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The Great Trigonometrical Survey: Histories of Mapping 1790-1850

Oyndrila Sarkar

Over decades historians dealing with the colonial period have looked into the processes of mapping the subcontinent of India. The major objective of this article is to identify the Great Trigonometrical Survey of India (GTSI) as a separate phenomenon of building an identity which helped to shape the Colonial India by mapping its terrain and people. The first part of this essay deals with the fact why the GTSI is historically so significant a phase, the second part is on the historiography of surveys in India, and finally, as to what requires immediate academic attention on this theme.

Introduction

The GTSI under William Lambton and George Everest is first examined to understand the cultural, social, political, and personal motivations of modern systematic surveys. Such surveys have so dominated the Western cartography that they define the modern concept of cartography as a progressive science. Under this belief, the early systematic surveys are seen to have developed as a matter of course, but this is belied by the British surveys in India.

The GTSI as Matthew Edney says, presents a paradox: *highly expensive and laborious it rarely fulfilled in this period its role of providing control for detailed surveys. Its continued existence stemmed not from its utility but from its embodiment of cultural and social values. It struck a cultural nerve in providing the image of system, uniformity, accuracy and precision in accordance with the contemporary enlightenment concerned with rationality and progress held by the directors and administrators of the East India Company.* The GTSI's geodetic work was supported as much for the cultural benefit of refining Newton's theories as for the social benefits of patronage of the arts and sciences. Finally the GTSI was undertaken to help create a uniform map of India, a key symbol signifying not only the British political and imperial control but also British cultural superiority over the Indian irrationality. Edney says that "*systematic surveys were not undertaken to meet the specific cartographic needs of the European governments but rather were begun in accordance with the cultural beliefs and values.*" This was a statement made by a historian who deals with colonial cartography, knowing full well that it

was a grand imperial project of mapping the terrain and people for better knowledge of administering the territory.

British Trigonometrical Survey in India

This entails the huge time consuming project starting off with William Lambton's triangulation of Southern India (1799-1817) and its successor institution, the GTSI, superintended first by Lambton (1818-1823) and then by George Everest (1823-1843). It is of course another story altogether whether or not the accuracy of a survey was actually achieved in practice.

Several reasons underlie the fact of why the GTSI was so important an event in the history of science and technology of India and what an immense contribution it had to the evolution of India as a nation. The East India Company relied on the written word. There is immense resource material lying in the British archives as well as in the cartographic section in the National Archives of India as well as in the dusty cupboards in the headquarters of the Survey of India (SOI) at Dehradun. The four volumes of Reginald Henry Phillimore's monumental "the historical records of the Survey of India" published by the SOI between 1942-1958 is by far the most detailed account of the survey operations any person has ever made. The surveys as such are not as simple as a trigonometric operation made on the field with a plane table and staff and couple of chains and theodolites. It is a complicated process. Each scratch and line on a map had a lot of meticulous thinking behind it and hard strenuous exhausting mathematical calculations were made in the offices

of the engineers and draftsmen before it was carried out on field. The British made surveys whenever and wherever they thought it was necessary. They made surveys of only those parts of India which they required for their proper administration. It is quite funny to talk about “British Surveys in India” because surveys carried out by Brits in Britain were nothing compared to the surveys carried out by the Brits in India. And there was no “Survey of India” in the 19th century because the entire subcontinent was never surveyed; only parts of the country were surveyed. So rightfully and literally the British made surveys in India. Cartographic ideal and Cartographic pragmatism? So be it! Power and control by mapping. Humanity’s orderly control over an unordered world – the enlightenment rationale, debated upon by scores of historians of colonial surveys, was all that they could come up with to justify British surveying operations in India.

George Everest during his command as the Surveyor General in India (1823-1843) had an entire department working under him. He was blessed in the sense he had a bit more experience than his predecessor William Lambton who had neither the human resource nor the luxury to carry out a project on such a huge scale. Neither did he have a department which was divided efficiently with the proper duties and responsibilities entailed to every man, and neither did he have time on his hand, he died before half way through.

The survey department comprised of various departments, like that of drafting, computing, clerks, correspondence and engineering. This division of skills started under William Lambton in 1806 and was revised under George Everest in 1830s. What we see as maps or manuscript records so easily in the cartographic section in the archives today was not so easy a process back then. There were many complexities and phases of activities to construct an institution whose documents we readily use as primary material today for research. The GTSI was a major project by which the British Empire wanted to measure the entire Indian subcontinent. They did this to make a general reconnaissance of the British occupied territory in India as well as the entire territory lying for their potential expansion.

The year 1799 saw Col. William Lambton propose a plan of a Mathematical and Geographical Survey right across the peninsula. In his proposal, Lambton noted: ‘*In a former communication I*

took the liberty of stating...My idea of a survey to be extended from the Coromandal to the Malabar coast, with a view to determine the exact position of all the great objects that appeared best calculated to become permanent geographical marks...facilitating a general survey of the peninsula and particularly the territories conquered...when these points are laid down in the exact situations in which they are upon the globe, all the other objects will also have their situations true in Latitude and Longitude’ (Phillimore 1950:234). The origin of the trigonometrical survey can thus be put in very simple words even for any layman, the measurement of the dimensions of India. Lambton’s proposal of measuring the Meridional Arc along 78°E from Cape Comorin to determine the size of the earth was given Government approval in February 1800.

Colonial Cartography as viewed by Historians

In order to understand the GTSI, we should first get an idea of the existing historiography on the surveys in India. It will be an attempt to look into whatever bit of scholarly work has been done on either the conditions of survey, the different strata of people associated with the surveys, with relation to the training departments imparting the scientific training to men for the instruments and technology used. Many perspectives have been brought to the history of surveying. The majority of the scholarly work has been in the form of official and professional history. At this moment research has evolved into a more critical approach to the history of surveying, a history that considers the socio-political and economic foundations of the surveying operations. Official reports and histories are generally concerned with strictly technical and organizational matters not necessarily with a historical outlook. The official historian writes with the survey’s authority in mind. In most of these, the trend is such that the survey institution is shown as fulfilling a project that must be continued in a circumstance, past policies are not really questioned, socio-economic scenario never really taken into account.

Professional histories on the other hand are written by the surveyors themselves, out of their own personal interest when they were part of the institution or as a retired figure. Even then, there is

a great deal of stress on instrumentation, techniques and personalities. Also there is a continuous trend of discovering errors in the survey operations. Most professional and official histories were intended for the guiding the professional surveyor engaged in their survey operations. Cartographic histories of surveying are those written by academicians generally interested in cartography and geography. For them surveying is important because it influences the map and mapping is a main focus of their research. *Cartographica*, and *Imago Mundi* houses excellent research which now relate surveying and cartography to each other.

Surveys and a Career in the GTSI

The literature on the East India Company's mapping activities is hugely dominated by Reginald Henry Phillimore. His work has furthered our knowledge of the surveys' history and by letting the "sources speak for themselves", (as he has quoted them at length, going into detail about the surveyors, their techniques and working conditions citing maps and memoirs produced), he wrote to provide the 20th century surveyors of the Indian subcontinent how their profession had developed. There is no real analysis but just minute and painstaking details. There were both groups of European and Indian people in the survey department. In his five volumes of "*The Historical Records of the Survey of India*", we observe the steady growth and consolidation of the GTSI department and the gradual application of improved methods and instruments to meet all the requirements of a good government. When the issue of discrepancies between the theories and plan of how the measurement of the country should be done and the actual process come up, our attention is drawn to the fact that the Court of Directors gave no less importance to the GTSI but more regular grants were bestowed upon the revenue survey department.

There is a gap between the trigonometric survey and the workability of the GTSI. This '*cartographic anarchy*' seen by Matthew Edney brings out the complexity of administrative policy of the Court of Directors with the administrative policies of the Surveyor General. It is most unsettling to see how the multifarious demands on the surveyor generals increased.

Ian Jeffery Barrow on the other hand asserts that colonial European maps of India through their supposedly rationalizing objectivity and their state-centre generalizing represented land as "territory" to justify colonial possession. His take on surveyors becomes lost in the process of relating developments which gave rise to mapping territory in India. It is more of a study of the empire building and the evolution of a national identity. Barrow and Edney both have looked in great detail about locating the hegemony of colonial power through imprinting the people on maps, and argues that without the trigonometrical survey no measurement could be possible. There was no overwhelming enthusiasm for technological change, but there were examples to show that the Indians did not shut their eyes to innovation and invention.

Before Phillimore, the major literature on the surveys was by Clements Markham, the Head of the India Office's Geographical Department. He wrote on the land surveys, trigonometrical surveys as well as the geological and marine surveys, mostly in his time period and had relied only on official reports available at that time (official report written by Andrew Waugh, the Surveyor General after George Everest) and his personal experience.

Another extremely important official history is that of Frederick Hirst's account of the "Revenue Surveys in Bengal, Orissa and Assam". He wrote mainly to codify the revenue survey system so that it would benefit the lawyers and tax officers in the long run. He looked into the detailed accounts of the *thakbast* (boundary), revenue (district), and *khasra* (field) and their relationship with each other.

The GTSI also published a number of papers which are of immense value to research scholars who wish to know about the progress, techniques and personnel of the survey. William Lambton's articles in the Journal of Asiatic Society of Bengal give an account of the progress of the survey through to 1815. George Everest also wrote on the Great Arc project. Later Andrew Waugh's papers were published in the same journal. Later the GTSI published the entire work of the GTS operations in 32 separate volumes.

Unofficial histories are mainly biographies and memoirs of the Surveyor Generals and the surveyors. James Rennell as the first British surveyor in India and as the producer of the first large scale map of the subcontinent, has contributed a

lot to the history of surveying in colonial India. *Historiographically*, Edney says, *he dwarves even George Everest!* Other than this, Andrew Cook and Susan Gole have produced a number of works on pre-1800 printed maps of India.

Deepak Kumar touches upon all the scientific surveys and to take up the trigonometrical survey as a point of exploration would be taking up just a “t” (trigonometrical survey) from amidst the “a” (archaeological survey) to “z” (zoological survey) that he has dealt with in detail. With the framework provided by Phillimore, a critical study of the GTSI can be carried out in a more thematic way as regards the nature of the surveys and the complex administrative policies which governed each decision of the Surveyor General’s Office.

Imperial Imaginings and Surveying

Thongchai Winichakul gives us an unusual and intriguing study of nationhood exploring the 19th century confrontation of ideas that transformed the kingdom of Siam into the modern conception of a nation. His research on wars and boundaries of the territory of Siam discussed the ways in which the boundaries shifted, evolved, matured and cemented or remained permeable. As Europeans moved into the core (Siam), from the peripheral areas in the 19th century bringing in new geography and technology of mapping, the confrontation between modern and indigenous conceptions of boundary and sovereignty caused misunderstandings in diplomacy, confusion in surveying, boundary demarcations, etc. Edney used this similar argument with regard to British imagining as a ruling power. The main argument he makes is that the British were flawed in their belief that they could reduce Indians to a rigidly coherent, geometrically accurate, uniformly precise imperial space within which a systematic archive of knowledge about Indian landscape and its native people could be imagined and thereby constructed.

Ian J Barrow brings in the concept of territory and representation of land. Drawing upon Winichakul’s thesis of the earlier age, Barrow asserts that East India Company’s efforts in mapping terrain through their national scientific efforts represented land as “territory”. Whereas he dwells with much emphasis on the scientific surveys becoming a political tool to provide legitimacy to the ECI’s rule, he brings out shifts in ideologies and simultaneous shifts from route mapping to trigonometrical surveying. What he doesn’t dwell upon is on the

institution of surveying, the survey department, the operations of the phenomenal trigonometrical surveys, methods employed and the men employed in these methods. Keeping this emotive argument in mind Barrow remains surprisingly silent on the essence of the people conducting the surveys, his thesis thereby giving importance to the ideologies of mapping territory, than studying the social interplay between the agencies and forces behind the actual surveying. What is significant in the process is – who is mapping, who is being mapped, and what purposes are served by the cartographic projects. So essentially the scholars deal in depth on the questions of marking boundaries and the permeability of such demarcations and the imagined nation state, and the ideologies of the imperial or not so imperial cartographic projects, but again as an effort to study the actual people and surveyors involved in the groundwork gets totally lost in the process.

Native Collaboration

“*Images and Contexts*”, by Dhruv Raina offers a textured study of the role in which science begins to shape Indian intellect in the latter half of the 19th century is of much interest to me. He gives an overview of the historiography of modern science in India. Though belonging to a much later period, he speaks about the two figures of Mahendralal Sircar and Prafulla Chandra Ray and how these Scientists of Bengal created awareness in the intellectual circles. He shows the ways in which a social history of science influences positive outcomes in scientific research. The approach was to emphasize on the complexity of the interactions and encounters between the intellectual space of the Indians and Westerners. I wish to take up on similar yet not-so-similar lines this complex process of “encounter” between the British and the Indians on the space of the ‘field’ in the GTSI as well as the ‘office establishments’.

The dynamics of the interaction between western (global) knowledge and Indian (local) knowledge comes up as Kapil Raj’s argument in his book “*Relocating Modern Science Circulation and the Construction of Knowledge in South Asia and Europe, 1650-1900*”. Modernity in knowledge was an awareness brought about by interaction between these two forces. The history of science should be an account of how, knowledge was set in motion, through the interactions not by any sudden

transplantation - but by material, economic and symbolic transactions, through “diffusionism. With regard to the GTSI, Kapil Raj argues that there was a negotiated adaptation of embodied skills and instruments connected with terrestrial surveying before the EIC and the GTSI stepped in. Keeping this model of a public space where opportunities were scarce, and professional categories were sharply delineated, my study will revolve around groups of people who became trained to work in the employment of the GTSI for the specialized offices of the computing, drafting and engineering department.

Great Trigonometric Survey in India

The most important work to be done on any such Trigonometrical surveying expedition has been that of Sekhar Pathak, *“Asia Ki Pith Par - Pundit Nain Singh Rawat: Jeevan Anweshan Tatha Lekhan”*. The topography of Tibet is unique, because no elevation on earth can be compared to its tablelands and mountain chains. It was forbidden territory for all moghul, Hindustani, and *firangi* men. Sekhar Pathak recounts the tale of Nain Singh a school teacher who entered Tibet in the guise of a monk with only a prayer wheel and a rosary in hand and armed with a magnetic compass, sextant, chronometer and a bottle of mercury secretly hidden. Nain Singh made his journey by foot from Nepal to Lhasa, through the upper valley of Brahmaputra to its source in Tibet. Sekhar Pathak is the first of his kind to give us a stupendously detailed historical narrative on this trans-Himalayan exploratory survey conducted under Capt. T. G. Montogmerie in 1868-1874. His book is almost a biography. He has used the worn out illegible diaries of Nain Singh to be seen in the National Archives of India even today. My research is not a eulogy of any Surveyor General or any institution in particular. It will be more of a nuanced study of the process of building such a huge information structure and its evolution from the time of William Lambton right till the 1890s.

John Keay’s approach in dealing with *The Great Arc* and the GTS is amusing. In his book, “The Great Arc; the Dramatic Tale of How India was Mapped and How Everest was Named”, he shows how the EIC tried to determine the length of the arc along a meridian. The basic idea was to determine how regular the “oblate” Earth was and from this measurement to gain more accuracy about the Earth’s shape. The Great Arc would

become like a skeletal framework, a “spine of a tree”, which could embrace the country and be used as benchmarks for regional surveys. The surveyors, Keay says had fuelled British superiority as well as Indian grievance, and he goes on to explain how the various tools and instruments of triangulation, like Bars, Chains, Rules, became objects of political strangulation! The survey had encouraged the mind set of an autocratic imperialism. Instruments cannot become objects of political strangulation. They were simply means for a greater means of getting the measurement done.

Conclusion

Geographical knowledge may not be just limited to the discipline of hardcore geographers and cartographers. History of mapping in India and its development under the colonial administration is not to be seen as a tightly compact and enclosed space. It is a system of practices (surveying), institutions (The Royal Geographical Society and The Survey of India), and concepts & spatial organisation (power, hierarchy, a tussle of regional vs. the colonial). The surveys developed a sense of territoriality, a sense of identity which would spur on later to the growth of a feeling of Indian nationality.

Today, India has been redefined. All its prominent features are in focus. The cities, the rivers and mountains are seen in their exact latitude and longitude. Virtually following the footsteps of the Great Arc had come a great surge of nation building development as though the Great Arc had stimulated the nerve endings of the nation, stroking out roads, canals, bridges, and railway and telegraph lines. What emerged was a triumphant and cohesive picture of India unified east to west, north to south, a subcontinent completely in possession of itself. Under George Everest and Andrew Waugh, the great arc was completed in 1866. The conclusion made by Clement R. Markham in his memoirs on the GTS was “*the story of the GTS when fittingly told will form one of the proudest pages in the history of English domination in the east*”.

According to Edney, “Map making was integral to British imperialism in India. The surveys and maps together transformed the subcontinent from exotic and largely unknown region into a well-defined and knowable geographical entity. The empire might have defined the map’s extent but mapping defined the empire’s nature”. We have seen that the British rulers were not interested in

science as such, .but in using science to further their interests. Whenever their practical needs pointed a finger towards a particular branch of science, attention was paid to that science, be it the revenue and trigonometrical surveys, the discovery of fossil fuels and mineralogy and the exploration of the flora and fauna leading to the botanical surveys. Harnessing science enriches it. Thus in the process of empire building, India was added as a laboratory to the edifice of modern science. Introduction of Indians to science came about when they were assigned the role of laboratory assistants.

The history of the GTS is relevant at present when technological thrust replaces conventional map making methods. The GTS was considered the best scientific way of mapping India. In spite of its ardent supporters from the highest echelon of British Empire, it could not fully satisfy the mapping requirement of India. As a concept it was ideal but in practice it was riddled with insurmountable problems. Now GIS and GPS throw up such great expectation as GTS did in the nineteenth century. Time alone will tell how well these expectations are fulfilled.

Bibliography

1. Account of the Operations of the Great Trigonometrical Survey Volumes (1-3)
2. Barrow, I. J (2003): Making History, Drawing Territory- British Mapping in India, C.1756–1905, OUP
3. Butlin R (2009): European Empires and Colonies, C. 1880-1960, CUP
4. Centenary Issue of the Asiatic Society of Bengal (1830 - 1832)
5. Driver, F (2001): Geography Militant: Cultures of Exploration and Empire, Wiley Blackwell
6. Edney, M. H (1997): Mapping An Empire: The Geographical Construction of British India, 1765-1843, University of Chicago Press
7. Habib I (1980): Cartography in Mughal India, in “The Indian Archives”, Vol XXVIII, New Delhi
8. Historical Records of The Survey of India , Volume 1, 2, 3, 4, Colonel Reginald Henry Phillimore C.I.E, D.So Dehradun, India 1945
9. Keay J (2000): The Great Arc; The Dramatic Tale of How India was Mapped and How Everest was Named, Harper Collins
10. Kumar, D (1995): Science and The Raj 1857-1905, OUP.
11. Markham, C. R (1871): A Memoir on The Indian Surveys , printed by Order of Her Majesty’s Secretary of State for India in Council, London, Allen & Co.
12. Pathak S and Bhatt U (2008): Asia Ki Pith Par – Pundit Nain Singh Rawat : Jeevan Anweshan Tatha Lekhan, Pahara Publication, New Delhi
13. Raina, D (2003): Images and Contexts-The Historiography of Science in Modern India, OUP
14. Raj, K (2007): Relocating Modern Science Circulation and The Construction of Knowledge in South Asia and Europe, 1650-1900, Palgrave Macmillan
15. Ramaswamy S (2007): Picturing The Nation, in Richard D (ed.), Iconographies of Mother India, Orient Longman
16. Renell, J (1778): A Description of Roads in Bengal and Bihar, printed by Order of the Honourable Court of Directors of The Company.
17. Survey of India – The Dehradun Volumes (1786 - 1894)
18. Winichakul, T (1997): A History of the Geobody of a Nation, University of Hawaii Press.



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