RADHANATH SIKDAR
FIRST SCIENTIST OF MODERN INDIA

UTPAL MUKHOPADHYAY*

In the first half of 19th century, a group of courageous young men of Bengal under the leadership of Henry Louis Vivian Derozio (1809-1831) fought against various social injustices and superstitions prevailing at that time. Radhanath Sikdar was the only person of this 'Young Bengal' group who acquired expertise in mathematics and physical sciences. Among the Derozians, Radhanath was a pioneer of scientific research in modern India. The bi-centenary of this great Indian falls this year. The motivation of this article is to make the readers aware of this little-known but talented Indian and pay tribute to him.

Radhanath Sikdar

Radhanath, son of Tituram Sikdar, was born in October 1813 (the date is unknown) at Jorasanko (famous as the birthplace of Rabindranath Tagore) in Calcutta (now Kolkata). Unfortunately, his mother's name has remained unknown till now. Radhanath was the eldest of two sons (younger son was Srinath) and three daughters of Tituram. Due to financial difficulties, both Radhanath and Srinath had to struggle hard for continuing their studies. However, being meritorious, both of them earned scholarships. Radhanath used to spend most of the money from his scholarship for purchasing books while the family was maintained largely by Srinath's scholarship. Radhanath received his primary education initially in a village school or *pathsala* and then in a school set up by a native Christian named Kamal Basu. In the year 1824, Radhanath entered of the Hindu College (now Presidency University) of Kolkata. In 1830, he started learning mathematics from Professor John Tytler, a renowned professor of mathematics of Hindu College. In that year, Radhanath read first part of Newton's *Principia* under the guidance of professor Tytler. Incidentally, Radhanath Sikdar and Rajnarayan Basak were the first two Indians to go through *Principia*. Apart from that book, in the period between 1828 and 1832, Radhanath studied Euclid's *Elements*, Windhouse's *Analytical Geometry* and *Astronomy,* and Jephson's *Fluxion* for learning mathematics. As a college student, Radhanath devised a new method for drawing common tangent to two circles. This work of Radhanath was published as a research article in *Gleanings in Science* (Vol. III, 1831) and the Editor of that journal commented: *"A good deal having appeared in the public prints lately, respecting the Hindoo College, it may not be uninteresting to publish the accompanying solution of a geometrical problem by one of the pupils there, Radhanath Sikdar. The solution is altogether his own discovery, and I have not altered a word in his composition."* (bold face by the author). This proved Radhanath's efficiency in mathematics since his early days. Apart from mathematics, Radhanath acquired sound knowledge of English, Sanskrit, and Philosophy. He also learnt Greek and Latin to some extent. In fact, Tytler

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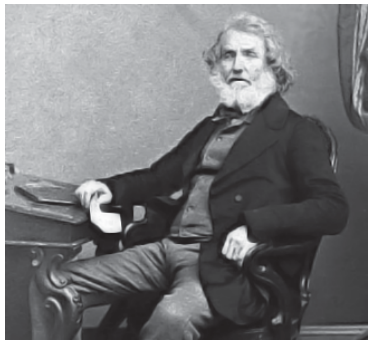

George Everest was a Welsh surveyor, geographer and Surveyor-General of India from 1830 to 1843. He was largely responsible for completing the section of the Great Trigonometric Survey of India along the meridian arc from the south of India extending north to Nepal, a distance of approximately 2,400 kilometres. (Credit: Royal Geographic Society)

himself had deep knowledge as well as fascination for Sanskrit and had an intention to translate classical books of western science. So he advised Radhanath to learn Sanskrit. However, Radhanath could not complete his Sanskrit course because he had to join service and move over to a place far away from Kolkata.

After studying seven years and ten months in Hindu College, without completing his studies, Radhanath joined the 'Great Trigonometric Survey of India' (GTS) on 19 December, 1831. Trigonometric Survey started its work from St. Thomas peak of Madras (present Chennai) in 1802. It was named as 'The Great Trigonometric Survey of India' from 1 January, 1818. Since then Sir George Everest (1790-1866) started working as an assistant of Colonel William Lambton (1753-1823), Director of GTS. Everest became Surveyor General of GTS in 1830. GTS was divided into two sections – Surveying Department and Calculating Department. Employees of surveying department used to send the results of their survey, done through observations and complex mathematics, to the calculating department for checking the accuracy of the results. So, efficiency in mathematics was a precondition for all the staff of the surveying department. Everest, the then Surveyor General of India, requested Professor Tytler to send names of some persons who were expert in mathematics. Tytler recommended Radhanath's name. According to Jim Smith: *"By the end of 1831 he had appointed eight Bengalese students as computers at an initial salary of Rs. 40 per month. Within a short while Radhanath, who had joined on 19 December 1831, had demonstrated that his mathematical ability was of a superior quality and he was appointed as a sub-assistant to GTS"*. Radhanath was the first Indian to join the survey department.

Radhanath started his duty of surveying at Barrackpore Trunk Road (the highway linking Kolkata with suburb Barrackpore), where he set up towers for survey work which exist till today. Then, in the year 1832, Radhanath started working with Everest in the Dehradun Circle. At that time, Everest was one of the world experts in the field of geodetic surveying. He introduced the Colby Bar System (or Compensating Bar System) in surveying for the first time in India. Earlier, high accuracy of measurements in surveying could not be maintained due to change in length of surveying chains in different seasons owing to variation in temperature. In the Colby Bar System, bimetallic rods made of iron and brass were used instead of chains so that change in the length of rod owing to temperature variation could compensate each other. Radhanath learnt many theoretical and practical aspects of surveying from Everest. He successfully applied the Colby Bar System and the use of chains in surveying was totally discarded in India. With the help of Radhanath, Everest surveyed 870 miles (more than 1400 km) of land starting from Bidar in Hyderabad to Pando of Mussouri. The result of this work was summarised by Everest in the famous book *An account of the measurements of two sections of meridional arc of India.* After publication of this book in 1847, Everest sent a copy of it to Radhanath where he wrote in his own hand – *"Babu Radhanath .....in acknowledgement of his active participation in the survey"*. It may be mentioned that Everest retired from service in 1843 and went back to England.

Everest held Radhanath's mathematical talent in high esteem. Radhanath was very efficient in applying basic rules of physics and mathematics according to necessity, often going beyond the traditional rules. Everest was very pleased with this quality of Radhanath's work. In a letter to Tituram, dated 3 July, 1840 Everest wrote: *"I wish I could have persuaded you to come to Dehra Dun for not only would it have given me the greatest pleasure to see you personally how much I honour you for having such a son as Radhanath, but you would yourself have, I am sure, been infinitely gratified at witnessing the high esteem in which he is held by his superiors and equals"*.

Postage stamp honouring Henry Louis Vivian Derozio was issued in 2009. Derozio was an Indian poet and assistant headmaster of Hindu College, Kolkata, a radical thinker and one of the first Indian educators to disseminate Western learning and science among the young men of Bengal.

Radhanath was promoted to the post of Chief Computer in Survey of India in 1851. As an employee of the survey

Postage stamp honouring Radhanath Sikdar, issued in 2004.

department, the most remarkable achievement of Radhanath was the measurement of the height of peak XV (later named Mt. Everest) of the Himalaya. Andrew Waugh, the successor of Sir George Everest as Surveyor General, asked Radhanath to devise a formula for calculating the heights of the peaks of the Himalaya. From a distance of 150 miles (about 242 km), using a theodolite, Radhanath collected necessary data for his work from six different locations. In 1852, according to Radhanath's calculation, the height of the peak turned out as 29,000 ft (8,839.20 m). But Radhanath took it as 29,002 ft (8,839.81 m) because the round figure (29,000 ft) might be misinterpreted as mere approximation.

Regarding this discovery, Kenneth Mason said in his lecture on 'Himalayan Romances': *"It was during the computations of the northeastern observations that a babu rushed on one morning in 1852 into the room of Sir Andrew Waugh, the successor of Sir George Everest and exclaimed, 'Sir, I have discovered the highest mountain of the world'. He had been working out the observations taken to distant hills. It was Sir Andrew who proposed the name Mount Everest, and no local name has ever been found for it either in the Tibetan or the Nepalese side"* (The Englishman, 12 November 1928, p. 17). According to C. R. Markham: *"The mightiest of the Himalayan peaks are visible from the principal trigonometric stations of this series, and were fixed by measurements with the great theodolite. ..... The heights of 79 peaks were fixed, of which 31 have names, and the rest only numbers. .....No. 15 peak, the highest of all, 29,002 feet above the sea was well named by Colonel Waugh, after his old chief Mount Everest"*. Of course there are some controversies regarding non-availability of local name for peak XV, but we are not going into that.

Trigonometric Survey tower on B.T. Road, Kolkata. The inscription says, "G.T.S. Tower. This 75-ft brick tower was built in 1831 for the Great Trigonometric Survey conducted by George Everest, Superintendent of Great Trigonometric Survey and Suveyor General in charge of all topographical & revenue surveys."

William Lambton was the Superintendent of the Trigonometric Survey of India, which he began in 1802. (Credit: Royal Asiatic Society of Great Britain and Ireland)

The news of this discovery was publicly announced in 1854. Great Indian scientist Professor Meghnad Saha has written about this discovery in *'Progress of Physics in Past Twenty-five Years' as: " In 1854, Radhanath Sikdar, the head computer of Trigonometric Survey and an accomplished mathematician, found from mathematical reduction of the observations made some years earlier on an obscure-looking peak of the Himalayas, that this was actually the highest peak in the world"*. It should be mentioned here that J. O. Nicholson, a surveyor who surveyed that region of the Himalayas during 1845 – 1850, first identified peak No. 15. However, Nicholson had no idea about the height of that peak. Then John Henesy used data of Nicholson, but he also could not calculate its height accurately. Radhanath, using altogether six readings (including those of Nicholson and Henesy) and applying intricate mathematical calculations, successfully determined the height of that peak. So, in true sense, all the three persons, viz., Nicholson, Henesy and Radhanath, had played some role in the discovery. But, since accurate calculations, physical interpretation, strong conclusion, etc., are essential parts of a scientific discovery, lion's share of the credit must go to Radhanath.

A hint of Radhanath's mathematical ability can be found in the report presented on 15 April 1851 in the

Radhanath Sikdar was the first to compute the height of Peak XV – the highest peak in the world, which was later named Mount Everest after George Everest.

British Parliament regarding activities of the GTS where it is said: *"A more loyal, zealous and energetic body of men than the sub-assistants forming the civil establishment of the survey department is no-where to be found and their attainments are highly creditable to the state of education in India. Among them may be mentioned as most conspicuous for ability, Babu Radhanath Sikdar, a native of India of Brahminical extraction whose mathematical attainments are of the highest order"*. A second Indian survey team calculated the height of peak XV in 1855 by using the same technique and it turned out as 29,029 ft (8,848.04 m).

In 1929, the Meteorological Office was established in the premises of the Survey Office located at Park Street, Kolkata. A well-equipped meteorological observatory was set up there through effort of Sir George Everest. Apart from his normal duty as the Chief Computer of the survey department, in the year 1852 Radhanath took over the charge of Superintendent of the Meteorological Department as an additional duty. As soon as Radhanath assumed his post in the meteorological department, he started upgrading and modernising the activities of that department. For the first time, beginning December 1852, he made arrangements for daily weather forecast, which became very useful for the shipping companies. Due to Radhanath's effort, regular publication of observed data started since 1853.

Those data were the first set of systematic meteorological data used for climatological work in India. Moreover, Radhanath devised a method for standardising the barometric reading from raw data. The thermal expansion of the metallic scale attached to the barometer as well as the dilation of the mercury itself affect barometric readings. Formulae for nullifying those effects which were in vogue in Europe were unknown to Radhanath. So Radhanath, using his scientific insight, devised the formula on his own. In a research paper published in the *Journal of Asiatic Society of Bengal* in 1852, Radhanath presented his formula for reduction of barometer reading at 32° Fahrenheit (0° Celsius). During the period 1857-1862 he was a member of the 'Meteorology and Physical Science Committee' of the department of meteorology. Some of his research papers were published in *Asiatic Researches*. Radhanath retired from service in March 1862.

Manual of Surveying, an authentic book on surveying, was published in 1851. The scientific portion of that book was written by Radhanath Sikdar. The book had five parts and it was written in the preface: *"In Parts III (On Surveying) and V, the computers have been largely assisted by Babu Radhanath Sikdar, distinguished head of the computing department of the GTSI. The Chapters 15, 17 up to 21 inclusive of Part III, and the whole of Part V are entirely by his own. Besides he compiled a set of auxiliary tables for the surveying department which were found to be greatly useful"*. Although Radhanath's contribution was admitted in the first and second (published in 1855) editions of the book, surprisingly, that acknowledgement was absent in the third edition. Incidentally, Radhanath passed away five years before the publication of the third edition in 1875. Omission of acknowledgement was criticised in various newspapers. Even Lieutenant Colonel Macdonald, Deputy Superintendent of GTS, strongly criticised the then Surveyor General H. L. Thuillier in the daily *Friend of India* of 17 and 24 June 1876 for this act. As a punishment of this act, Macdonald was suspended from service for three months and after completion of the period of suspension, as a demotion, Macdonald was made a 2nd class Deputy Superintendent.

Radhanath had a sound background in mathematics which he utilised as a computer of survey department. He made some original contributions in scientific arena in the form of research papers and finally his scientific works

were duly appreciated and recognised by experts. So, in every respect he fulfilled all the criteria necessary for being called a scientist. Thus, it can be said that Radhanath was the first scientist of modern India.

Apart from his work in the survey and meteorology departments, Radhanath was involved in various philanthropic activities. He and Peary Chand Mitra (1814-1883) jointly edited a monthly magazine meant primarily for women. That magazine was instrumental in the origin of modern Bengali language. As a mark of recognition of his mathematical ability, Radhanath was elected a member of Bavarian branch of famous 'Philosophical Society' of Germany. He was the first Indian to achieve this honour. In the fag end of his life, Radhanath worked for a while as a mathematics teacher of General Assembly Institution of Kolkata. Radhanath built a house beside the Ganges River at Gondalpara of Chandannagore in Hoogly district. In last part of his life he lived in that house. There he passed away on 17 May 1870 at an age of 57. The newspaper *Hindu Patriot* wrote in its obituary on 23 May 1870: *" Radhanath was a remarkable man and had many good qualities"*. Recently a tablet has been erected in the National Library of Kolkata in memory of Radhanath Sikdar – the first scientist of modern India. ❐

1. Radhanath Sikdar: Beyond the Peak – Ashis Lahiri; Boi-Chitro, Kolkata, 2010.
2. Nabya Bharater Protham Bijnani Ganitagjna Radhanath Sikdar – Dipak Kumar Daw (Editing and compilation), The Science Association of Bengal, Kolkata, 2012.
3. Dwi-satabarse Radhanath Sikdar – Ashis Lahiri; Sutradhar, Kolkata, 2013.
4. Sources on the Internet for photographs.

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