SYSTEMATIC SURVEYS AND MAPPING POLICY IN BRITISH INDIA, 1757-1830

Matthew H. Edney, Assistant Professor, Department of Geography, State University of New York, Binghampton, NY 13901

We remember George Everest today for his work between 1830 and 1843 as Surveyor General and as Superintendent of the Great Trigonometrical Survey of India. I would like to start the proceedings by discussing the circumstances in which he and his colleagues worked, by considering the East India Company's mapping policies as they evolved in the seven or so decades before 1830. Mapping policies tend to be complex, and the Company's were no exception. They were created through an intricate process of give and take between several factions within the Company's administration. The Court of Directors and its secretariat in London set the basic parameters, which the three Indian governments (or 'Presidencies: Calcutta/Bengal, Madras and Bombay) all interpreted to meet their own ends. Many of the governors, administrators, and bureaucrats actively supported survey activities; others were concerned with keeping the Company's costs to a minimum by eliminating expensive activities and targeted the surveys as principal offenders; but the majority were too busy with other matters. It is important to realize therefore that the Company's mapping policies were usually set by only a handful of individuals. I cannot hope to go into all the intricacies here,(1) but I can present the essential characteristics of the Company's surveys.

The Nature of the British Surveys of India

Even when one accepts the iniquities inherent to, and which resulted from, the East India Company's conquest of India, one cannot help but be fascinated by the sheer spectacle provided by the handful of Europeans who brought a vast empire under their control. The main agency of this conquest was, of course, the Company's British-officered and Indian-manned army. But force of arms alone is insufficient to govern foreign territories. One of the keys to British success in India was their ability to collect and marshall information rather than soldiers. By 1800, the Company placed great emphasis upon a proper education for its civil and military servants; and it actively encouraged those same servants in their inquiries into Indian society and culture.

The mapping of India must, first and foremost, be seen as a major part of this marshalling of information. All levels of the Company's administration needed geographical information for their operations. The district collector and the military commander in the field needed it for their daily work. For example, in 1824, the British Resident at Indore wanted a survey of the Narmada Valley for three reasons: to map the passes through its bounding hills for military purposes; to aid the detection of bandits for the police; and to help track the movement of opium so that it might be taxed.(2) The three Indian governments needed basic geographic data for strategic planning, as did the Company's Directors in London.

Furthermore the British surveyors in India were rarely concerned with only the land. Whenever possible they collected statistics regarding populations, castes, commerce, agriculture, industry, and trade. They recorded information on local languages and local systems of land tenure. They delved into the local geology in search of gold and other precious metals, and they were always on the look-out for stands of good timber.

One example was an 1920 survey to determine the route of a new road between Midnapore and Nagpore which consisted of the cartographic survey followed by investigations into the area's "statistics and political economy", its climate, soils, population, and so on.(3)

As Europeans, the British made surveys in the established European manner. When James Rennell (Bengal Surveyor General, 1767-77) was given the task of mapping Bengal shortly after the Company accepted responsibility for the province's administration in 1765, his techniques were those of contemporary English colonial surveyors in Ireland, Scotland, and North America.(4) Rennell made a series of traverses along roads and rivers; determining the positions of a few places by astronomical observations, he then combined the route surveys into a general map. The same process was used for extensive mapping in India throughout the eighteenth century, and until 1830 in the flat Gangetic Plains.(5) Rennell published his work as A Bengal Atlas in 1780; the other surveys remained in manuscript and so are far less known, but they are no less remarkable.

Route traverses were well suited to the Company's mapping needs. They were fast, simple, and easy to combine into geographic maps. But they were also error-prone and did not lend themselves to high density mapping. By the end of the eighteenth century, European surveys were increasingly based upon frameworks of triangulation. Triangulation -- also known as "trigonometrical surveying" -- provides a dense network of control points whose relative positions are fixed very accurately. It is therefore a far superior method for surveying large regions than the method of route traverses, but it is much more time consuming and much more expensive.

The technique of triangulation had been in regular use for small surveys in Europe since the sixteenth century. The famous Cassini surveys of the eighteenth century were the first to extend a high-quality triangulation across an extensive region, i.e. the entire country of France. Most of Europe followed the French example between 1789 and 1815 and as the popularity of triangulation increased in Europe, so too did it increase in India. The advocates of such systematic mapping in India consciously modelled their proposals after 1799 upon the British Ordnance Survey. By 1830, when Everest assumed his post as Surveyor General, it was accepted Company policy that all detailed surveys in India should be based upon an India-wide triangulation.

There is, however, a contradiction here. Company policy advocated a systematic basis for the survey of India, yet the triangulation was generally too slow to keep up with the many detailed surveys made to meet the huge demand for geographic information. In Europe, centuries of surveying and mapping had produced a solid corpus of information which would suffice until the modern, laborious, and highly-detailed systematic surveys could be finished. And if existing information would not suffice, then there were always commercial surveyors who could provide stop-gap surveys. In India there was neither an existing corpus of geographic data nor any body of commercial surveyors trusted by the Company's officials.

Yet imperial logic is such that peripheral areas are continually subdued to protect core regions. Each campaign which annexed more territory to the Company's direct control, and each treaty which bound another native state to the Company's sovereignty, necessitated another survey to be completed as soon as possible. But there were insufficient funds and personnel available

to ensure that each new territory was triangulated before it was mapped topographically or cadastrally. Often there were no official surveyors available, so that field commanders and district collectors directed their own men to make the necessary surveys. There was a huge abyss between the ideal form of the European systematic survey and the pragmatic needs of imperial rule for geographic information.(6)

The Map of India

The Company's mapping policies revolved about this contradiction. Unable to make a single survey of India, the Company instead advocated the creation of a single map of India. The distinction is subtle, but significant. The Company's officials wanted to ensure that once an area had been surveyed, the information could be quickly brought to bear. They treated finished maps as the equivalent of written studies of Indian culture and society. The Directors paid out handsome rewards to the authors when a specimen of either form of study was presented to the Court. Thus, Charles Reynolds was awarded the huge sum of two lakhs of rupees (or about £18,400) for his 1809 map of India.(7)

Moreover, the Company's administrators generally lacked a sophisticated perspective on the quality of different surveys and of the resultant maps. Until explicitly informed to the contrary, the assumed that a map's quality depended not on its internal consistency and accuracy but on how well it had been produced. For example, an 1821 update of Reynolds' map "struck" the Governor of Bombay with "the carefulness, distinctness, and beauty of (its) execution".(8) But John Hodgson, Surveyor General of India, dismissed the map as being out-of-date and as being inferior even to Aaron Arrowsmith's smaller-scale Improved Map of India published in London in 1816.(9) In 1837, the Directors provisionally appointed Thomas Best Jervis, of the Bombay Engineers, to succeed George Everest on the strength of Jervis' map of the Concan.(10) It was indeed a beautiful work, for which the Court also gave Jervis Rs.10,000 (=£960), yet it was soon discovered to be riddled with inconsistencies which prevented its reconciliation with surveys of surrounding areas.

Now, at the start of the nineteenth century, there were several different offices involved in map production. First, each province had its own Surveyor General who spent more time organizing and copying maps than in controlling actual surveys; second, other officers in each provincial government, notably the quartermaster generals and the chief engineers, maintained establishments to make, to copy, and to store maps of different kinds. Attempts to bring this material together into a single map were flawed by the mutual jealousies of the surveyor generals, who wanted their data to bring rewards to themselves rather than to their colleagues. Reynolds, Thomas Call (Bengal SG, 1777-86), and Robert Colebrooke (Bengal SG, 1794-1808) were all unable to create a complete map of the subcontinent. With the lack of communication between the survey officers, the Directors observed

> that the information.. is liable to become obsolete, the authentication of it in memoirs, or other explanations to be lost, or mislaid, or to perish from vermin, or the effects of the climate, before it can be (incorporated into) a general Map of the Country.(11)

They therefore ordered in June 1814 that the three provincial offices of Surveyor General be abolished and replaced by the single office of Surveyor General of India.

The Court directed that the duty of a single Surveyor General of India was not

> to conduct Surveys himself, but to receive and appreciate the Surveys made by others, to arrange the materials existing or which may hereafter be procured, after selecting the best, and reducing them to one uniform scale, to frame from those materials Maps of Provinces, or of Divisions, comprehending a certain extent in latitude and longitude, these to be constructed on a larger scale with all practicable detail, and to be accompanied with a memoir, explaining the authorities, and the Construction of the work. A general Map of India (is) to be carried on at the same time of which the foregoing Separate Maps will constitute the foundation, but reduced to a scale which may confine the general Map within manageable limits.(12)

The Surveyor General of India was to be an armchair geographer par excellence, creating general maps of India and thereby justifying the Company's large expenditures on the actual surveys. The Court was quite willing to pay for its geographic information, but it wanted that expenditure to be applied efficiently. The Court devoted only one paragraph (out of 26) to the issue of the administration of the actual surveys. It directed that all surveys were first to be approved by the relevant government, they were to be made by an officer who had passed through the Company's military academy at Addiscombe, and the results (both map and memoir) were to be passed on to the Surveyor General.

The first two Surveyor Generals of India -- Colin Mackenzie (1815-21) and John Hodgson (1821-23) -- had great difficulty in meeting the duties prescribed by the Court. Mackenzie finally took up his position in August 1817, and spent the next four years either too ill to work or swamped with immediate demands for maps. Mackenzie advocated the solution of publishing an atlas of India at four miles to an inch, and he cited his earlier surveys in southern India as an example of the form that such an atlas might take. John Hodgson went one step further and began the creation of just such an atlas. He consciously modelled the first stage, covering the Gangetic Plains between Bengal and Delhi, on James Rennell's A Bengal Atlas.(13) But his progress with similar maps for the rest of India was made redundant by more decisions made in London.

Mackenzie's and Hodgson's ideas for an atlas of India were parallelled in England by those of one of the period's principal commercial map publishers in London, Aaron Arrowsmith. The Court of Directors underwrote Arrowsmith's production in 1822 of two works: an Atlas of South India and a single-sheet Sketch of the Outline and Principal Rivers of India.(14) The atlas, based extensively on Mackenzie's work, had sixteen sheets at four miles to the inch. The "sketch" also illustrated how the same sheet lines might be extended across all India. With this work before them, the Court accepted the arguments made in India by Mackenzie and Hodgson and ordered the creation in London of an Atlas of India, at four miles to an inch, which would constitute the basic map of all India.

Arrowsmith died shortly thereafter and the Atlas of India lapsed until 1825 when it was taken up by another commercial map publisher, John Walker. Walker established the final sheetlines for the Atlas: 177 sheets for all India, each sheet covering 160 by 108 miles. As Arrowsmith had earlier suggested, each sheet was engraved as suitable materials were received. Thus, the first six sheets issued (in 1827) were compiled from the most recently received materials.(15) With exception of six sheets in Assam, Walker's work on the Atlas for the next twenty-five years was devoted to 29 sheets for the well-surveyed Madras presidency.

But how were the individual surveys to be fitted together and related to Walker's sheetlines? Let us turn now away from the East India Company's mapping policy as set in London and consider the policies pursed by the three provincial governments in India, policies which tended to be more concerned with questions of survey technique and style.

Systematic Surveys in India

Several people had suggested in the eighteenth century that India be the site of a geodetic arc measurement. Alexander Dalrymple, the Company's Hydrographer, proposed it in 1784 and was seconded by William Roy, founder of the Ordnance Survey. The Company accordingly charged the astronomer Reuben Barrow with the task, but he died in 1792 and the project lapsed. Michael Topping , the Company's Astronomer at Madras, intimated that a triangulation could be made of all of southern India, but such a scheme could not have worked until the British had political control of the entire region. That circumstance came with the defeat in May 1799 of Tipu Sultan of Mysore. By a historical accident, a Crown officer who had taken part in the campaign also happened to have an intense personal interest in geodesy.

Faced with a huge territory waiting to be mapped, and heeding Roy's call for geodetic arc measurements in the subcontinent, William Lambton, of His Majesty's 33rd Foot, submitted a proposal to the Madras Government. Lambton was actively supported by several very influential figures, among them his regimental commander, Arthur Wellesley (later the Duke of Wellington), and Wellesley's elder brother, Richard, then Governor General. These supporters were sufficient to override the gainsayers and to allow Lambton to embark upon a program to measure two geodetic arcs. The first ran eastward from Madras to Mangalore across the peninsula of India; the second was an arc of meridian, running north from Cape Comorin, which would soon become known as the Great Arc. Right from the start, Lambton's assistants also surveyed secondary triangles and even some topography, and in 1807 Lambton obtained permission from the Madras Government to extend the secondary triangles across the entire peninsula. Whereas his published and manuscript reports stressed the geodetic aspects of the work, there can be no doubt that Lambton was also concerned with providing high-quality control for topographic surveys.

While Lambton began his trigonometrical survey, Colin Mackenzie was detailed to survey the state of Mysore. Aided by a number of assistants, he undertook the task with a triangulation basis, in a sharp break with his older techniques of route survey. Mackenzie eventually expanded the survey to cover almost all of the southern Deccan. Although Mackenzie's surveyors operated in advance of Lambton's triangulation, the surveys were found to coincide closely when they did overlap. Another batch of surveyors -- the students of

the Military Institution at Madras under Anthony Troyer -- used Lambton's triangulation as the basis for the plane-table survey of the Carnatic, the broad coastal belt between the Deccan and the eastern coast of India. Other localized surveys were undertaken on bases of triangulation: Garling's triangulation around Goa was eventually subsumed into Lambton's work; while John Hodgson and William Webb made trigonometrical surveys in the Himalayas.

Lambton's trigonometrical survey was always seen as being distinct from other surveys. He was warned away from topographic surveying and ordered to stick to his geodetic and secondary triangulations . Topographic surveys were different, being mechanical in nature, whereas Lambton's work always bore the social cachet of being 'scientific'. The distinction was heightened yet further when in 1817 Lord Hastings, Governor General, ordered that Lambton's survey be brought under the control of the Supreme Government at Calcutta and was henceforth to be known as the Great Trigonometrical Survey of India. Hastings had previously been Master General of the Ordnance, in which capacity he had learnt something of the Ordnance Survey. For Hastings, Lambton's survey was essential not only because of its geodetic work, but also because

> There is no other solid basis on which accurate geography can so well be founded. The primary triangles thus spread over this vast country establish almost beyond error a multitude of points, and the spaces comprehended within these, when filled up by the details of subordinate surveyors, will afford...to the world, a map without a parallel, whether in relation to its accuracy, to its extensiveness, or to the unity of the effort by which it will have been achieved.(16)

To help Lambton in his future work, especially as he was now sixty years old and needed to train his successor, Hastings appointed to the GTS a young artillery officer of the Bengal army who had displayed exceptional engineering skills: Captain George Everest.

In creating the Great Trigonometrical Survey, Hastings was certainly influenced by the Court's decision in 1814 to unify the offices of Surveyor General. Moreover, Hastings followed Mackenzie's personal interpretation of the Court's order as requiring the prosecution of a single survey of India, and that the Surveyor General should have control of at least the topographic surveys (although it should be realized that Mackenzie also wanted control of Lambton's triangulation). The realization inherent in Hasting's decisions was that detailed surveys were necessarily undertaken without the benefit of an India-wide triangulation, yet the Great Trigonometrical Survey would nevertheless provide the framework for bringing all the separate surveys into a single whole, for tying them together on a standard system of latitude and longitude.

But could the Great Trigonometrical Survey really cover all India? Certainly, Lambton envisioned sending chains of triangulation from the Great Arc westward to Bombay and thence north along the coast to Guzerat, or from Madras along the eastern coast to Calcutta. But Lambton did not consider extending the Great Arc beyond Agra. The problem was the flatness and closeness of the northern plains. Without hills, the surveyor was hemmed in by trees and buildings, whereas a good triangulation required visibility of many miles in all directions. The problem had been encountered before, if only to a lesser degree. James Garling recorded that in his survey of Soanda

the flatter, coastal areas were slightly in error, whereas the hilly areas were "generally executed with a minute correctness".(17) Throughout the 1820s, Indian surveyors believed that the vast northern plains could not be surveyed properly unless a commitment was made by the Government to construct expensive towers to raise the surveyors above all obstacles to their vision.

When the Court of Directors deliberated in 1823 the establishment of its Atlas of India, it asked its old cartographic expert, James Rennell, to propose the best method for surveying those tracts of India that had yet to be mapped. Rennell assumed that the Atlas was wanted very soon, and so described a quick system that was no different from his own survey in Bengal of the 1770s: an astronomer would determine the positions of key towns which would then serve to anchor fast route surveys.

The Court modified this proposal so that an astronomical survey would be restricted to those areas where the Great Trigonometrical Survey did not already extend, or could not be extended. That is, the plains were to be surveyed in the old manner, without a triangulated base. The Court subordinated the future progress of the trigonometrical survey to the Atlas.(18) Thus, publication of Everest's 1830 memoir on the Great Arc was sanctioned by the Court as it constituted "part of the materials for the Atlas of India", and as such would be sent to the same institutions as those to which it had already sent maps of the completed triangulation "already published for the Atlas of India".(19)

John Hodgson (SG 1821-23, 1826-29) and Valentine Blacker (SG 1823-26) both supported Lambton's plans to extend his triangulation across Deccan; indeed, they went further by urging the Bengal Government to permit the Great Arc to cross the Gangetic Plains and to push into the Himalayas, to which the Bengal Government agreed in 1824, eighteen months after Lambton died. For the rest of the plains, Blacker initially accepted -- with reservations -- the Court's scheme for astronomical control. He nonetheless made several concise and effective arguments, based on conversations with Everest, now Superintendent of the GTS, for an all-India triangulation.

The plan for an astronomical survey of the plains did not materialize. Instead, the Company's policy underwent a dramatic change between 1825 and 1827. On furlough in England, Everest urged the Directors in early 1827 to commit themselves to pushing ahead with the Great Trigonometrical Survey,(20) but the Court did not reply to Everest's suggestions. No reason readily presents itself, except that the Court had already accepted the principle of triangulating all India, both hills and plains.

This policy shift is borne out by three documents from later in the same year. First, in September 1827, the Court sent to the Bengal Government a copy of the 1824 parliamentary report which had led to the creation of the Ordnance Survey of Ireland. That survey would consist of a strictly trigonometrical survey to be followed by detailed surveys of sufficient scale to show individual fields. Those surveys could then be reduced to give topographic maps. The Court "thought it probable" that the Bengal Government might find the report to "contain information or suggestions which may be useful in the prosecution of Indian Surveys".(21)

In August 1827, James Salmond, the Court's military secretary who was responsible for coordinating all debates on military issues and for drafting military letters to India, wrote a memoir on the subject of a general survey of Ireland. This contained several significant points. First, the Court accepted that the Great Arc would eventually extend to the Himalayas.

Second, prospective delays in the progress of the triangulation should not be allowed to delay the detailed surveys, which would be rectified by the triangulation at a later date. And third, the triangulation was to cover all India.(22) Reinforcing this last point, the third document (a report of a private conversation with the military secretary) quoted Salmond as saying that "it has been found however that the triangulation of Colonel Lambton could be extended to Bengal."(23)

So why the sudden shift away from a cheap and fast, if error-prone, astronomical survey of the northern plains to a slow and expensive triangulation? The answer seems to lie in the Court's inability to find anyone willing to be the astronomer; those approached in England refused, while the Burma War had diverted the few capable officers in India. Moreover, someone within the Court or its secretariat -- most likely Salmond -- found state-of-the-art techniques to be far more appealing than astronomical control which was far more appropriate to the eighteenth than the nineteenth century.

Before Everest returned to India in 1830, the Court appointed him Surveyor General of India. He sailed with the full approval of the Directors for extending the Great Trigonometrical Survey across the northern plains, no matter the cost. As they wrote to the Bengal Government:

> We wish to impress upon the Surveyor General that the points upon which the maps of the Bengal Presidency are to be constructed, must have triangulation for their basis, being convinced that the Atlas can by no other method be rendered a permanent and useful work.(24)

But it must also be stressed that the Court did not want there to be a new detailed survey of, in this case, Bengal. Rennell had, after all, already collected the necessary data which only needed correction to be incorporated into the Atlas of India.

The rejection of proposals for single, systematic surveys -- such as those by Lord William Bentinck (Governor General, 1828-35) and by Thomas Jervis in 1838-39 was reinforced by the poor state of the Company's finances. Bentinck appears in a strange position: a fervent supporter of surveys, he advocated the wholesale expansion of the Great Trigonometrical Survey yet ordered a drastic cutback in topographic surveys. However, both the Court in London and Bentinck in Calcutta realized that the key to the mapping of India was in the efficiency of the surveys: the Great Trigonometrical Survey was highly cost effective, but in the long term "detached, unscientific, and unsatisfactory surveys" were not.(25) As a result, Everest was able to expand the Great Trigonometrical Survey tremendously after 1831.

Thus, total savings effected in the military department in 1833-34 amounted to Rs.300,000, but these were offset by Rs.63,300 of increases "principally from charges on account of the expensive work of the Great Trigonometrical

Survey".(26) The personnel of the trigonometrical survey comprised just Everest and four civil assistants on January 1st, 1831; on the same day, 1833, there were eight military officers and twenty-two assistants!

It is tempting to claim that the Great Trigonometrical Survey in the nineteenth century was the precise equivalent of the great national surveys in Europe. It was however quite different because it was justified for its ability to correct existing detailed surveys, an ability which even at the time was recognized by experts as being dubious. For example Henry Kater, who had assisted William Lambton between 1803 and 1806, testified to the British Parliament that triangulation must precede detailed surveys for the proper corrections to be made; if the triangulation followed the detailed surveys, who could say whether the errors were being reduced or compounded?(27) That the Great Trigonometrical Survey ever consisted of more than the Great Arc, together with its offshoots to Madras, Bombay, and Calcutta, was due not to the dictates of good surveying principles but to the desire for a single cartographic image of India.

NOTES

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1. For (almost) the full story, see my "Mapping and Empire; British Trigonometrical Surveys in India and the European Concept of Systematic Survey, "Ph.D. diss. (Geography), University of Wisconsin-Madison, Ausgust 1990. The best source on the surveys themselves, in the early nineteenth century, is the monumental and incomparable Reginald H.Phillimore, Historical Records of the Survey of India (Dehra Dun: Survey of India, 1945-58, 5 Vols).

2. India Office Records F/4/1017 27954, 23-25: Bengal Military Consultations 8 Sep 1826 ff 157: Resident at Indore to Bombay Political Secretary, 25 Nov 1824. For contemporary knowledge of the region, see British Library Maps 52450 (23), Map of Central India, including Malwa and the adjoining Provinces, constructed by order of Major Gen. Sir J.Malcolm, GCB, from the routes of his division and the Surveys of officers under his command (London: Aaron Arrowsmith, 1823), in which the lands immediately on either bank of the river were well mapped, but the ridges were stylized and separated from the river by blank space.

3. India Office Records F/4/679 18861, 687-96: Bengal Public Consultations 15 Jan 1819 ff 52: Colin Mackenzie to Bengal Public Secretary, 5 Jan 1819, ff 3.

4. J.B Harley and Yolande O'Donoghue, "Introduction", in The Old Series Ordnance Survey Maps Of England and Wales .. (Lympne Castle: Harry Margary, 1975 - ,many Vols), 1:xi.

5. Phillimore, Historical Records 3:25: "the last deliberate peace-time survey to be based wholly on traverse and astronomical fixings" was Alexander Frileau's resurvey of the country between Agra and Allahabad in 1827-28.

6. Andrew S. Cook, "More by Accident than Design: The Development of Topographical Mapping in India in the Nineteenth Century, "Eleventh International Conference on the History of Cartography, Ottawa 1985.

7. India Office Records E/4/1023: Court Despatch (military) to Bombay, 7 Sep 1808, ¶ 8-11. One lakh was for expenses, the other as a reward.

8. India Office Records F/4/682 18864, 267-71: Bengal Public Consultations 31 Aug 1821 ¶ 4: Bombay to Bengal Public Secretaries, 26 Jul 1821.

9. India Office Records F/4/682 18864, 273-92: Bengal Public Consultations 28 Sep 1821 ¶ 3: J.A. Hodgson to Bengal Public Secretary, 18 Sep 1821.

10. India Office Library X/2746: T.B.Jervis, "An Atlas Illustrative of a Geographical and Statistical Memoir of ... the Konkan",1934.

11. India Office Records E/4/679: Court Despatch (separate military) to Bengal, 3 Jun 1814, ¶ 10.

12. India Office Records E/4/679: Court Despatch (separate military) to Bengal, 3 June 1814, ¶ 19.

13. India Office Records X/345: J.A. Hodgson, "Atlas of the North-West of India...", in 15 sheets, 1823.

14. The two are bound together as India Office Records X/344/1 and /2, and as British Library Maps 146.e.6. Cambridge University Library has copies of the two with different provenances and bound separately: Atlas 1.82.1 and Maps 360.82.1.

15. Sheets 47,48,65 and 66 were compiled from John Hodgson's and William S.Webb's work in the Himalayas; sheets 69 and 70 were from James Franklin's survey of Bundelcund.

16. India Office Records F/4/679 18861, 385-41: Bengal Public Consultations 25 Nov 1817 ¶ 111: Hasting's Military Secretary to Bengal Military Secretary, 25 Oct 1817, ¶ 3.

17. British Library Additional MS 14377, ff.1-8: James Garling, "Soanda Survey: Introductory Observations Illustrative of the Map and Manner in which the Survey has been Made" ca.1815, ff.2v-3r.

18. The Court accordingly ordered John Walker to engrave a series of maps of the triangulation to date as the first stage of creating the Atlas of India: (Section of the Great Meridional Arc from Beder to Takhalkara), J.& C Walker sculpt. (London: Horsburgh, 1 Mar 1827); Sketch of the Principal Triangles extending over that part of the Nizam's Dominions laying to the eastward of Nirmal & Kurnool by Lieut.Col.W.Lambton and Capt.George Everest, J.& C Walker sculpt. (London: Horsburgh, 1 Mar 1827); Plan of the Trigonometrical

Operations in the Nizam's Dominions, Extending from Kurnool to the Godavery by Lieut. Col.Wm.Lambton, J.& C Walker sculpt (London : Horsburgh, 1 Mar 1827); Plan of the Trigonometrical Operations on the Peninsula of India from the Year 1802 to 1814 inclusive under the Superintendence of Lieut. Col. W.Lambton, J.& C Walker sculpt. (London: Horsburgh, 20 Jun 1827) in eight sheets. All these are in India Office Records X/Plas Newydd purchase; other copies of the last three are British Library Maps 52450 (25) and (26), and British Library Maps 52415 (25).

19. India Office Records E/4/729: Court Despatch (military) to Bengal, 25 Aug 1830, 2. India Office Records E/1/266 1244: Miscellaneous Correspondence: Court's Secretary to Everest, 27 May 1830. The institutions were the Royal Society, Royal Astronomical Society, Royal Asiatic Society, Geological Society (of London), and the British Museum.

20. India Office Records L/MIL/5/402 205, ff.358-406: George Everest, "Memoir regarding the Survey Establishment in India and particularly the Great Trigonometrical Survey", *ca.iii-27. Other copies are India Office Records F/4/1130 30211B* and *British Library* Additional MS 14380,ff.54v-67v (10-129 only).

21. India Office Records E/4/720: Court Despatch (revenue) to Bengal, 26 Sep 1827, 2-3.

22. University of Nottingham, *Portland Papers*, Pw Jf 2744/3: James Salmond, "Memorandum Respecting a General Survey of India", nd, but annotated as Aug 1827.

23. *University of Nottingham, Portland Papers, Pw Jf 2127: Anthony Troyer to Lord William Cavendish Bentinck, 26 Nov 1827.*

24. India Office Records E/4/732: Court Despatch (military) to Bengal, 20 Jul 1830, 11.

25. India Office Records E/4/736: Court Despatch (military) to Bengal, 16 Jan 1833, 2.

25. India Office Records E/4/149: Bengal Despatch (military) to the Court, 3 Apr 1835.

27. British Parliamentary Papers 1824 (445) 8: "Report of the Select Committee on the Best Mode .. to Provide a General Survey and Valuation of (Ireland)", 89-90, evidence given, 25 May 1824.