parliament in April, 1851:

> Radhanath Sikdar, a Native of Brahmanical extraction, whose mathematical attainments are of highest order......

Geographical maps are projections of the spherical surface of the earth on plane sheets. Before discovery of aerial photography method after the first great war or the electronic method of the present time, such projections were made using Clarke's tables published in 1866.

While everest was conducting the trigonometrical survey of India he formulated his rules for projections, and some of these rules were modified by Radhanath himself. Based on these rules, Radhanath published his work "A set of tables for facilitating the computation of trigonometrical survey and the projection of maps for India". For this work he studied the latest works on geodesy in English and French including Puissant's work of 1842. These tables were greatly used for surveying India.

The Manual of Surveying for India by F. Smith and H.L. Thuillier was published by the Govt. of India in 1851. The book is complete in 5 parts, the fifth part being

Practical astronomy and its applications to surveying. The book itself acknowledged its indebtedness to Radhanath in the preface in the following terms:

> In parts III (On Surveying) and V, the compilers have been largely assisted by Babu Radhanath Sikdar, distinguished head of the computing department of the GTSI. The chapters 15, 17 upto 21 inclusive, and 26 of part III and the whole of part V are entirely his own. Besides, he compiled a set of auxiliary tables for the surveying department which were found to be greatly useful.

The manual consists of the following five parts:

> Geometry and Trigonometry, Surveying instruments, On Surveying.
> On Khusrah or native method of field measurement, Practical astronomy and its application to surveying.

A critical review of the content and merit of this book appeared in the *Calcutta Review*, Vol. XVI.

After retirement from services in March 1862, he once went to visit Dehradun in 1864. On that occasion, *The Hill*, a science journal of Dehradun, published a memoir on Radhanath. The Hindu Patriot wrote apropos to *The Hill*:

> In the calm evening of a long and useful life, says *The Hill*, which has been devoted to the advancement of mathematical services, the late Chief computer of the GTSI and Superintendent of Calcutta Observatory has returned to these hills where thirty years ago he studied with Col. Everest the works of La Place and Newton.
>
> ..... The Scientific portion of the *Manual of Surveying* is entirely his, and it is enough to say that by common consent, it has become the standard authority on this all important subject.

All these records show that the mathematical talents of Radhanath, particularly his astronomical method of land surveying were duly recognised, and also that he was held as a top-rate scientist in contemporary India. But unfortunately, he is remembered to-day as discover to the peak Mt. Everest and his mathematical genius is little remembered.

If discovery means finding out a new or unknown physical object like discovery of America by Columbus, then this peak was discovered by J.O. Nicholson in the undefined boundary between Nepal and Tibbet while surveying the Himalayan range between 1845 to 1850. Nicholson himself did not know that he was viewing the top of the earth through his telescope. The processing of the data collected by the team of Nicholson was made by John Hennessey. Radhanath had no share either in the field work or data processing. This peak had no local name and it was designated K XV. the ranges of Africa and South America had not been fully surveyed till then and so it was not known by that time that K XV was the highest peak on the earth.

In 1852, it became known to be the highest peak on the earth and then it was renamed Mount Everest. Name of Radhanath became associated with its discovery.

In all the tributes paid to Radhanath during his life-time we have quoted earlier, there is no reference anywhere which can even remotely connect his name with discovery or surveying of Mt. Everest. In contemporary Newspapers of Calcutta, there is nowhere any report by any editor or any correspondent connecting Radhanath's name with this peak.

Sivanath Sastri (born 1847), a near-contemporary to Radhanath, write a short biography of Radhanath I. Sastri has written there several important and interesting events relating to the service-career of Radhanath, but there is no where any mention of any connection between Radhanath and the peak Everest.

However, the following report appeared in *The Nature,* 10 November, 1904, more than fifty years after renaming K XV as Mt. Everest.

> About 1852, the Chief computer of the office (of GTSI) at Calcutta informed Sir Andrew Waugh that a peak designated XV had been found to be higher than any other hitherto measured in the world.

A discovery of the order of finding the highest peak on the earth, whether by an institution or an individual, deserves far more felicitations than a casual statement as made above. It may be that all the ranges in Europe, Africa, South America etc. were fully surveyed by that time and all data on the heights of the various peaks had become available by that period to the geographical world. Height of the peak XV was found to top the list, and Radhanath made a casual reference of it to Waugh.

Radhanath is not yet honoured as a great mathematician astronomer of 19th century Bengal even though his name is associated with Mt. Everest.

Radhanath died a bachelor in 17th May 1870.

III

The third name we propose to mention here is that of Pratap Chandra Ghosh (b. 1839 A.D.), whose works on calendrical astronomy published in 1860's, are quite relevant even to-day as well.

Bengali *pancangs* (almanacs) computed according to Bengal school of astronomy started appearing in printed form by the second decade of 19th century[2]. The computational works were based on tables constructed in the 16th century. Astronomical parameters of these tables had become obsolete by that time and so computed calendrical elements like eclipses, planetary positions, etc. as predicted in these Bengali *Pancangs* were observationaly incorrect. But the *Pancangs* commanded so high an authority that nobody questioned their correctness.

Several civilians of the Company studied the Hindu calendar, some remarkable works on the subject were published by Sir J. Jones, Samuel Davis, John Bentley and others[3]. But the first native of Calcutta to persue a study on Hindu calendar was Pratap Chandra Ghosh[4].

The earliest list of *Nakṣatras* in Indian tradition begins with *kṛttikā*, and general consensus is that *eta Tauri*, the brightest star of the *kṛttikā* group was the vernal equinox (i.e. the equnoctial colure passed through it) at that time and hence it was named first in the list. The present list of *Nakṣatras* begins with *Aśvinī*, and. Ghosh argued, from the above analogue, that this list was reconstructed at a period when *Aśvinī* was the vernal equinox. This refers to a period around 458 B.C., as shown by Ghosh in his paper.

Ghosh deduced, applying a little of spherical astronomy that, at present, (in 1860's) the sun enters *Aśvinī* (*beta Arietis*) between 20th and 21st April.

Ghosh asserted in his paper :

> The Hindu year is determined by two consecutive conjunctions in longitude of sun with *beta Arietis*. By the existing Bengal calendar the initial moment of the year is placed on 13th April, seven days earlier than the real conjunction.
>
> Hindu calendar is now in one view 22 days in advance (from vernal equinox) and in another 7 days behind (from *Aśvinī*) the real state of things. It is proposed to eject 21 days from the month of *Caitra* and thus to bring the *meṣa Saṃkranti* back to the equinox.
>
> The Hindu calculations, owing to the errors of tables made up some centuries past are all defective, and need correction. But these are secondary to the correction of the year.
>
> It is proposed therefore to bring the civil year from vernal equinox (i.e. 23 March). Though this enforces the change of order of aseterisms making *Revati* the first one and *Aśvinī* the second, we have yet the advantage conferred by European calculations to support our view.

Now, two points in the assertion of Ghosh are subject to criticism.

Firstly, we know from evidences of *Arthaśāstra* that the calendar year in India around 450 B.C. commenced from a full moon at summer solstice. and the vernal equinox, and the star beta Arietis (*Aśvinī*) had no role at all in year beginning. It is not clear how a stellar list with *Aśvinī* as the initial star could originate at time. A stellar list beginning with *Aśvinī* is first found in *Brahmasputasiddhanta* by Brahmagupta.

Secondly, year-beginning was changed from summer solstice to vernal equinox by the 3rd century A.D. or nearabout, and also, then year began at the initial point of the arc-division *Aśvinī*, and not the star *Aśvinī*. In Indian tradition year-beginning in no period was reckoned from the star *Aśvinī*. We do not know why Ghosh's readers missed these points.

However, Ghosh suggested a reformation of the calendar where year should begin from the vernal equinox.

We mention here that the Calendar Reform Committee, founded in 1952, formulated after two years of deliberations, a civil calendar similar to the one proposed by Ghosh some 100 years earlier. The civil year of the Indian National Calendar is a tropical year beginning from vernal equinox (i.e. 23rd March) and has the advantage conferred by European calculations as this calendar is based essentially on the Gregorian principles.

His alternative observations, a civil sidereal year beginning from *Aśvinī* was not accepted by the Bengal School of Pancāngs. But that is a separate story.

Ghosh was a versatile writer, his other papers were published in the Journal and the Proceedings related to his researches on inscriptions, coins etc.

Ghosh, after passing B.A. from the Calcutta University, joined the Asiatic Society as assistant Librarian, later he joined Govt. services as Registrar of Deed and Joint Stock Company. He died at the ripe age of 81 in Bengal San 1327 (1920 A.D.).

The progress of scientific temper in 19th century Bengal becomes further evident from the fact that many more natives of Calcutta devoted themselves to popularise modern Western astronomy among the common man through popular essays in local news papers in simple Bengali language, and all these were in great demand. This temper reached its culmination in the three names we have mentioned.

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