Radhanath Sikdar: Through the Haze of Time and Neglect

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Modern science arrived in the traditional East with Western colonialists and in India, strange as it may sound, it first arrived as land surveying through triangulation. It is not that there was no prior surveying in India, save that such practices were basically disjointed surveys of inhabited areas like townships, villages or holdings. There were even some astronomical observations for specific purposes in selected locations, but these hardly amounted to accurate geographical knowledge.

Then in the second half of the 18th century, the British (through the East India Company) acquired, "by many questionable actions" perpetrated over more than a century, complete political control of a vast swath of India. However, most of it was virtually unknown to them. "To define it, defend it and exploit it, maps were desperately needed" and the answer lay in surveys, for which task the Company established a department called the Survey of India in 1767.

Encouraged by the initial work of this department, an audacious and seemingly impossible plan was mooted in 1799 - to map the great meridional are of 78° E from the deep south of India to the foothills of the Himalayas. This would serve as the "trunk of a tree" or the "spinal column of the skeleton" that would be the basis for the mapping of the entire country by trigonometric surveys. It would, additionally, provide data to calculate the curvature of the earth.

As it so happened, one of the great scientific quests of that age (the 18th century, spilling into the 19th) was the accurate determination of the shape and dimension of the earth (and subsequent location of important geographical features in terms of latitude and longitude). This survey could, therefore, be touted as a part of the global effort and add to British pride of scientific achievement while serving the cause of Empire. There was, therefore, no difficulty in procuring ever increasing funds needed for the project sanctioned by the directors of the Company and approved by the Crown.

Thus began an endeavour that turned out to be one of the most perilous undertaken by humankind. "Through hill and jungle, flood and fever, an intrepid band of Indian and British surveyors carried the Arc from the southern tip of the Indian subcontinent up into the frozen wastes of the Himalayas." Starting its work in 1802, the "Great Trigonometric Survey", as it was aptly named later in 1818, was a hailed as "one of the most stupendous works in the whole history of science" (by a later president of the Royal Geographical Society) and "by common consent one of the greatest achievement of a science-mad society" (by John Keay, a late 20th century chronicler). Far removed from today's remote sensing, satellite-aided, surveying aids, it was indeed a "stupendous" project, and the person who completed the major part of this gigantic task of unimaginable difficulties was deservedly extolled. He was later also immortalised by having the world's highest peak named "Everest" after him.

However, nobody remembers the band of brilliant and dedicated young Indians without whose wholehearted participation this near impossible task could never have been accomplished and that, too, with a precision difficult to match, even today. True to colonial tradition, they were not accorded mention in the roll of honour for their glorious achievement. Regrettably post-Independence Indian historians have also contrubuted to that neglect.

This, then, is a tribute to one who was deemed "first among" these "few natives" (Friend of India, Calcutta, November 11, 1852) - Radhanath Sikdar (Radhanauth and Sickdhar being variants used at times).

Born to Tituram in Calcutta (now Kolkata) in 1813, Radhanath was a child prodigy. He entered Hindu College, the predecessor of Kolkata's elite Presidency College, at age 11 and soon came under the spell of a young firebrand teacher, Henry Vivian Derozio, a forceful votary of an upright and questioning mind. Radhanath also became the pet of his mathematics teacher, Dr John Tytler, for his proficiency in that subject. Tytler not only groomed the boy in advanced mathematics but also introduced him to Newton's "Principia" and, thereby, to physics. This dual influence of Tytler and DeRozio equipped Radhanath with a solid scientific base coupled with a dauntless disposition and probing mind. He was also blessed with a robust physique, inherited from his family of hereditary law-keepers and was, thus, perfectly equipped for the onerous task he would be soon be called upon to undertake. Tytler used to take great pride in his student's mathematical proficiency so when GTS was searching for energetic young men with scientific training to assist the British surveying staff, he recommended Radhanath. At the bidding of his mentor, as also to help his cash-strapped father, the brilliant final year college student, still in his teens in 1831, left his studies to join the Surveyor General's office in Calcutta (for Rs 30 per month).

Having started from the tip of the peninsula, GTS had, by 1820, reached the Himalayan foothills. Ascertaining the height of the mountains was, by then, incorporated in GTS as official policy. Instead of long range sightings from the plains, surveyors had "pushed up the headwaters of the Ganga and Jamuna rivers to brush round the flanks of some of the main Himalayan peaks and even pass beyond them on to the Tibetan Plateau". With this, the work also turned more complex involving "some terrifying mathematics" with "...impossible equations" requiring "arcane calculations" with "observations vital of geodesy" and then "mind boggling recalculations". (A later day writer estimated that the trigonometric surveying of India involved 9,230 unknowns and produced unwieldy equations exceeding anything of the kind ever attempted.)

Meanwhile, in 1815 the post of "Surveyor General" headquartered at Calcutta was created with authority over survey work at different locations. But for better coordination of its Himalayan phase of the world GTS got a separate office at Dehra Dun in 1833. The Calcutta office retained the computations, graphic and administrative core of the Surveyor General's office. Radhanath initially joined this office but was almost immediately transferred to one of the Himalayan base camps for survey work. But as his “number crunching genius” became evident, he was soon sent to the Dehra Dun office to work as a “computer”, the first Indian “of rank” to be so inducted.

George Everest was Superintendent of GTS at the time as the second incumbent. Radhanath’s investigative mind quickly grasped the astronomical methods required for geodetic surveying. He also devised his own working formulae from first principles, wherever required, and applied these in practice with admirable mathematical precision. His proficiency in geodetic surveying was so impressive that Everest, by all accounts a quintessential Victorian “sahib”, was moved to comment (in 1838) that “... there are few in India whether European or native that can at all compete with him. Even in Europe these mathematical attainments would rank very high”. Greatly valuing Radhanath’s aptitude “not only to apply formulas but to investigate them”, Everest had remarked in 1840 that “computers comparable to Radhanath cannot be hired in England at a price less than a guinea per diem...” As a later chronicler had remarked, “Accolades so fulsome would rarely spill spontaneously from Everest’s pen” to whom “giving credit to subordinates would not come naturally”. It may be remembered that there was no institutional arrangement to teach advanced science and higher mathematics till the end of the 19th century in British India.

Radhanath’s mastery of higher mathematics and science was achieved by his own “unremitting self-cultivation”, as Andrew Waugh, Everest’s successor as Surveyor General, put it. It is also a measure, indeed, of the strong foundation of basics he inculcated during his student days.

Radhanath was elevated as Chief Computer in Surveys of India in 1851 and posted back to Calcutta. The responsibility of this office was to derive the ground reality, from the raw geodetic survey data collected during field work, by using complex equations, It was Waugh who had asked Radhanath, “the Chief Computer in Calcutta”, to devise suitable formulae for computing geographical positions and altitudes of snow peaks observed from “distances of over 100 miles”. Radhanath’s computations provided the first clear proof that a peak in the Himalayas, then designated XV, was higher than any other in the world hitherto measured. Waugh was appreciative of Radhanath’s ability as was Everest. On an earlier occasion, he had extolled Radhanath’s mathematical attainments in a report to the British Parliament (in 1851).

Ironically, this same Waugh who, true to the imperial tradition of ignoring the contribution of its subjects, proposed naming the peak Mount Everest after his illustrious predecessor. A complete grasp of the subject along with his unparalleled innovative ability had made Radhanath the most valuable asset of the Survey of India till he retired in 1862. Many publications, like *Surveying Manuals, Computational Tables,* etc, authored by him remained indispensable for Indian surveys throughout the 19th century. But after his retirement and subsequent death, there began conscious attempts to downplay, even deny, this Indian his contributions. So blatant were these machinations that even some British officers of the Survey of India openly voiced their revulsion, braving punishment, but to no effect.

For example, in a glowing chronicle of the entire project to map the whole of British possession in India in the early 19th century (The Great Arc) by a contemporary British historian (Keay, 2002) Radhanath finds passing mention only thrice, although with a sobriquet - "mathematical genius" - every time. Lately, this lacuna has been only partly corrected and the Survey of India has come to accept Radhanath as the one whose calculations proved that Mount Everest was the world's highest peak. However, his contribution to another field of scientific activity is yet to be recognised. It was Radhanath who laid the foundation for accurate and systematic meteorological observations, as well as their methodical processing, in the country. He was truly the pioneer Indian Meteorologist. Sporadic meteorological observations had started in India from 1785 as an adjunct to surveying. From March of that year, continuing up to February 1788, barometer, thermometer and hygrometer readings, direction and force of wind and rainfall were done at Fort William, Calcutta (by Colonel TD Pearce). Meteorological observations were also commenced in 1795 at Madras for the same purpose (by J Goldingham).

To give due importance of atmospheric conditions on surveying data, a full-fledged meteorological observatory was set up in the premises of the office of the Surveyor General at Calcutta under a superintendent in 1829. In November 1852, while still serving as Chief Computer at the Survey of India, Radhanath was given additional charge as superintendent of this observatory. By then, he had become famous for his geodetic world and his appointment as the first Indian Superintendent was widely acclaimed. *The Friend of India*, predecessor to *The Statesman* and the leading English daily of Calcutta at the time, commented in a headlined reference, "This native gentleman... whose scientific acquirements emulate those of Europeans" (a great compliment in those early colonial days) and goes on to say that "we have little doubt that he will ably fulfill his duties as the head of the office", adding, intriguingly, "of which he has long been the soul", *Ibid*).

The last phrase indicates his association with the observatory even before he was put in charge. He must have been aware of the intrinsic value of meteorological data but watched helplessly at his European predecessor's neglect of a scientific methodology and a strict time schedule. Observations were taken around sunrise, apparent noon and sunset, whose times varied from day to day, place to place. But even these hours were not adhered to strictly. No correction was applied to barometer readings either. On assuming charge, Radhanath lost no time in correcting everything. He immediately started reducing the raw barometer observations to a standard temperature. It may be mentioned here that temperature reducing has to be applied to barometer readings to assess the real changes in atmospheric pressure. Temperature affects barometer readings on two counts: the thermal expansion of the brass scale attached to the barometer and the dilation of the mercury column itself in the tube. Formulae for reducing barometric observations to 32° Fahrenheit, already in use in Europe, were not available to Radhanath. He had to build up his own reduction table from the first principles of physics.

He introduced the system of hourly observations right from December 1852. From 1853, he started regular compiling, and publishing, of abstracts of hourly, daily and monthly means of all the observed, as also the derived elements along with their extremes and monthly ranges. This series was the first ever scientifically recorded set of meteorological data and basis of the first ever work on the climatology of an Indian city, in this case Calcutta, then capital of British India.

An important service, which later became the responsibility of the India Meteorological Department for ships using Calcutta port was also commenced by Radhanath in 1853. Keeping accurate time was crucial for navigation in those days and it was necessary for all sea-faring vessels to carry multiple chronometers for this purpose. But during long voyages significant errors used to creep up in the times indicated by even the most precise of these chronometers. The availability of accurate time to correct these was therefore deemed an important facility at all major ports. To provide this service for Calcutta harbour, the transit of stars across the Calcutta meridian was observed through a transit instrument kept at the Survey of India office. The "sidereal" time thus obtained was converted into the time for ordinary use and signalled to a "semaphore" tower at Fort William. From this tower a "time-ball" was dropped at a fixed time every day as a visual time signal for ships berthed at Calcutta. (The whole arrangement with transit instrument was transferred to the Alipore Observatory of IMD in 1880).

Radhanath was made a member of the Royal Asiatic Society of Bengal in 1853 and a member of its Meteorology and Physical Sciences Committee in 1858. On his retirement from service in 1862, he set about fulfilling some of his unrealised dreams. As one enamoured by modern science "at first sight" through Dr Tytler, he had resolved to translate all scientific texts into Sanskrit, the supposed classical root of all Indian languages. He had started preparing for the task by studying Sanskrit in depth when he joined the job at Calcutta but had to give it up on being transferred to a field station. Upon retirement, he realised it would be more useful if scientific writings were in the language used by the common man. So he started publishing articles in colloquial language not only to popularise science but also to inculcate a scientific spirit and eradicate irrational beliefs among the common man. Very sensitive to the social issues of his time, he also plunged into campaigns against child marriage and for widow remarriage. In his time, he had himself defied his venerated mother's wish to marry an under-aged girl of her choice and, perhaps as a penance, remained a lifelong bachelor instead. He was very sympathetic to women's causes and could clearly sense that lack of education among women ws the root of many handicaps they faced in life. He remained very active in an organisation established to propagate education among girls till he died on 17 May, 1870.

(Most of the quotes are from *The Great Arc — The Dramatic Tale of How India was Mapped and Everest was Named,* by John Keay, Harper Collins, 1999.
