



Geopolitics and the GTSI: The Schlagintweit Brothers in India: 1854 –1857

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Abstract

This article tries to find an answer to the question why a group of three German brothers, the first batch of the glaciologists working in the Himalayas, India, vanished from the records of the formative stages of the scientific history in India as hastily as they had emerged. It also tries to reflect upon the chaotic flows of concepts and knowledge, against the backdrop of Anglo-Russian rivalry (more popularly known as the Great Game), and within the paradoxically narrow constraints of state operated/institution operated spaces.

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Introduction

In 1854, when most transculturally intellectual movements in Europe were neither termed 'intellectual' nor 'transcultural', three glaciologists, sons of an eye-surgeon in Munich, became the focus of major discussion and dissent in the East India Company Board Rooms and the European Scientific Societies. This paper tries to trace the story of the Schlagintweit Brothers Hermann, Robert, and Adolphe who came to India on a three-year scientific expedition and returned to Germany in 1857 with not only a detailed cartographic account, but also records of the flora, fauna, and ethnographic data, along with an Atlas filled with diagrams, maps and panoramic paintings (that were later to be published in Dublin, London and Paris).

At the time when work was in full swing, and different surveying data sets were being pooled into comprehensive publishable records from the Great Trigonometrical Survey of India (GTSI¹) under Col. Andrew Waugh (1843-1861) and Major Henry Edward Thullier (1861-1878), who headed the Survey of India after Col. George Everest's death in 1843, the East

India Company realised that their knowledge over the *terra incognita* in the north-western areas of the Indian peninsula was scarce. It was a mountainous tract, which was difficult to access from the earlier constructed baselines at Attock (Kutch), and Karachi². The need to complete the triangulations³ rose to an utmost priority, since there gradually emerged a contesting Imperial Power on the Central Asian horizon – the Russians. The British and the Russians have been called 'friendly rivals in the noble science of geography'⁴ in their pursuits of a trans-national knowledge gathering project, based on common civilizational assumptions; but obviously, information or knowledge as each of them saw it was neither naive nor devoid of conflicting geopolitical purposes. Beginning his narrative of a journey to Ya'qub Beg's new domains in Turkistan in 1868-69, a young Anglo-Indian tea planter Robert Shaw raised an important question relevant for any European traveller into an unknown, uncharted territory to what extent should one be preoccupied with surveying the country? For Shaw, the task given to him, however rigorous or quantitative it might have been to the European

geographic societies and general reconnaissance staff, was not an end in itself, but an order to follow the flag naturally in the name of science⁵—

“After all, we do not desire to know a country in order to map it, but we map it in order to know it. It would be sacrificing the end to the means were I to correct our maps at the expense of our future intercourse, and to explore Eastern Toorkistan in such a manner as to shut it against all future explorers”...⁶

The first of the European travellers in the region were however Hermann, Robert and Adolphe Schlagintweit, who at the recommendation and proposal of Alexander von Humboldt were referred to the East India Company to undertake a massive expedition to 'India and High Asia' for three years (1854-1857)⁷. They had as their financial patron, the King of Prussia, Frederick Wilhelm IV, who had been immensely impressed by the earlier scientific achievements of the Schlagintweits in the physical geography and the geology of the Alps⁸.

The mission to the Indian subcontinent resulted in four humungous volumes⁹, and the death of their youngest brother Adolphe at Kashgar. The project undertaken by the Schlagintweits in 'India and High Asia' was over 18,000 miles on foot, across forests, plains, deltas, deserts, hills, and snow. There are 106 sections of magnetic and meteorological records, route surveys, route maps, and notes; 749 sketches and paintings, in which there were 484 water colours, pastels, and oils, the magnitude of a few extending to up to 12 feet wide; there were 14,777 specimens collected, of which 9577 were rock and soil samples, 1800 were botanical samples, 650 tree and bark cross sections and seeds, 750 were zoological samples, 400 human skulls, facial casts, with skeletal casts later set in metallic casts in May 1859 in Leipzig. There were 202 sections of anthropomorphic data sets, 1400 ethnographic objects (as they were then known), and 200 manuscripts and other miscellaneous prints¹⁰. Their work has been useful till date, for multi-purpose research on cartography, geology, geo-physics and for studying glacial dynamics in this very region¹¹. The Schlagintweits have recently appeared as German nationalist characters boxed in together with philologists and geologists as 'German Servants of the British Raj' in a rather recent colonial discourse whose title reeks of a false Hobsbawmian notion¹².

The institutions in the limelight at that juncture with regard to this particular body of scientific knowledge were the Royal Society, the Bavarian Academy of Sciences, and the Court of Directors in the East India Company. In February 1854, the Schlagintweits were accompanied by Alexander von Humboldt and the Prussian minister, Baron Bunsen to London to officially communicate Frederick Wilhelm IV's intentions of funding the expedition to the Court of

Directors of the East India Company, after which Adolphe proceeded to Munich from London for further discussions and plans of the journey with Bavarian Minister, Baron Cetto¹³. This was the third attempt on Humboldt's part to try and gain access to scientific research in the Indian subcontinent—

“I will undertake an expedition to the sources of the Ganges and inside Asia... [] ... the aim of my Asiatic journey is the high mountain chain that stretches from the sources of the Indus to the sources of the Ganges”...¹⁴.

Humboldt had visited the library and the offices of the East India Company earlier, while the then King of Prussia (Frederick Wilhelm III) tried persuading the Prince Regent of Britain to give his support, but had failed. However important and attractive his proposals seemed, he had become a character, '...who had described colonial conditions in Latin America without distortion, a man who detested all forms of slavery and of racial discrimination, who granted equal right to freedom to all peoples, could only have revealed to the public a state of affairs in India that was better kept hidden. It is however also possible that the assistance of the Prussian state and Humboldt's relations with Russia made him appear suspect and finally obstructed the English consent¹⁵. He however travelled on the invitation of the Russian Government to Asiatic Russia till as far as the Urals, and Western Siberia to conduct and present his scientific findings on geology and mineralogy in 1829. Humboldt started taking an active part in the publication of geography books for 'Hindu Schools', and in 1853 when he was nearly 85 years old, he made every effort to help the Schlagintweits' expedition¹⁶.

For the first time in the history of scientific explorations on the Indian subcontinent, we see a change in the kind of men sent out to conduct actual reconnaissance surveys. These three men were trained in science, and had already published as glaciologists of the Alpine regions in the German academic world. The usual suspects who are clubbed as 'men of science' or 'surveyors' in the historiography of early Indian colonial expeditions were military majors, colonels, retired army officers, who headed a department, be it the Revenue Survey, the Topographical Survey, or the Trigonometrical Survey of India. There was a rising concern from both the bureaucrats who ran the Survey of India, the imperial merchant company who was funding such heavy survey operations, and the scientific societies who waited for information and data to pile in, as the field was laid open to discovery, integration and interpretation by German scientists who were actually trained to cover mountains and swamps by foot, and produce systemic sets of much needed information, raw data and maps in their researches, which were published not just in Britain, but in Leipzig. The Schlagintweits were received with a mixture of

admiration and envy. Referring to the Schlagintweits' expedition, Charles Darwin in one of his letters to both the Royal Society and Joseph Dalton Hooker (widely known for his achievements in botany) is said to have commented on Humboldt's energy, enthusiasm, and restlessness: *I believe that you are fully right in calling Humboldt the greatest scientific traveller who ever lived*¹⁷. This was perhaps slightly unfair, given that Humboldt had in this case not done the scientific travelling.

Moreover everything seemed to be in a haze when Adolphe wanted to end the mission in a Humboldtian manner, by taking the overland route to Russia from India, and ended up getting beheaded for being a suspected Chinese spy on the Chinese border at Kashgar¹⁸. The two other brothers after receiving the news wrote frantically to the Russian foreign minister, A.M. Gorchkov to gather more information on Adolphe's disappearance and death, since they knew Adolphe had planned to reach the Russian border in Central Asia. Gorchakov with the help of his officers in Western Siberia brought back the news only to confirm his execution. The Schlagintweits made a similar speedy query to the Court of Directors and the offices in Upper India, who speedily provided them with whatever information they had to Adolphe's execution at the hands of Wali Khan in Kashgar. All this was carried out amicably at a time of unfriendly relations between the British imperial and Russian imperial powers. Neither the Russian nor the British explorations on the north-western fringes of the Indian subcontinent and in Central Asia could have carried on with their scientific endeavours without the German achievements in botany, geography, and what could be called orientology.

From the paratextual information, we find the Schlagintweits dedicating their volumes to the Royal Society for their 'untiring efforts to promote the advancement of physical science in general and more especially by the labours of many of its distinguished members, promoting the science of magnetism', to the East India Company, and to their financier, the Prussian King.

Scientific Findings of the Schlagintweits

The first part of the first published volume starts with a general introductory report and an address to Charles Wood, the Secretary of State for India, followed by an itinerary (given in Table I), a list of the help they received from 'observers, interpreters, collectors and servants'. The next section is an account of the last leg of the journey, and the correspondence from both the Assistant Commissioner at the British office in Kulu, the St. Petersburg office through the Russian Minister at Berlin, and two reports by Capt. Henry Strachey and Col. H. B. Edwards on the events of Adolphe's disappearance and execution. The last section comprises the language system adopted, the phonetic

accents used, consonants and diphthongs, and a glossary used for transcription. The second part is on the Astronomical determination of Latitudes and Longitudes, and what methods were adopted to observe and make calculations. The brothers were already well equipped with theodolites, chronometers and barometers from Berlin. There is a section on the methods of calculation of latitude and time, and longitudes. The observations for the determination of geographical coordinates have been dealt with in three sections 'India', 'High Asia', and 'Tibet' respectively. The section on the Magnetic observations is of much importance, as this was the reason why they were called in, in the first place. The method of height determination, instruments used, declination and dip, the stations of observation in India, High Asia and Tibet are again classified. The results of observations on the terrestrial magnetism in India, and the entire Indian Subcontinent from stations in Bombay are given. The maps showing the magnetic survey appear later in the *Atlas* which was also published in the same year as this volume, in 1861.

The second volume of the findings of the Schlagintweits deal mainly with sections across the Karakoram range and the Kunlun. The first part deals with methods of observation and calculation, the second part on heights determined in India, the third part on heights determined in the Himalayas, part four on heights determined in Tibet, part five a documentation and analysis based on field data, books, maps and private communications. This volume was the first of its kind. The Schlagintweits covered heights of 3,495 points, 1,615 belonging to India, and 1,880 belonging to High Asia. The area over which these elevated points were spread extended from the southern parts of Ceylon to Kashgar in Turkistan (6 degrees to 39° N), and from the eastern boundaries of Assam to Sindh (97° to 70° 30' E).

The Tibetan names had to be transcribed, which was the youngest brother Emil's responsibility, and later he helped to compile a glossary of names. Emil Schlagintweit never went with his brothers on their travels¹⁹. From these new data sets, the cross-profiles of each peak were completed with reference to hypsometry (the measurement of land elevation relative to the sea level: its underwater equivalent is called bathymetry, which is not a concern here). The sketches, water colours of the landscapes and the oils in the *Atlas* were also part of this journey's volume. The mathematical portion in the first section was carefully laid out as barometric height measurements, trigonometric measurements of heights, logs and tables which were used, and could be further used by the East India Co.'s officers and surveyors. Such organized and structured data sets, route sketches, details of every station, nature of the areas methods of calculation, determining latitudes, and longitudes assimilating data on the go sketching and finishing landscapes of each stop and sending off their research by *dak* in duplicate

(entrusted to two sets of runners) to the Survey of India's office, later to be sent to their patrons in Germany, was not an easy task. But these volumes show how well organized they were in their efforts.

In their third volume which dealt with the Western part of the Himalayas, Tibet and Central Asia, they provided in the first part, a documented section of a route book, based on their travel itineraries, collected works of earlier European travellers near that region, an arrangement of the route area-wise in an alphabetical order, with index maps and the nature of each route, the stages of the journey, and every other literary publishing result with regard to the space between Central Asia to Russia. There is also a detailed instruction to the traveller, as to which season is favourable for travelling, what passes one would have to encounter and cross, what disguises were used and which ones were most inconspicuous, what equipment to carry and what medicines were taken by them, what kind of cooking apparatus would be most convenient.

The second part of this work was the first ever document on languages of India and Tibet, including a detailed analysis of phonetic transcriptions and interpretations based upon their travel data, which contained verbal information in the respective provinces and from 'native' writings. This piece was edited by Hermann. They had for their help what they called 'native assistants', which ranged from an Abdullah from Madras, a Harkishen from Almora and a Mani Singh and Nain Singh from Tibet. It is of much interest to note that this same Mani Singh (or Man Singh as he is called) and his cousin Nain Singh, were the Pundit Brothers, who had made the next almost-impossible trans-Himalayan expedition to Tibet (first stopped, and later successful). In a matter of a few years, the British had trained them in Dehradun, under the Surveyor General T. G. Montgomerie²⁰, first with a drum and pace stick, to be later assisted by a specially designed Buddhist rosary with 100 beads, rather than the usual 108, so that they could keep count of the 1000th pace with the 100th bead. They too had to disguise their compass and mercury beads. The trans-Himalayan expedition by the Pundits, who were not just two persons but a group of 21 Indian explorers, from Nepal to Lhasa, through Brahmaputra became easier once they knew the means of survival, disguise, and return through routes the Schlagintweits took in 1854-1857.

Controversy

What happened after these reports were published in 1869?

If these reports were so important, why are they not well-known?

What were the conditions in which these scientific findings were received (both in London, and in Germany)?

Did they bring about any change in the existing body of knowledge, and if so, what were these changes?

These are few questions which come to mind. The Schlagintweits disappeared from the Survey of India documents after they returned back to Berlin. There must have been some incident, some reason for this indifference and silence by the British and the GTSI. There was absolutely no mention, or a word of acknowledgement anywhere in their scientific documents, but harsh criticism. It was as if this three-year expedition did not take place, or should not be spoken about. The reason has not been worked out as yet, and there is an unnegotiated space to work on this historiographical gap, primarily because history and geography has been studied in quite watertight compartments, in their respective contexts. The categories as we see are interspersed with each other. Just as it is not possible to look into the history of modern science in India without looking at both 'pre-modern', and 'non-Indian' science(s), it is also not possible to study the GTSI without looking at the similar trigonometrical efforts in mapping and surveying outside India, in other British Colonies, and non-British Colonies. Possibly it would be more constructive to look at the Indian scene (Indian explorers and men of science operating simultaneously along with the British 'surveyors'), the British scene (both because scientific research findings needed an international outlet to be discussed and debated on, and depended on the circulation of knowledge, and an intellectual platform for interaction), and the other scene (which might include contemporary development of science and technologies related to each science, which also includes French Naturalists travelling to India, and in this case the German brothers).

Another question arises often: *after repeatedly turning down the proposals for a German Scientific Expedition to India what made the East India Company finally give in? What did they seek to gain?* It is also important to ask on the other hand, *why the Prussian king decided to finance a scientific expedition if there was nothing in it for him.* It had to be more than just the dedication in their reports as patron and financier. Each record of the GTSI produced between the years 1815-1860, gives us a fair idea of which survey was taking place in which field of science (refer to Table II)²¹. The first attempt to get a new knowledge of the mineral and metal base of the Indian subcontinent is seen with Thomas Oldham's *Memoirs of the Geological Surveys in 1873*²². Oldham's first *Memoir on the Geological Surveys*²³, was based on the Schlagintweits' scientific findings which were published in 1869. A concrete example would be Hermann's work titled *Sikkim, Khasi hills and Assam* was submitted to the Royal Society in 1856, with its coal strata, petroleum springs and the hydrographical observations (branch of science dealing with the measurement and description of water bodies) which the Dihang River offered²⁴.

An urgent knowledge of metal and minerals was required for ore extraction. The East India

Company needed raw materials to be transported back to England for its industries.

With the industrial revolution in Europe²⁵, it was important to bring specialists to the field, *men of science* who would pick up the threads of earlier British of a magnetic survey in the eastern archipelago (Malay region) in 1846²⁶, and help them with this new body of information. The technology or mechanics of a magnetic survey operation is performed by means of spatial variations in the earth's surface. It is a process to locate mineral bearing ore-bodies, or even oil-bearing sedimentary structures on the earth's surface. Its essential feature was the measurement of the magnetic field intensity and sometimes the magnetic inclination (the dip), and the declination (the departure from the geographic north) at several stations. The surveyor sets up the grid of the area, makes the required measurements at each station on this grid. The corrected data was then entered on a scale drawing of the grid and contour lines are drawn between points of equal intensity to give a magnetic map of the target areas that may clearly indicate the size, extent, spread of the mineral body²⁷. Once you had this information in hand, you can set up a proper system of mineral and metal extraction. It was a rather long drawn process, and elements of adverse weather, wild animals, fever, and instrument transport on human and non-human agents had to be taken into consideration.

A Critical Appraisal

Something interesting emerges here. Earlier in 1840-1841, when the Surveyor General Col. George Everest was trying to negotiate with the East India Company for a financial grant to re-survey, and re-check his predecessor Lambton's work, primarily because the earlier calculations did not match his present survey data, Everest failed miserably²⁸. The Court of Directors refused to grant his office either men or material resources. They made it very clear that their objective was basic knowledge. Accuracy of data was not to be held supremely important. In a matter of 10-15 years, the East India Company became aware of a need to have 'precision measurement²⁹, and accuracy'. They finally invited on recommendation, a non-British group of scientists to investigate the geology, and terrestrial magnetism in India (earth's magnetism and its range and diversities in a certain area). A bitter-sweet end to this was that the East India Company was abolished immediately after the mutiny in 1857, subject to budget control that they themselves were so fond of subjecting on scientific research.

In this essay, I tried to bring in a narrative to the study of the Survey of India. Original questions in most research methodologies are more hypothetical than practical. The Schlagintweits not only travelled all over India and High Asia to make observations on the geology of the Himalayas, but also brought with them a knowledge of instruments³⁰, which made the East India

Co.'s task much easier³¹. They kept in contact with their patrons; the Prussian king, and the East India Co., when on field through *Zeitschrift für Allgemeine Erdkunde*, the *Proceedings of the Royal Geographical Society*, and the *Journal of the Asiatic Society of Bengal*³².

The British Scientific Efforts in India, and any political development would have been non-operational if the Schlagintweits entry into the Asian territory did not exist. They have been criticised on accounts of espionage. Yet espionage was actually started off by Capt. Montgomerie who trained and sent off the Pundit Brothers into Tibet³³. Ego and envy also were a part of these institutions, which is not a subject of concern here, but even though the Schlagintweits were being followed keenly by a global intellectual audience, (be it the British Association for the Advancement of Science in Dublin, or the French Academy of Science in Paris, or the Imperial Russian Academy of Sciences), the response from scientists like Hooker and others was critical both in the press, as well as in the Royal Society meetings³⁴. This is a part of a bigger debate, which will be taken up in another essay. In short, their expedition was rendered 'unreadable'. The Royal Society was rendered 'unprofessional', for encouraging such a massively expensive expedition. It was a harsh reaction as no British scientific figure had been so heavily funded earlier. 'Their contribution to Himalayan geography was of little value' says Phillimore, who has documented the history of the surveying in his 5 voluminous books on the Survey of India: '*The Schlagintweits brothers were not surveyors, and had little or no experience in the use of the barometers, chronometers, and other surveying instruments they carried. They were, however, accomplished artists and keen observers, and conscientious in recording and collecting evidence on the products and natural history of the countries they visited*'³⁵.

A lot can be said of science in the colonial context, but practices of science, and a contribution to the existing body of knowledge was precisely what the Schlagintweits did. It was quite different from the theories and calculations in board rooms or angry viscous editorials³⁶. The Schlagintweits were in the pursuit of knowledge. They had to their name long before they were approached for the mission to India, *Untersuchungen über die physikalische Geographie der Alpen, in ihren Beziehungen zu den phänomenen der Gletscher, zur Geologie, Meteorologie, und Pflanzengeographie* (*Studies of the Physical Geography of the Alps, in Relation to the Phenomena of Glaciers, Weather, and Phytogeography*) and *Neue Untersuchungen über die physikalische Geographie und Geologie der Alpen* (*New Studies of the Physical Geography and Geology of the Alps*)³⁷.

Hence, the matter of grave concern — If these men of science, with a training in Geology and earth sciences, (Hermann had a PhD in Physical Geography

and Adolphe had a PhD in Geology from Munich. Robert was the Assistant Professor of Geography at Giessen)³⁸, were declared to be inexperienced and naive, one wonders what really happened ! It is an important sequence of events for the practising historians, geographers, or any scholar, that took place in the 'history of science' in the Indian Subcontinent, and need further research to unravel and compare the huge body of database collected by them regarding, geology, geomorphology, soil, flora, fauna and cartography with the current resources of knowledge in the interest of the current breed of 'knowledge explorers' in the scientific community of the world.

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13. Theodorides J (1966): *Humboldt And England*, The British Journal for the History of Science, Vol. 3.1 (June 1966), p.50
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Endnotes

1. The Great Trigonometrical Survey of India was one of the biggest and most significant projects that Imperial Britain undertook on the Indian subcontinent.
2. Ralph Smyth and H. L. Thullier, Index map to the *Manual of Surveying for India for India*, (First Ed.) London, 1851, p. 3.
3. Triangulation refers to the art or science or method or mechanics of measuring horizontal and vertical distances between objects, angles, elevations, and depths, using trigonometric calculations, and this was the basic science of surveying in the Great Trigonometrical Survey of India
4. George W. Hayward, *Journey from Leh to Yarkand and Kashgar, and Exploration of the Sources of the Yarkand River*, Journal of the Royal Geographical Society Vol. 40, 1871, pp. 33-166
5. I.W.Campbell, "'Our friendly rivals': rethinking the Great Game in Ya'qub Beg's Kashgaria, 1867-77", Central Asian Survey, Vol. 33, No. 2, 2014, pp. 199-214
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7. Hermann, Robert, and Adolphe de Schlagintweit, *Results of a scientific mission to India and High Asia*, Vol. 1, Leipzig and London, 1861
8. Schlagintweits, *Results*, Vol. 1, p. 5.
9. Schlagintweits, *Results*, Volume I: 1861, Volume II: 1862, Volume III: 1863, Volume IV: 1866, Atlas: 1861
10. We get a comprehensive compilation of these statistics from, Gabriele Finkelstein, 'Headless in Kashgar', Endeavour, Vol. 23 (1) (1999), p. 8
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12. Kris Manjapra, *Age of Entanglement: German and Indian Intellectuals Across Empire*, Cambridge, MA: Harvard University Press, 2014. His footnotes with regard to the paragraph on the Schlagintweit Brothers is wrongly placed, and hence has not been dealt here, because of its irrelevance. Authored works by Alexander von Humboldt and the Schlagintweits are easily available on www.archive.org, and the National Institute of Informatics webpage, <http://dsr.nii.ac.jp/> for further corroboration.
13. Schlagintweit, *Results*, Vol. I, p.5
14. First in a letter to Napoleon Bonaparte in 1808, and later again in 1812, cited by Jean Theodorides, *Humboldt and England*, The British Journal for the History of Science, Vol. 3, No. 1 (June 1966), Pg 43
15. Jean Theodorides, *Humboldt And England*, The British Journal for the History of Science, Vol. 3.1 (June 1966), p.50

Endnotes (contd.)

- ¹⁶ Theodorides, *Humboldt And England*, The British Journal for the History of Science, Vol. 3.1(June 1966), p ?. I have not been able to trace this book as yet.
- ¹⁷ Charles Darwin, *Life and Letters*, III: 247, 1887 (entry 1881: <http://www.darwinproject.ac.uk/entry-13277> , accessed: 18.26, 19.07.2014)
- ¹⁸ Schlagintweit, H., and Schlagintweit, R., *Official Reports on the Last Journeys and the Death of Adolphe Schlagintweit in Turkistan*, 1859, Berlin
- ¹⁹ Schlagintweit, *Results*, Vol. II, p.x
- ²⁰ There has been a lot of research on the Pundit Brothers' expedition in Lhasa, but the one which is referred to here is, Montgomerie, T. G 'Report on The Trans-Himalayan Exploration, in Connexion with the Great Trigonometrical Survey of India during 1865-7: Route Survey made by Pundit from Nepal to Lhasa and Thence Through the Upper Valley of the Brahmaputra to its Source', *Proceedings of the Royal Geographical Society*, Vol 12, No.3 (1867-1868), pp. 146-175
- ²¹ A table drawn up for easy reference Refer to Table I
- ²² Oldham Thomas, *Memoirs of the Geological Survey of India*, Vol. I, London, 1873
- ²³ Oldham Thomas, *Memoirs of the Geological Survey of India*, Vol. I, London, 1873, *Preface*
- ²⁴ Schlagintweit, *Results*, Vol. I, p.14-16
- ²⁵ Refer to Hobsbawm, Eric, *Industry and Empire*, New York, 1968
- ²⁶ Elliot Capt. C. M., *Magnetic Survey of the Eastern Archipelago*, Philosophical Transactions, 1851
- ²⁷ The first map of the Schlagintweits, from the *Atlas*, p. 17
- ²⁸ Everest, George, *Letter to the Court of Directors*, Dehradun Vol 286, pages 223-226, 31-10-35
- ²⁹ A term used by Gabriele Finklestein, *Conquerors of the Kun'lun*, Publ., Hist.Sci. xxxviii: 2000, p 183
- ³⁰ Cistern Barometers came in from Berlin to Calcutta in 1855 replacing standard barometers, thermo barometers also were used which were not only easier to carry and piled onto *kulis*, but also easier to disguise where bigger instruments looked suspicious, *Results of a Scientific Mission*, Vol. II, P.11
- ³¹ A short table of their travel has been compiled from their work, which makes it easier to refer to if required
- ³² Referred to in the different volumes of the *Proceedings of the Royal Geographical Society, 1830-1954*
- ³³ Stewart, Jules *Spying For The Raj: The Pundits And The Mapping Of The Himalayas*, London, 2006
- ³⁴ The Athenaeum, 'Opinion of the Press, General Index, Ref.112,5-6, No. 1764, 17th August, 1861, 215 - 16
- ³⁵ Phillimore, R. H. *Historical Records of the Survey of India*, Vol. 5, p. 144-147
- ³⁶ The Athenaeum, 'Opinion of the Press', (see above)
- ³⁷ *Neue Untersuchungen über die physikalische Geographie und Geologie der Alpen (New Studies of the Physical Geography and Geology of the Alps)*, 1854, Leipzig, and *Untersuchungen über die physikalische Geographie der Alpen, in ihren Beziehungen zu den phänomenon der Gletscher, zur Geologie, Meteorologie, und Pflanzengeographie (Studies of the Physical Geography of the Alps, in Relation to the Phenomena of Glaciers, Weather, and Phytogeography)*, 1850, Leipzig
- ³⁸ Gabriele Finklestein, *Conquerors of the Kun'lun*, Publ., Hist.Sci. xxxviii: 2000, p 180
- ³⁹ This data has been compiled from Clement Markham's '*A Memoir on the Indian Surveys*', 1871, London, and C.E.D.Black's '*A Memoir on the Indian Surveys 1875-1890*', 1891, London

Table - 1: A Compilation of the Journeys of the Schlagintweits

Observations	Year	Conducted by
Southhampton to Bombay via Egypt	1855	Hermann, Robert, Adolphe
Bombay – Madras	1856	Hermann, Robert, Adolphe
Sikkim, Khasia Hills, Assam	1855	Hermann
Kumaon, Tibet, Garhwal	1856	Adolphe, Robert
Upper Assam , Bhutan, Bengal	1856	Adolphe, Robert
Central India, Madras, Nilgiris	1856	Robert
Central India, North Western Provinces	1857	Adolphe, Robert
Ladakh, Turkistan	1857	Hermann, Robert
Western Himalayas, Balti	1857	Adolphe,
Punjab – Sind – Bombay	1857	Hermann, Robert, Adolphe (Tibet)
On the last journey and Adolphe's death	1859	Hermann and Robert – Overland via Egypt Adolphe – Overland via Kaashgar (Executed)

Source: Compiled by the author

Table – 2: A compilation of the different survey operations undertaken by the British Government in the Indian subcontinent from 1600-1890s, and a few of the contributions among the many published memoirs and papers.

Name of the Survey	Time Frame	Conducted by
Indian Marine Survey	1601-1830 1832-1862	Captain Court, Daniel Ross (Marine Surveyor General); Charles Malcolm, Robert Oliver (Commander In Chief); Captain Llyod (Marine Surveyor General)
Route Survey	1763-1800	James Rennell
Trigonometrical Survey	1800-1823 1823-1843 1843-1861 1862-1870	William Lambton George Everest Andrew Waugh James Walker
Topographical Survey	1800-1823 1823-1843 1843-1861 1861-1869	Colin Mackenzie Valentine Blacker, John Hodgson, George Everest Andrew Waugh, Maj. Henry Ed. Thullier James Walker, Maj. Henry Ed. Thullier
Geological Survey	1851-1871	Thomas Oldham
Archaeological Survey	-1870	William Jones, Alexander Cunningham
Statistical Survey	1877-1885	W. W. Hunter
Meteorological and Tidal Observation	1785-1788 1816-1823 1823-1843 1843-1844 (?) 1877-1881 1850 1806-1827 1835-1840	Col. Pearce General Hardwicke (Voluntary observations by numerous other travellers) McClelland Messrs. Schlagintweits' abstracts J. Elliot's and Dallas's Meteorological Memoirs Col. Skyes Capt. Kyd's Tidal Observations Capt. Ross
Astronomical Survey	1787-1865	Hodgson, Worster, Jacob, Tennant, Caldcott, John Broun

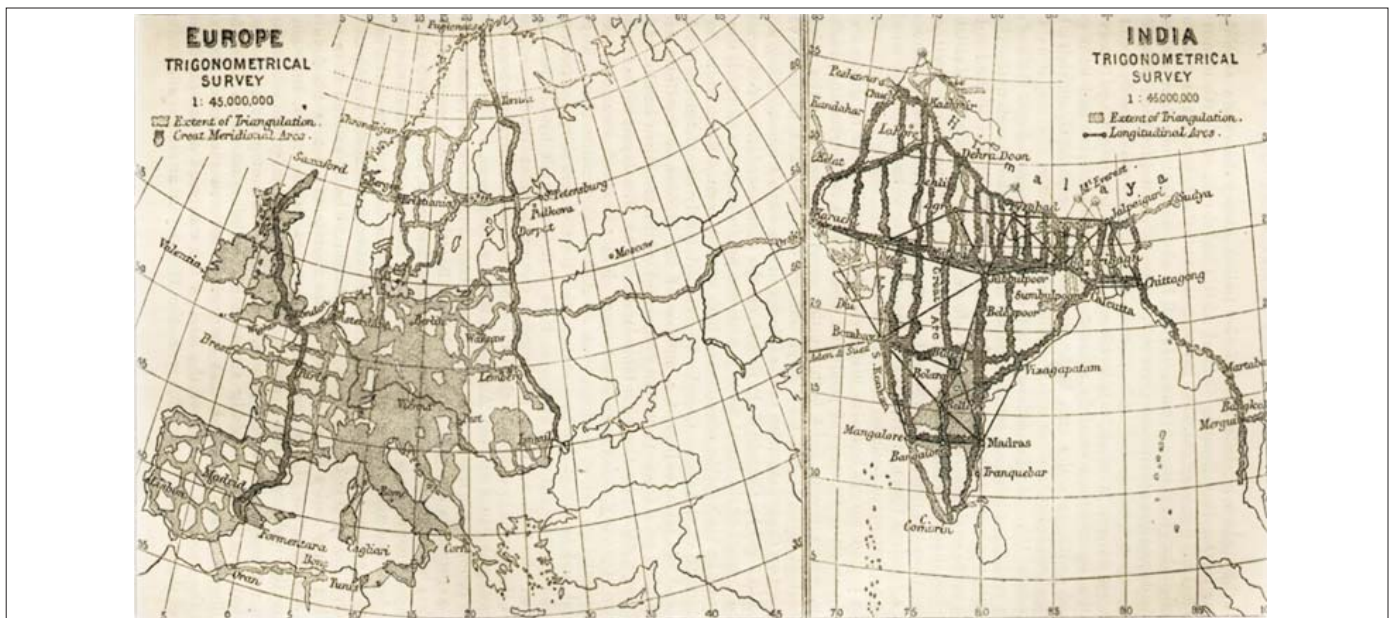


Fig. 1: Progress of Trigonometrical Survey in Europe and Indian Subcontinent

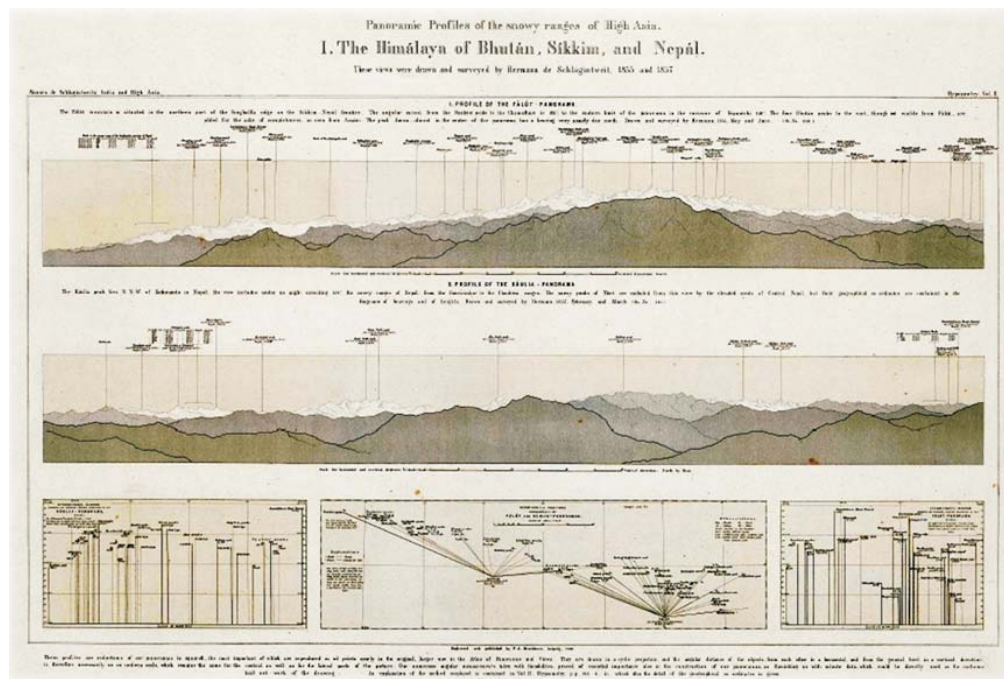


Fig. 2: Panoramic Profiles across the Bhutan, Sikkim and Nepal Himalayas

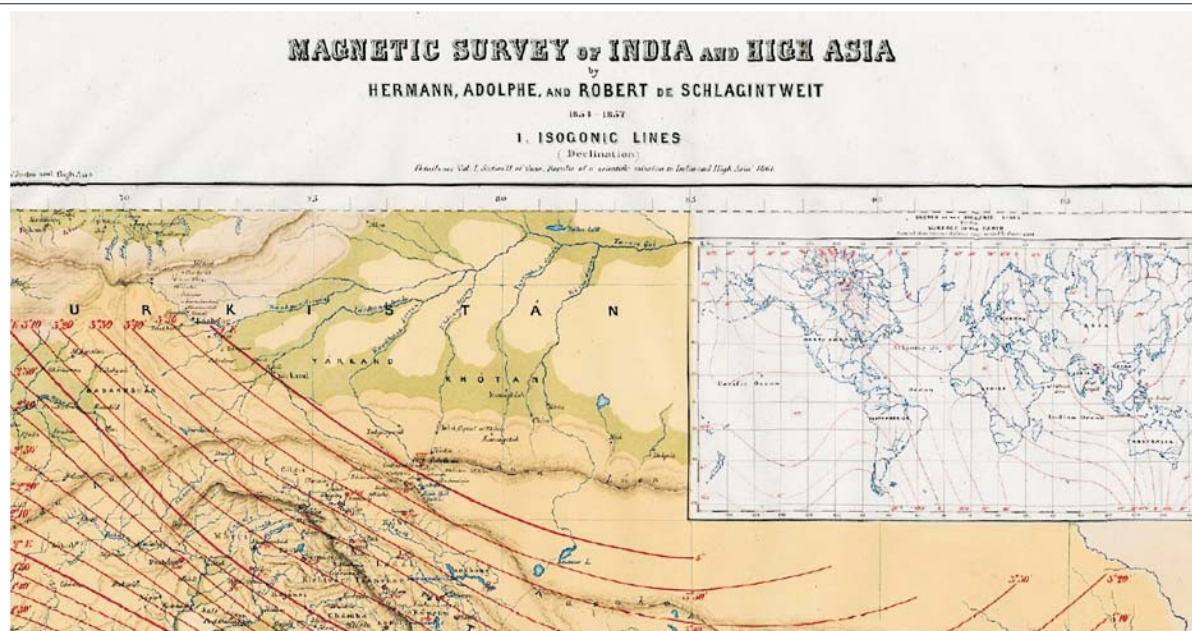


Fig. 3: Isogonic Map of India and High Asia



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