Bibhutibhusan Dutta: A Sage Mathematician

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Abstract: Bibutibhusan Dutta (Swami *Vidyaranya* in later life), a successful professor of mathematics, has glorified India by bringing in limelight the significant contributions of Indian mathematicians of ancient period as well as doing high level mathematical research in applied mathematics. In this work, life and scientific contributions of Prof. Dutta have been discussed with special emphasis on history of mathematics of ancient India.

Keywords: Mathematics; ancient Indian mathematics; applied mathematics

1. Introduction

The year 1888 is a significant milestone for India because two luminaries of our motherland, viz. Dr. Sarvapalli Radhakrishnan (1888-1975), a world famous philosopher as well as the second President of India and the Nobel Laureate physicist Sir C.V. Raman (1888-1970) were born in that eventful year. But most of us either do not know or have forgotten that Bibhutibhusan Dutta (1888-1958), another great son of India who glorified our country by highlighting the significant contributions of ancient Indian mathematicians, saw the light of this world in the same year. Through his in-depth research work, he presented before the world the origin and subsequent developments of various mathematical ideas made by our ancestors starting from the Vedic period.

Fig. 1: Bibhutibhusan Dutta

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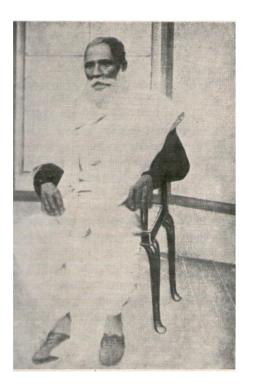
Fig. 2: Father Rasik Chandra Dutta and Mother Muktakeshi Devi

2. Biographical Sketch

Biographical facts are drawn largely from [1] unless mentioned otherwise. Bibhutibhusan Dutta, the third son of Rasik Chandra Dutta (1854-1926) and Muktakeshi Devi (1861-1958), was born on 18 June, 1888 at Kanungopara of Chittagong in undivided India (now in Bangladesh). It may be mentioned that in the previous year legendary mathematician Srinivas Ramanujan (1887-1920) was born. Rasik Chandra was a Government servant in Chittagong court. He had eleven sons and four daughters. Although Rasik Chandra had to pass a life of extreme hardship and financial stringency, he was fortunate enough that each of his eleven sons was a jewel. The eldest son Rebatiraman (M.A.) was a Deputy Magistrate, second son Bhupatimohan (M.A.B.L.) a lawyer, Bibhutibhusan (D.Sc., P.R.S.) a professor, Nirodlal (M.B.) a physician, Benodbehari (Ph.D., P.R.S.) Controller of Examination of Calcutta University, Harihar (M.B.) a physician, Pramatha (Ph.D.) a professor, Subimal (I.A.S.) Indian Ambassador, Sukomal (B.Sc., Engg.) an engineer, Parimal (M.B.) a radiologist and youngest son Ranajit (B.E.) was an engineer. For giving birth to so many great sons, Muktakeshi became known as a 'golden womb lady' (*ratnagarva* in Bengali).

Bibhutibhusan loved his father so much that he stayed with him at Rasik Chandra's working place in a remote area 30 km away from Chittagong town devoid of any institution. So, beginning of formal education of Bibhutibhusan was delayed by nearly three years. After Rasik Chandra was transferred to Chittagong town, Bibhutibhusan entered the Chittagong Municipal School and passed Matriculation Examination in 1907 with District Scholarship. Then he entered Presidency College (now a University), Kolkata in I.Sc. course. In 1909 he passed I.Sc. Final Examination in first division but failed to win scholarship. Then he took admission in the same college in B.Sc. course with Honours in mathematics. In the B.Sc. final examination in 1911, he performed well in theoretical papers, but his result in the practical examination was not up to his expectation. So, he had to appear again in the same examination in 1912 and obtained second class honours. It should be mentioned here that his performance in the I.Sc. and B.Sc. examinations were not proper indicators of his talent. His two papers were accepted for publication even before his graduation was completed. In fact, his too much inclination towards the religious world proved costly so far as his academic career is concerned. However, in 1914 Bibhutibhusan secured first class in M.Sc. Examination in Mixed Mathematics (presently Applied Mathematics) from Calcutta University. It is interesting to note that seven months before his M.Sc. final examination, Bibhutibhusan suddenly disappeared from his mess in Kolkata. After a tiring effort of his eldest brother Rebatiraman, he was traced at Haridwar where he went for asceticism. Rebatiraman brought him back to Kolkata and in spite of this distraction from his studies, Bibhutibhusan was talented enough to obtain first class in M.Sc. final examination.

Even before publication of result of M.Sc. Examination, Bibhutibhusan published a short research paper which drew attention of Sir Asutosh Mukherjee (1864-1924), the then Vice-Chancellor of Calcutta University. Being a great mathematician himself, Asutosh readily recognized excellence of Bibhutibhusan and in 1915 granted him a research scholarship of Rs. 75/- per month. In 1916 he was appointed as an assistant to famous mathematician Ganeshprasad (1876-1935), the then Rashbehari Ghosh Professor of mathematics in Calcutta University. At that time Bibhutibhusan had to take some classes of M.sc. course. He became Premcahand Roychand Scholar (PRS) in the year 1917. The entire amount of the scholarship was awarded to him because the standard of his article was much higher than other candidates. Being a PRS he received Mouat Medal. He was awarded Elliot Prize also. He obtained D.Sc. degree from Calcutta University by working on problems related to hydrodynamics.

In the session 1917-18, Bibhutibhusan got an appointment as lecturer of Mixed Mathematics in the University of Calcutta. In that golden era of Calcutta University, a group of highly talented youth, viz. S. N. Bose (1894-1974), M.N. Saha (1893-1956), N.R. Sen (1894-1963), N. Basu, S. Banerjee etc. were colleagues of Bibhutibhusan. When Ganeshprasad resigned from his Professorship in 1919, Dr. S. Banerjee succeeded him till 8 April, 1922. When Prof. Banerjee also resigned the Chair was offered to Prof. Dutta. According to Dutta's brother Benodebehari, after resignation of Dr. Banerjee, Bibhutibhusan was offered the post but he declined by saying: "*After a couple of days I shall become sannyasi [and so] I have no need for the promotion*" [2]. But, as no other befitting person was found for that post, Prof. Dutta agreed to accept the offer for a brief period but declined to receive any extra remuneration. This incident proves the generosity of Bibhutibhusan and this type of sacrifice is rare now-a days. As a teacher, Prof. Dutta was very successful and he could teach efficiently any topic included in the syllabus. He also successfully

performed his duty as a Secretary of the Calcutta Mathematical Society (CMS), the brainchild of Sir Asutosh Mukherjee. In the 20th Foundation Year Celebration of the CMS in 1928 Ganeshprasad paid his respect to Bibhutibhusan by saying: *"But I consider it my duty to state that but for the devotion of Dr. Bibhutibhusan Dutta, who at the earnest request of Sir Asutosh Mukherjee in 1924 undertook to shoulder the responsibility of a Secretary, the Society would have found it extremely difficult to publish so many volumes of journals as it did in last four years"*. Incidentally at that time Asutosh was not in this world to witness that he rightly handed over the responsibility of his dear CMS to a befitting person. In the last years of 1920s B. B. Dutta became irregular in his teaching profession and went on leave during 1928-1930. Ultimately he resigned from his post in 1931 to become a *sannyasi*. In April, 1932 he wrote a review article on '*Siddhantasekhar*'. Finally, since 1933 he detached himself from all kind of activities related to the university and received the Order of *Sannyas* on 17 February, 1938 in Chittagong by accepting Swami Vishnu Tirthji Maharaj (1889-1969) as his Guru [3] and since then he became known as *Swami Vidyaranya*. After staying hither and thither for some time, he ultimately settled at Puskar near Ajmer of Rajasthan where he spent the rest of his life at that place until his demise on 6 October, 1958. It may be mentioned here that his brother Nirodlal, who was a renowned physician, also became a *sannyasi* and his ancestor Mukundaram was a close associate of Sri Chaitanyadeb (1486-1534). B.B. Dutta wrote two books on Indian religion and philosophy which were published posthumously [4, 5].

3. Scientific Contributions

It has already been mentioned that Bibhutibhusan obtained his D.Sc. from Calcutta University by working on hydro-dynamical problems. His thesis contained eight papers which were published in Philosophical Magazine (London), American Journal of Mathematics, The Tohokuo Mathematical Journal etc. Apart from the thesis papers, he wrote some more papers on mainstream mathematics. After resigning from his service, he left the path of hardcore mathematical research and entered into the field of history of mathematics. So, B. B. Dutta's research works can be classified into two major fields, viz. (1) mainstream research in Applied Mathematics and (2) history of mathematics in ancient India. The period of his hardcore research spanned from 1910-11 to 1921, i.e. about ten years. After this period he focused his attention towards ancient Indian mathematics.

3.1 Research in Applied Mathematics

Prof. Dutta worked mainly on fluid dynamics and theory of elasticity. The main characteristics of his research were extraction of physical significance of fundamental theories. For instance, in his maiden publication he showed that proper interpretation of some formulae in elasticity theory in a homogeneous medium might explain the theory of gravitation [6]. In the next paper, considering a law of gravitation of the form $F = - \mu/r^k$ he showed that an ellipsoidal figure can be a surface of equilibrium only when $k = -1$ [7]. Then he also investigated by assuming the law of gravitation as $F = - k^3/r^2 - \mu r$. Some of the results obtained by Prof. Dutta were related as well as applicable to real life. For instance, he proposed a method of determining the non-stationary state of heat in an ellipsoid [8] and in that process with the help of solid harmonics he generalized the equation of elliptic surfaces. In that work, he also calculated the changes in the thermal field perpendicular to the elliptic plane. In the context of this work it may be mentioned here that the solution of physical problems related to elliptical and spherical surfaces can be applied for antenna and other electrical devices. B.B. Dutta made significant contributions in the field of fluid mechanics. He studied the motion of two spheroids in an infinite liquid [9, 10]. Using judicious mathematical techniques he investigated the stability of circular and rectilinear vortices [11, 12]. In two successive papers, Prof. Dutta studied the behavior and periods of vibrations of vortices [13, 14]. He had two publications on spherical harmonics also [15,16].

3.2 Reasearch in Ancient Indian Mathematics

In spite of his important contributions in Applied Mathematics, Prof. B.B. Dutta is remembered chiefly for his seminal work on history and development of ancient Hindu and Jain mathematics. He had nearly sixty research publications in this direction which were published in foreign journals, viz. American Mathematical Monthly, Bulletin of American Mathematical Society, Quellen und Studien zur Gaschichte der Mathematik, Archeion and

Scientia as well as in various Indian journals. In colonial India, contributions of Indian mathematicians were mostly underestimated by Western scholars of history of mathematics. To them, Indian mathematics was nothing more than astrology and Indian mathematicians are indebted to Greek mathematics. Under this situation, Prof. Dutta, being inspired by Prof. Ganesh Prasad (a pioneer in India for research work in history of mathematics), took up the task of highlighting achievements of ancient Indian mathematicians. In this work he was supported by Avdhesh Narayan Singh, a student of Prof. Ganesh Prasad. Dr. Singh, after obtaining M.Sc. degree from Benaras Hindu University in 1924, came to Calcutta around 1926 and received D.Sc. degree in 1928 from Calcutta University working under the supervision of Prof. Ganesh Prasad. During his stay at Calcutta, Dr. Singh used to visit Dr. Dutta in his mess for getting some direction and help from him. In this way Dr. Singh had some intimacy with Dr. Dutta. After resigning from his service, Prof. Dutta left the path of hardcore mathematical research and entered into the field of history of mathematics. He went on to explore the contributions of ancient Indian mathematicians. In fact he started publishing papers in this field since 1920. But he entirely engaged himself in this area of research near the end of 1920s. B. B. Dutta observed that many researchers had a tendency to show the indebtedness of India to Greek and Arab mathematicians. Those scholars arrived at their conclusion without going into details and misinterpreting the available resources. Moreover there were a number of commentaries of great masters like Aryabhatta, Brahmagupta, Bhaskaracharya II etc which differed slightly from each other. So, Prof. Dutta had an uphill task of going through the primary resources which were written in Sanskrit. Since he had proficiency in Sanskrit, he could extract the real meaning of the literature, written mainly in the form of '*slokas*'.

In the year 1926, Prof. Dutta's first five papers on the history of mathematics were published [17-21]. His lecture entitled *Contributions of the Ancient Hindus to Mathematics* at Allahabad University on December 27, 1927 was subsequently published in the Bulletin of the Allahabad Mathematical Association [22]. Prof. Dutta firmly established that ancient Hindu mathematicians had a deep knowledge in geometry; otherwise it was impossible for them to construct altars of various shapes meant for religious observances. Not only that, he showed clearly that Hindu geometry was earlier than Greek geometry of Hellenistic era, regarded as the golden period of geometry in Greece. In his article *Hindu Origin of Geometry*, Prof. Dutta wrote: "*The Hindu geometry commenced at a very early period, certainly not later than that in Egypt, probably earlier, in construction of altars for the Vedic sacrifice……In course of time, it however, grew beyond its original sacrificial purpose or the limits of practical utility and began to be cultivated as a science for its own sake. Indeed, there is no doubt about the fact that the study of geometry as a science began first in India. Further, the early Hindu geometry was much in advance of the contemporary Egyptian or Chinese geometry. The Greek geometry was yet to be born*" [2]. According to Dutta, ancient Hindus used ropes (*sulba* in Sanskrit) for constructing altars of specific configurations. So they had written the method of constructing various altars (using ropes) in the form of *slokas* which were called '*sulba sutra*' At that time Boudhayana, Katyana, Apastamba, Manab etc. were famous '*sulbakars*', i.e. geometers in modern sense [23].

Prof. Dutta established that for constructing altars the ancient Hindu mathematicians had to master the process of dividing any figure into a number of parts, the method of drawing a perpendicular on a straight line, the process of finding three suitable numbers satisfying Pythagoras theorem $x^2 + y^2 = z^2$ etc. Moreover, they could find the approximate values of $\sqrt{2}$ and π. In fact, Boudhayana and Apastamba derived the value of square root of 2 correct to five decimal places which were unknown to Greek mathematicians of contemporary period.

Similarly, Prof. Dutta proved that Arabs learnt algebra from the Hindus. In his paper *Origin of Algebra* [2] he wrote: "*The science of algebra derived its name from the title of a certain work by the Arab Mahammad bin Musa Alkhowarizmi, viz. al-gebr-w'al-mugabalah, which contains an early systematic treatment of the general subject as distinct from the science of numbers……But the subject matter of Alkhowarizmi's treatise was not his original contribution. He got it from the Hindus*". Regarding the use of calculus, Dutta reasoned that the word *Tatkalika gati* (instantaneous motion) found in the works of Manjula, Aryabhatta II and Bhaskara II are nothing but the idea of differentials.

Prof. Dutta encapsulated all these works in his magnum opus *The History of Hindu Mathematics* in three volumes. After his premature retirement from Calcutta University, Prof. Dutta handed over the manuscripts of those volumes to his younger assistant Avadhesh Narayan Singh who published first two volumes in 1935 and 1938 respectively [24, 25] from Lahore. Afterwards, in 1962 this book (Part I and II) was published again by Asia Publishing House. In the third part of this book, contribution of Hindus in geometry, in the development of trigonometry, calculus, permutations and combinations, surds, series and magic squares were discussed. Dr. Singh

could not publish the third volume due to his premature death in 1954 and it was never published as a book. However, due to sincere effort and editing by Dr. Kripasaran Shukla, Professor of mathematics of Lucknow University, it was published serially in Indian Journal of History of Science as separate papers during 1980-1993 [26-32]. In his review of History of Hindu Mathematics (Part I) L. G. Simons, a renowned historian of mathematics, has commented: *"Datta and Singh's History of Hindu Mathematics should be in every library which reaches standards covered by the word 'approved'. It should be owned by individuals who have any interest whatever in the history of the progress of science. From the standpoint of authoritative subject matter and from that of book-making, it is a notable history"* [2, 33]. Part I of the book deals with history and development of Hindu numerals in the place value system as well as other numerals followed by Hindu mathematicians. Prof. Dutta strongly opined that the term 'Hindu-Arabic numerals' should be replaced by 'Hindu numerals'. Second part of the book deals with the process of obtaining general solutions in rational integers of indeterminate and bi-quadratic equations. But prior to writing this book, in the year 1931, being invited by Ganesh Prasad, Prof. Dutta delivered six lectures on ancient Hindu geometry. Those lectures were compiled in the book *The Science of Sulva: a Study of Hindu Geometry*. Dr. Dutta wrote (28 July, 1932) in the preface of this book: *"I tender grateful thanks to Mr. A. C. Ghatak, Superintendant and to the staff of the Calcutta University Press for kindly expediting the publication of the book in order to help me to go back to my retirement earlier"*. It was published by the University of Calcutta. Raymond C. Archibold (1875-1955), a scholar in History of Mathematics, has commented on this book: *"Dr. Dutta's volume should be in the hands of every student of the history of mathematics"* [33, 34]. Finally it should me mentioned that B. B. Dutta had publications on ancient Jain mathematics also [34, 35].

4. Conclusion

Great minds spend their lives for fulfilling some missions. Prof. B. B. Dutta also had two missions- mathematical research (including history of mathematics) and religious activity. No doubt, he could fulfill both his dreams. In the first part of his life, in spite of a spiritual inclination, he concentrated mainly on his academic career and mathematical research. Then he delved into history of ancient Hindu mathematics which, most probably, was motivated by his patriotism. Finally he detached himself from mundane attractions and led his life as a sage. So, the life of Prof. Dutta can be regarded as that of a mathematician in the cocoon of a sage. His contributions in reviving the glorious past of India in mathematical science should be remembered for ever.

References:

1. *Ganitagya Bibhutibhusan tatha Swami Vidyaranya*; edited by Sukomal Dutta (Calcutta, 1990).
2. R.C. Gupta, *Historia Mathematica* **7** (1987) 126.
3. R.C. Gupta, *Math. Student* **55** (1987) 117.
4. B.B. Dutta, *Ancient History of Bhagabata Religion* (4 volumes in Bengali, 1963-66).
5. B.B. Dutta, *Ancient Story of Advaita Philosophy* (in Bengali, 1972).
6. B.B. Dutta, *Bull. Cal. Math. Soc.* **2** (1910-11) 19.
7. B.B. Dutta, *Bull. Cal. Math. Soc.* **3** (1911-12) 21.
8. B.B. Dutta, *Am. J. Math.* **41** (1919) 133.
9. B.B. Dutta, *Bull. Cal. Math. Soc.* **7** (1915) 49.
10. B.B. Dutta, *Am. J. Math.* **43** (1921) 134.
11. B.B. Dutta, *Phil. Mag.* **40** (1920) 138.
12. B.B. Dutta, *Bull. Cal. Math. Soc.* **10** (1920) 219.
13. B.B. Dutta, *Proc. Benares Math. Soc.* **2** (1920) 23.
14. B.B. Dutta, *Proc. Benares Math. Soc.* **3** (1921) 13.
15. B.B. Dutta, *Tohoku Math. J.* **15** (1919) 166.
16. B.B. Dutta, *Tohoku Math. J.* **17** (1920) 210.
17. B.B. Dutta, *Proc. Benaras Math. Soc.* **7** (1926) 9.

18. B.B. Dutta, *Am. Math. Mon.* **33** (1926) 220.

19. B.B. Dutta, *Bull. Cal. Math. Soc.* **17** (1926) 59.

20. B.B. Dutta, J. *Asiatic Soc. Beng.* **22** (1926) 25.

21. B.B. Dutta, *Am. Math. Mon.* **33** (1926) 449.

22. B.B. Dutta, *Bull. Allahabad Math. Assoc.* **1** (1927) 49.

23. B.B. Dutta, *Quellen und studies Zur Geschichte der Mathematik* B **1** (1929) 245.

24. B.B. Dutta and A.N. Singh, *History of Hindu mathematics: A Source Book*, Part I (M.B. Das, Lahore, 1935).

25. B.B. Dutta and A.N. Singh, *History of Hindu mathematics: A Source Book*, Part II (M.B. Das, Lahore, 1938). Motilal Banarasi Das, Lahore.

26. B.B. Dutta, *Ind. J. Hist. Sci.* **15** (1980) 121.

27. B.B. Dutta, *Ind. J. Hist. Sci.* **19** (1984) 95.

28. B.B. Dutta, *Ind. J. Hist. Sci.* **27** (1992) 51.

29. B.B. Dutta, *Ind. J. Hist. Sci.* **27** (1992) 231.

30. B.B. Dutta, *Ind. J. Hist. Sci.* **28** (1993) 103.

31. B.B. Dutta, *Ind. J. Hist. Sci.* **28** (1993) 253.

32. B.B. Dutta, *Ind. J. Hist. Sci.* **28** (1993) 265.

33. J. J. O'Connor and E. F. Robertson, *Mac Tutor History of Mathematics*, mathhistory.st-andrews.ac.uk

34. R.C. Archibald, *Isis* **22** (1934) 272.

35. B.B. Dutta, *Bull. Cal. Math. Soc.* **21** (1929) 115.