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The Asiatic Society and its Vision of Science : Metropolitan Knowledge in a Colonial World

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The Asiatic Society established by William Jones in 1784 was inspired by a quest for truth, knowledge and enlightenment. Its model was the Royal Society of London (1660). By the 18th century science had dramatically changed European philosophy, culture and society. The obsession with the rationalist pursuit of knowledge, the will to explore the world, to venture into untrodden territories and to find order and laws in the apparent chaos of nature, informed European rationalist epistemology. Science was integral to that agenda. The Royal Society came to epitomise that search, the endeavour for truth, in the 19th century.[1] In 1820, Sir Humphrey Davy, on taking the chair at the ordinary meeting of the Royal Society, lectured on 'Present State of Royal Society and the Progress and Prospect of Science'. He concluded with such assertions.

> Gentlemen, to conclude, I trust in all our researches are shall be awakened by our great masters, Bacon and Newton. ... I trust that those amongst us who are so fortunate as to kindle the light of new discoveries, will use them, not for the purpose of dazzling the organs of intellectual vision, but rather No enlighten us, by showing objects in their true forms and colours; that our philosophers ... will look, where it be possible, to practical application in science, not, however forgetting the dignity of their pursuits, the noblest end of which is, to exalt the powers of the human mind and to increase the sphere of intellectual enjoyment, by enlarging our views of nature,...[2]

Steven Shapin's thesis of the social legitimisation of truth in 17th century England argues that the making of knowledge in general takes place on a moral field and mobilises particular appreciation of the virtues and characteristics of types of people.[3] The *Gentleman* in seventeenth century England was a person who was trusted to speak the truth. He was accounted to be such a man who had no inducement to misrepresent fact or to shift his commitment towards reality. It was for this reason that the early Royal Society had aristocrats as its most prominent members. But such a sociological approach to the question of truth by itself cannot explain the rise of 'truth' as an objective social virtue. Any hegemony does justify itself through an articulation of its conformity to the truth. Thus in 17th century England, where the 'gentleman' was emerging as a dominant social and cultural entity, his *ability* to speak the truth would be obvious. What remains to be answered is why science became such a crucial component in that truth. Why did Boyle take up science or natural philosophy the way he did? Why did only certain aspects of its complex project involving Christianity and natural philosophy, appear as 'truth'?[4] The ascent of 'truth' as an objective social value and that of science as the dominant truth can be traced in the nature of European Enlightenment thought, which had placed truth and reality as its basic moral value along with humanism. 'Authority', 'testimony', 'evidence', and 'truth' had become the dominant concerns and concepts like 'truth' and 'fact' were entrusted with new moral significance when introduced in the field of natural philosophy.[5]

The establishment of the Asiatic Society has to be seen in correspondence to such an intellectual development. William Jones, while writing a paper for the Asiatic Society expressed his similar concerns for 'truth' and 'vision',

> It is painful to meet perpetually with words that convey no distinct ideas, and a natural drive of avoiding that pain excites us often that (sic) to make inquiries, the result of which can have no other use than to give us clear conception. Ignorance is to the mind what extreme darkness is to the nerves; both cause an uneasy sensation, and naturally we love knowledge as we love light, even when we have no design of applying either to a purpose essentially useful.[6]

To this was added the Asiatic Society's particular agenda of a search for the Orient—the 'Other' of the Occident. What made the project more challenging, the 'darkness' more engulfing was the geographical and cultural location of India so far away from Europe. It posed new challenges to the scientific theories originating from the Centre. Baconian science in the colony had to conquer nature in a strange and remote land. Jones, while inaugurating the Asiatic Society, found this task of exploration and investigation almost daunting;

> I could not help remarking, how important and extensive a field was yet unexplored, and how many solid advantages unimproved, and when I consider with pain that, in the fluctuating, imperfect and limited conditions of life, such inquiries and improvements, could only be made by the united efforts of many.[7]

Thus the spirit of exploration became central to these scientific pursuits. Jones' instructions to his colleagues were very clear, "... you will investigate whatever is rare in the stupendous fabric of nature, will correct the geography of 'Asia' by the new observation and discoveries..."[8] Science in the colony manifested itself in an obsession to synthesise and order a strange and complex world. *Asiatic Researches,* a journal published from

the Society, defined its scientific activities as an urge, (to) 'acquire an accurate knowledge of facts to a synthetic explanation of particular phenomenon...'[9]

This was the primary logic for the major scientific surveys in colonial India. Map-making formed an important pre-occupation. The initiation of detailed topographical surveys based on a rigid framework, was undertaken around the closing years of the 18th century when the Great Trigonometrical Surveys were started by William Lambton. Lambton wanted to ascertain the great geographical features of this country on correct mathematical principles, the maps of every district could then be combined into one general map.[10] The purely map-making work of the Survey of India, however, began at an earlier date-1767. By the 2oth century it had surveyed and mapped 1,304,453 square miles of India and Burma out of a total of 1,884,640 square miles.[11] Map-making in the colonies had become and remained the primary of object of survey. So much so that Sir Sidney Burrand, Surveyor General of India, reviewing past work of the department, commented as late as 1905, 'The primary object of a national survey is the making of Maps, and all operations subordinated to that end...'[12] In a major way Lambton's Trigonometrical Surveys served the important purpose of mapping the Indian Empire. It not only provided a highly effective informational weapon, it also provided what Matthew Edney calls 'structures of feeling', the transformation of the subcontinent from an exotic, unknown region into a well-defined geographical entity.[13]

The need and the process of arranging and institutionalising the scattered materials of Indian natural world was illustrated in the words of the geologist, captain J. Campbell:

> In collecting information on Indian geology, the greatest difficulty appears to be, that the number of people, who have time and opportunities of the pursuit, are very few; but if everyone who chooses to attend to the subject, would apply himself, to compile accurate description of the part of the country, adjacent to their station, one should soon have a valuable collection of the geology of isolated spots, which those who are employed by the government in those scientific pursuits could soon and easily connect together.[14]

To order the natural world it was necessary to first organise its study. The need was to institutionalise scientific research particularly devoted to the collecting and collating of scientific information. Discussing geological researches, Campbell added,

> In the furtherance of this end, a geological society would be of the utmost advantage,—they would receive and assist in the discussions of such information, compare specimens, have chemical examinations made, and afford that information and direction to tyros which no printed work on the subject could give—and particularly any individual of the society who has had the advantage of studying the science practically in Europe, could then afford the most valuable information, in identifying minerals with those of Europe.[15]

Thus started the project of studying, understanding, and incorporating the rocks, the soil, and the plants of this land by the European epistemology. It was an interesting journey from the Centre to the periphery and back, the European study of the non-Europe. A form of dislocation was central to it; European knowledge had to establish itself in a distant land that promised the unknown and the undefined. We now study how this disorientation was essential to this European project.

MARGINALITY, LIMINALITY AND THE INDIVIDUALS

An interesting methodology to understand such expansion of Centralist knowledge through peripheral experience is provided by Martin Rudwick, through his concept of 'Liminal Experience'.[16] Rudwick takes up the case of geology—a field science. He shows that geological expeditions in the past involved a double movement, from the familiar to the unfamiliar and back again. He compares the dynamics of this process with Van Gennep's classic concept of 'Liminality' and with Victor Turner's application of that concept to the processes of 'pilgrimage'. The argument being that theoretical innovation in a field science such as geology may require, or at least be facilitated, by a pilgrimage-like process in which scientists are exposed to unfamiliar lands and surroundings. This leads to a growth of new insights which leads to the development of the hypothesis itself, the gradual transmutations which the original ideas undergo, as a result of the slow process of active cognitive construction in the scientists' minds.

This concept of liminality is particularly useful to understand scientific researches in colonial India, for its appreciation of the role of the individuals working in a distant land. The separation of the individual scientist from his 'home community' gave him the opportunity to develop and articulate new and distinctive insights without fear of being crushed at birth by the critical competitiveness of the 'common-sense' conformism of the group. Individual scientific researches hold a significant clue to understanding the researches in the colonies. Often scientific researches rested solely on the initiative and interest of these individuals in the distant and remote parts of the country yet to be integrated within the British administrative system. A brief study of the careers of these individuals would help us to understand the trajectories of colonial science.

As in late 18th and early 19th century England only the medical colleges offered scientific education, most of these men had graduated in medicine and then joined the army in India as surgeons. But thereafter their lives followed very diverse patterns. Hugh Falconer, who was later internationally recognised for his paleontological discoveries, was born in Forres (1808) north of Scotland. Hew proceeded to Edinburgh to study medicine and also followed up his interest in Natural history by studying botany and geology. After acquiring M.D. he proceeded to London and studied Indian Herbarium under Dr. Nathaniel Wallich, a British Indian botanist. In the museum of the Geological Society of London he studied Indian fossils from the banks of the Irawaddi under Dr. Lansdale. In 1830 he proceeded to India as an Assistant Surgeon and in 1831 he was posted in Meerut where he worked with Dr. Royle at the Saharanpur Botanical Garden. Initially he was posted in the Shiwalik Hills and then in the higher Himalayas. It is here that Falconer collected fossils for many years, the study of which made significant contributions to geological science and were highly lauded in Europe. In 1837, he and Cautley were jointly awarded the prestigious Wollaston gold medal by the Geological Society of London. Falconer was one of the few colonial scientists who began and spent a large part of their scientific careers in a colony and gained high reputation in England. When he went back to England, he was a member of the Geological Society and read many papers on Glacial Erosion, the Himalayas and compared it to other mountain ranges. In fact he played a leading role in raising Centralist geological attention towards the Himalayan mountain ranges.[17]

Frederick Corbyn, who was a unique organiser and editor, was one of the most important scientists in colonial India. He was born in Manchester in 1792 and passed his medical degree from London. In 1813 he was appointed to the medical service of the E.E.I. Company in their Bengal establishment. In 1814, he joined the troops assembled in the Tarais against the Nepalese under General Morley where in 1815 they suffered a great loss. In 1818, while serving the 25th Regiment, the troops suffered greatly from a disease known in India as the 'Tarai Fever'. In the same year Corbyn published a small tract describing the disease, its effects, and the manner in which he had counteracted these effects.

From 1818 onwards Corbyn wrote continuously. In 1819, he gave a short treatise on Cholera, which was followed up in the next year by same additional observations on the some disease. His days in the Tarai regions enabled him to study its topography and he was supposed to be one of the firsts to discover the tea plant. In 1828, Dr. Corbyn wrote on the diseases of infants in India and in 1830 his larger work on Cholera was published. Four years later he became the editor of the *Indian Journal of Medical and Physical Science*. In 1836 he started a new periodical, *India Review and Journal of Foreign Science and Arts* which he continued to edit along with the other till 1842.[18]

Sir William Brook O'Shaughnessy, famous for his contribution to the Indian Telegraph system, also began his career as a surgeon. He was appointed as an assistant surgeon in Bengal in 1833. While in Bengal he wrote numerous articles on medicine, chemistry and other subjects but devoted his attention mostly to the electric telegraph. Anxious to introduce it in India, he published a pamphlet detailing the results of experiments conducted by him in 1839. He was subsequently appointed the director general of telegraphs in India, and was sent to England to collect men and materials. He returned to India and commenced work in 1853. The line between Calcutta and Agra was functional by March 1857. His efforts were recognised in England and he was knighted in 1856. Earlier, in 1843, he had been elected a Fellow of the Royal Society.[19]

Colonel Lambton was a pioneer in the field of topographical and trigonometrical surveys in India. He was appointed a barrack master in the province of New Brunswick in North America where he applied himself to the study of mathematics and topography. In 1799 he joined the 33rd Regiment at Calcutta and was a part of the army that seized Tipu Sultan's capital. After the successful termination of the war with Tipu Sultan, Lambton put forward to the government, plans of a geographical survey of that part of peninsular India. This work subsequently became the nucleus of the great Trigonometrical Survey of India.[20]

These were men who to some extent received recognition and support for their work. Many others were not so privileged. T.D. Pearse, a pioneer in the field of Indian meteorology, conducted one of the first two meteorological observations in India between 1785-1788. He also took an interest in astronomy and wrote articles on astronomical observations between Calcutta and Madras.[21]

Francis Balfour made very important contributions on meteorology's connection with health. He probably received his M.D. from Edinburgh. He entered the English East India Company's service in Bengal as an assistant surgeon in July 1769 and was appointed a full surgeon on 1 August 1777. He retired from service on the 16th September 1807. Balfour not only interested himself in politics and medicine but also devoted much time to Oriental studies.[22]

Two most interesting yet forgotten characters were Dr. R. Tytler and Henry Piddington. Tytler was born at Brechin, Augurshire, Scotland. He commenced his medical career in H.M. service and was appointed in the Company's medical service at the Bengal establishment in 1807. He subsequently proceeded to Java and was appointed to the charge of 5th Volunteer battalion. During his stay, he made some valuable studies of the mythologies of that country. Dr. Tytler's attention was likewise attracted to the destructive and malignant character of the fever so prevalent in Batavia. Under the name of 'Benevolous', Dr. Tytler published in the *Java Gazette* in 1815 some useful hints on the causes of the unhealthiness of Batavia. In March 1817, he was directed to take charge of the medical duties of Jeshore district in Bengal. While at this station he printed a concise narrative of facts connected with the Cholera which occurred in that district during the months of August and September (1817) and made some observations on its symptoms, causes and treatment. He was also well-grounded in anatomy, surgery and mathematics. But the field where he made significant discoveries was electro-galvanism, where he claimed to have made discoveries similar to those of Faraday and prior to him. He also studied the influence of magnetic geological geometry upon the science of geology. This versatile man died in Futehgarh, unknown and unsung.[23]

Hentry Piddington, a meteorologist, was also the foreign secretary to the Agricultural Society of India, sub-secretary to the Asiatic Society, founder and curator of the Museum of Economic Geology, president of the Marine Court of Enquiry and Coroner of Calcutta. He was in the mercantile marine, apparently in the East India and China trade, and was for some time commander of a ship. In 1830, he retired from the sea, was engaged in the culture of coffee and indigo and the manufacture of sugar. During that period he contributed various notices on agricultural subjects to the *Transactions of the Agricultural and Horticultural Society*. The work for which he is best known is his series of twenty-five Memoirs accompanied by charts on the Law of Storms in the Bay of Bengal. Between 1839 and 1851 he continued to give accounts of all the important cyclones that occurred in the East. In fact it was he who coined the term 'cyclone for the peculiar swirling storms of this regions.[24]

Three important elements emerge from the above cases. First, these men had an extremely diverse range of interests, from botany to electromagnetism. Second, these men were keen to explore whatever natural environment their job had placed them in a foreign land. In fact it was often this geographical diversity of their locations that contributed to the enormous range of their researches. Finally, to these individuals science was a passion, a pursuit of knowledge and a search for truth. Here they were inspired by the same ethic of pure research that the contemporary scientific community of Europe revered. It was due to such a commitment that they took up these researches often outside their official jobs. They conducted such studies on their own, mostly without the Company's instructions and often without its official recognition or sanction.

Their liminal experiences in conditions very different from Europe and their association with the dual project of the Asiatic Society had defined their creative space. An interesting instance of such space was in the works of Falconer and Cautley, in the study of the fossils of the Siwalik. Not having been versed in fossil oestology and stationed at the remote confines of the Siwaliks, they were away from any living authorities or books on comparative anatomy. Thus they devised their own methods. They established a Museum of Comparative Anatomy. In the surrounding hills, plains and jungles they slaughtered wild tigers, buffaloes, antelopes and other Indian quadrupeds, preserved their skeletons, obtained specimens of all reptiles which inhabited that region. They compared and discriminated between different recent and fossil bones, and reasoned according to the laws of comparative oestology and reached interesting formulations. It was on the basis of these findings that Falconer developed his theory of the geographical formation of India in which he described how the sub-continent, once an island, gradually was joined with the Asian mainland.[25]

Another area where this creative space was evident was in devising instruments necessary for the scientific studies. Lack of proper instruments and sparse supplies from England was always a problem. The scientists were thus left to design their own instruments.

For instance, there were certain interesting developments on the manufacture of the barometer, used to measure atmospheric pressure. In 1837

William Gilchrist, of the Madras medical establishment developed a self-registering barometer and a metallic tube barometer. The first one would he claimed, record constantly and with scientific accuracy, the varying pressure of the atmosphere which so far was lacking in the study of meteorology. His instrument was constructed by suspending a barometer tube from one end of a balance, an apparatus being connected with the other end to record the oscillations occasioned by the varying weight of mercury in the tube or the varying pressure of the atmosphere on the top.of the tube.[26] A year later he claimed to have simplified the apparatus even further.[27]

The metallic tube barometer developed by Gilchrist was intended to remove a major complaint of meteorologists regarding the barometer. The common barometer was liable to be damaged as a result of the entry of the air, and there was a great danger of destroying the instrument in attempting to expel this by the only efficient mode : boiling the mercury in the tube. This problem was even more acute in India where once air had entered the tube the instrument became useless as only the maker of the instrument in England, could do something about it. Gilchrist thought it practicable to substitute iron for glass in that part of the barometer, which was necessary to expose to heat for expelling the air.[28]

Lieutenant R.S. Shortrede also tried to remove certain shortcomings of the conventional barometer. He suggested a method to free the tube from atmospheric pressure, which would not involve boiling it. Dipping the tube into a base of mercury and thus using atmospheric pressure to remove the air in the tube, he believed, would serve the purpose.[29] He also suggested certain solutions to the problem of graduation in the thermometer.[30] Charles Hudson's developments on the water barometer were to ensure that would be of a more permanent use, removing the danger of accidents and disruptions. His method was to reverse the principle of the barometer, by replacing vacuum generally used in the tube by 'Plenum' or artificially condensed air. This had the same elasticity and expandability and could correspond equally well with water, air or mercury. Above all the expense to construct it was also to be relatively minor. In fact, Hudson was hopeful of procuring a patent for it.[31]

James Princep was also involved in constructing various astronomical and meteorological instruments. In 1823, he constructed a pluviometer (to register the fall of rain) and an evaporameter (to read off the depth of evaporation) in Benaras. In the *Asiatic Researches*, he described his instruments with which he registered the rainfall of and evaporation in Benaras.[32] In March 1833, he published the results of his experiments on the expansion of gold, silver and copper and two months later described a new barometer invented by him.[33] At Mysore Lieutenant Henry Kater in 1810 was faced with a similar problem of lack of instruments. He solved it by developing a hygrometer from a species of grass found in the neighbourhood. He came across this grass quite accidentally and found it to be extremely sensitive to moisture. He claimed that hygrometer was extremely suitable for registering micro-changes of moisture in the atmosphere.[34] Kater confidently claimed that this hygrometer was more sensitive than anything hitherto developed:

> This grass appears to be far superior to any other hygrometric substances, hitherto discovered. In the 'Encyclopaedia Britannica' the scale of Sausser's Hygrometer is said to consist of 400 degrees or rather more than 'one' revolution of the index; the Hygrometer here described makes eleven or twelve revolutions,...[35]

For others the distance from Europe had more fundamental theoretical significance. They found India vital for actually forwarding scientific hypotheses. John McClleland, a botanist, argued that the study of natural history of India, given the unfamiliarity of this country, was more crucial than that of Europe. It provided the opportunity to discover and analyse the several 'new' species found here, which were otherwise 'lost to the mankind',

> ...if Natural history has so much to recommend it in Europe, how much greater are the attractions it holds out to those who are destined to spend the best parts of their lives in India, where almost every step introduces us to objects, regarding which, the scientific world have little or no information, and where thousands of species of animals, plants, and minerals, are as lost to mankind from our ignorance of their nature and properties, as if they have never been created...[36]

Several others expressed similar sentiments. These have important implications for the Centre-periphery link of 19th century science. How did this liminal creative space enrich the European scientific enterprise and lead to the growth of scientific knowledge? Did this displacement from the Centre express itself in an empathy with the periphery? How did such empathy locate itself vis-a-vis the Centre? How do we understand the role of this colonial science in the constitution of 'colonial knowledge', the multifaceted accumulation of enormous bulk of information about the colonial world by Europe? For an examination of these issues we first visit the Orientalist problematic.

COLONIAL SCIENCE AND THE ORIENTALIST PROBLEMATIC

The Asiatic Society was involved in the grand project of coming to terms with the Orient both geographically and culturally. One of the projects was the scientific examination and graphic reproduction of the natural world of the colony. The other was the Orientalist search for the 'exotic', the socially unfamiliar customs, rituals, and practices of the natives. This was subsequently codified in a particular language of power and legitimisation. Edward Said's *Orientalism* has questioned the various assumptions regarding politics and society of the 'Orient'.[37] Said argued that the knowledge about the Orient since the colonial period has been a systematic discourse by which Europe has been able to control and even reconstruct the 'Orient' politically, sociologically, militarily, ideologically, scientifically and imaginatively. According to him, European and American views of the Orient formed a condition in which the Orient was forced to live. In defining the Occident's distinction from the Orient, the European had actually legitimised the former's power over the latter. Although Said's work dealt primarily with West Asia, it has encouraged a number of researches on similar lines on South Asia particularly India.[38] However, there have been few attempts to link the cultural and social aspects of the scientific researches with this question of Orientalist knowledge particularly of the late 18th and early 19th centuries.[39] How did Orientalism shape scientific research in the colony? Were the two identical processes of codifying the Oriental world or were there areas of tension? It is important to seek answers to these questions because it was around the same period, under the same institution (Asiatic Society) and often by same individuals that researches on India's nature and culture were carried out. Moreover, both these forms of knowledge had strong implications for the exercise of imperial 'power'.

One fundamental link between the two forms of inquiry was that both were attempts by disciplines of European post-Enlightenment epistemology like linguistics, grammar, anthropology, botany, and geology to come to terms with the 'Other'. Both were western empiricist methods of manipulating, formulating and subsequently codifying this alien land and society in a particular language of power and legitimisation. Bernard Cohn has argued that the discovery of India's past "was an European project, the end being to construct the history of the relationships between India and the West, to classify and order and locate their civilisation on an evaluative scale of progress and decay."[40] Like the cultural project, the 'understanding' of Indian nature also buttressed 'control' and provided the colonial government with the necessary premises to rule. At an another level, the Orientalist characterisation of the east and the subsequent assertion of the cultural superiority of the west helped to establish western science as the dominant paradigm.

CRITIQUE OF EURO-CENTRISM

Another sphere where both the projects shared grounds was in their criticism of Euro-centrism. Although never consistent in his attitude, hostility towards Euro-centrism characterised much of Jones' Orientalist works. In his critique of Voltaire's disapproval of Persian imagery, in his study of 'Mystical Poetry' of East we see in Jones elements of empathy with the Orient. There was an attempt to have the intricacies of Eastern knowledge respected and accepted within western scholarship.[41] The scientific researches of colonial India too manifested themselves as an exercise to question the existing geographical Euro-centrism of western science, although its paradigms remained firmly within the contours of European epistemology. During the 19th century European science was influenced by the physiographical argument that north-western Europe was located precisely in the longitudinal and latitudinal middle of world's continental mass. It gave rise to various Euro-glorifying maps that drew Europe at the centre of the global distribution of landmasses.[42] This had important implications for the idea of the cultural supremacy of Europe. The scientific works under the Asiatic society, although conforming to this cultural Euro-centrism, argued that the study of nature of Asia and could contribute crucially to Europe's understanding of the earth. To that extent the geographical centrality of Europe was being challenged.

This can be best illustrated in meteorology. Meteorological researches in India tended to flourish not so much because of its commercial prospects for its scientific potentialities, in this tropical country. Due to its particular geographical location, a consensus had been reached among scientists working in India that India offered excellent facilities for meteorological studies. Although the basic objective of meteorological studies was to collect data from which to determine the climatic condition of this alien country, Indian environmental conditions proved to be favourable to the sudden proliferation of such studies. As early as 1805, Francis Balfour wrote that the topical peculiarities, over the huge landscape of India particularly facilitated the advancement of this science.

> ...it is natural for those who are prosecuting (sic) discoveries in medicine and meteorology to look towards 'India' for some information respecting, the nature and peculiarities of the climate in which we live. Possessing as we do, the peculiarities of a tropical situation, with a more extensive field, and greater conveniences for making observation than any European nation, ever enjoyed before, its an expectation which they have reason to entertain, and which on that account, and many other consideration, are ought, if possible, to gratify...[43]

Balfour discussed in detail the particular advantages that India afforded for meterological studies. With similar faith, further meteorological researches were carried out in India. Almost fifty years later Dr. G. Von Leibig, while discussing some meteorological observations, talked of the 'peculiar advantages' of this country. His report started this way :

> The following discussion of a few meteorological observations made on the Parisnath Hill in 1856, I started to submit to the society less because they contain any new facts than with a view of drawing attention to the peculiar advantages afforded in India for the investigation of meteorological question by the great regularity of all atmospheric change.
> *A few days observation in this country will suffice to trace laws, the exhibitions of which would in Europe, require months and years of continued research...*[44] (My emphasis)

Leibig's argument was that the shape of the barometric curves of one day in India was so regular that it was equivalent to the stabilisation of a year's study in Europe. The questioning of Europe's geographical centrality had thus begun.

Henry Blanford who was the most significant meteorologist in colonial India, the geographical entirely/unity of the Indian subcontinent had more appeal than that of Europe. In the introduction to his brilliant work *Meteorology of India* (1877), he wrote about India as the 'epitome of atmospheric physics', because of its varied conditions, its seas, the high altitudes, the vertical sun, etc.:

It is a safe prophecy that, given a few earnest and intelligent workers this country will one day play a part second to none in the advancement of national meteorology. As England is an epitome of stratigraphic geology, *so is India an ipitome of atmospheric physics*, and, while it presents within itself, the most varied condition of form and surface, and together with the seas, the great primary contrast of continent and ocean, ranging through nearly 30 degrees of latitude, and during five months of the year is bathed in the intense radiation of a vertical sun, it is, so to repeat, a secluded and independent area. On the north, the Himalayas shuts in the lower half of the atmosphere and constitutes the natural limits of the monsoons, on the south an only less defined meteorological frontier excites in the zone of all but unvarying, barometric pressure of all equatorial belt.[45] (My emphasis) .

But such sentiments were not restricted to one particular science, which might have been enriched by particular conditions in India. Similar feelings were reflected in colonial India with regard to geology, the major 19th century European scientific discipline. Campbell argued that the very important research of primary rocks has been neglected in Europe because the Isles of Great Britain provided few opportunities for the study of primary geology. Thus in the absence of sufficient data, no appropriate theory could be developed. India, to that extent, was a great advantage, against which Europe 'sink into insignificance';[46]

The Peninsula of India presents a vast field for the study in question, where the formation of enormous magnitude, extent sometimes for 50 miles, presenting to view the same kind of rock, until its peculiar nature and varieties can no longer be overlooked. *Compared with this vast field, the primary formation of Great Britain and even of Europe sink into insignificance, and we require but energy and application, to collect the necessary knowledge, and possibly to unravel the law by which the formation has been aggregated*[47] (My emphasis)

The work of the Archdeacon of Calcutta, J.H. Pratt on the Himalayas regarding the geodetic problems, also reminds us of the famous researches. To him India with its diverse surface features—highest mountains, great plains followed by large ocean stretching to the South Pole provided the ideal facility for examining the differential action of gravitational forces on the surface of the earth,

...Hindostan affords a remarkable example of this as the most extensive and the highest mountain ground in the world lies to the north of that continent and an unbroken expanse of ocean stretches south down to the South Pole. Both these causes by apposite effects make the plumb line hang somewhat northerly of the true vertical.[48]

Colonial scientists believed that India had to lot to offer to palaeontology especially with respect to the Siwalik fossils. Falconer was singularly responsible for drawing the attention of the European scientific community to the Himalayan ranges. The finest hour of this claim for India's superiority came when he, while addressing the Royal Asiatic Society of London in 1844, claimed that through the geological researches in India. 'The human race has been traced further back into time in the past than in any other quarters of the globe; and the tendency of all enquiries has been to show that the civilisation of *at least a large section of mankind first dawned in the valley of Ganges'*.[49] (My emphasis)

Claims of this nature were made at a time when the study of geology was displaying acute Euro-centrism in Europe. There was a general presumption in England amongst geologists that the history of the Earth had been a teleological process and that the British Isles were composed of a uniquely complete succession of rock formation, the ultimate purpose of which was to bring about the pre-eminence of its civilisation. Falconer's claims show that Europe no longer enjoyed the lone superiority in this teleology. Other parts of the world like India were proved to be unique, too. At one level this was an aspect of the Orientalist challenges to claims of European superiority. At another, this was on outcome of the experiences of the European scientists working away from the Centre, of the challenge they and their science faced in remote areas. Repeatedly we find scientists who had worked on Indian stratiography and geodesy referring to the 'completeness' of Indian geography, to the presence of *all* sorts of geographical features rendering comprehensiveness to such researches.

In botany and entomology too, some scientists found certain wholeness in Indian nature. Thomas Thomson who studied Indian plants remarked.

To the philosophical botanist who is desirous of investigating the laws by which the distribution of plants is regulated, no flora in the world is more interesting than thatof India... The interest of the Indian flora lies in the absence of new forms, in the identity of its plants with those of other countries, in the occurrence of European plants on our Western mountains, of Japanese plants in the Eastern Himalayas, of Chinese plants in our dense Eastern forests, of a purely Egyptian flora in Sindh, of a Polynesian flora in Malaya, and of numerous African types in the mountains of the Madras Peninsula...[50]

In Thomson's words we see India being imagined as a confluence of earth's natural history, similar to the 'amphitheatre' of ideas of Jones. In scientific terms the implications were clear. Through the study of the natural world of India one could possibly grasp the natural life of the entire earth.

We have to remember here that the European scientists' journeys away from their native conditions have generally been enriching and crucial to their knowledge. Charles Darwin's long period in South America, Alexander Von

Humboldt's and Ami Boupland's studies also in South America, Leopold Von Buch's long travels in many parts of Europe that were still remote, and Charles Lyell's long trip through remote areas of France and Italy provided important links in their ideas. But what was unique in the Indian case was the presence of an institution like Asiatic Society, which helped to codify and articulate this critique of Euro-centrism both in terms of its culture and geographical location. To that extent these studies were not just a product of the fascination for the alien, they became an attempt to institutionalise comprehensively the search for an alternative Centre.

However, it was in this 'discovery' of another world that the project of the Asiatic Society translated itself actually into a celebration of the Western man. The urge to explore the unknown had placed him in a unique position as the author of this modern world. Thus this critique of Euro-centrism was essentially an 'European' project. This becomes clear in William Jones' words,

> ...there is an active spirit in European minds which no climate or situation can wholly repress, which justifies the ancient notion that, "a change of toil is a species of rose" and which seems to consider nothing is done or learned, while anything remained unperformed or unknown.[51]

Colonialism had provided this authority to the European epistemology and confirmed the 'power' of its enterprise. The European saw themselves at a crucial juncture of history and with a glorious role to play. Hugh Falconer's geological researches thus became an exercise of that power of European reason to 'order' the nature of the east; 'The Almighty has given us reason, and left us, by the adequate exercise of that power, to investigate the laws and order of the creator.'[52] Colonialism had conferred both the dislocation and the expansion of European knowledge, one complementing the other. By its ability to relocate itself in different geographical and cultural settings, European epistemology could secure itself as the dominant paradigm.

In locating the links of the scientific project with such questions of colonial knowledge and power, I divert from Deepak Kumar's arguments regarding colonial science. His detailed research has established the links between science and the colonial exploitation of resources, administrative requirements as well as the racial bias of the colonial state. It demonstrates how the apparently scholarly researches on Indian topography, geology, botany were guided mostly by commercial and administrative factors.[53] However, such an approach tends to reduce scientific research to an extension of the state machinery. It leads to a pre-conception that a career made in the colonies was ultimately confined to serving the economic priorities of the colony. The economic setting was certainly crucial but imperialism itself, as recent researches emphasise, needs to be understood in terms of cultural and political control as well.

This issue of colonial knowledge takes us to an important distinction between the Indo-centrism of the textual studies and that of the researches

in natural science. It was in their approaches towards tradition and modernity. The cultural project revered Indian culture. The Orientalists here were fascinated by its rich, ancient and classical traditions. They believed that contemporary India was steeped in medieval darkness and a renaissance was possible only from within the original culture, by a return to its pristine sources. There was an attempt to preserve that tradition from the onslaught of British administration and law, which were considered to be alien to India society. This is explicit, for instance, in Halhead's recommendation that Bengali be cleansed of foreign vocabulary Persian, Portuguese as well as English.[54]

However, in the scientific project the scientists were aficionados of neither Indian nor European nature. Their actual commitment was only to science. This science implied a rupture with tradition, particularly in a colonial world; the Baconian 'new' method was distinct from other traditions of studying natural history both in Asia and Europe. In colonial India the project of science thus was a conscious process of introducing an alien knowledge, which the scientists actively undertook. The quest was to make a new and fundamental statement about the Orient's natural world.

In the cultural Orientalist project the articulation of the European epistemology operated at an indirect and subconscious level. At an immediate level the celebration was of the traditional Indian systems of knowledge. The scientific sojourns were a conscious advocation of Western rationality to discover the 'truth' of Indian nature, hitherto unknown and unexplained. The intervention was thus more deliberate and direct. At that level it shared the same aggressive rationalist logic of Benthamite positivism which Orientalism was opposed to. Interestingly, both these contradictory trajectories of research were pursued often by the same individuals and under the same institution.

THE NEW METHOD

Science had by the 18th century clearly defined its cognitive identity as distinct from and superior to other 'non-sciences'. It had also more directly established itself as a hegemonic discourse. This it had achieved by rejecting other traditions of knowledge, discrediting all existing forms of culturally distinct social norms, in the interest of rationality and 'progress'.

In colonial India, the early scientific texts demonstrate ample evidences of a reverence for the 'new' science and the subsequent disregard for tradition. In an interesting letter to the *India Review* a writer expressed his disdain for older forms of science like Alchemy and Astrology, the same disciplines that the Orientalists had otherwise celebrated in their works. He stated his surprise that an experiment in alchemy had found a place in the pages of the famous *Mechanic's Magazine* of England. He also expressed his shock at the fact that two European merchants patronised an Indian alchemist in an attempt to produce gold from dewdrops. Terming these activities as irrational and non-scientific the writer wondered how such subjects still attracted attention despite 'the advance to which learning has attained in the present...'[55]

Henry Piddington's booklet *Conversations about Hurricanes* is another significant example.[56] It was written in the form of an imaginary conversation between a naval scientist, Mr. Helmsley and his nephew who were acquainted with the 'new' naval science and two old sailors who depended on their traditional knowledge. The book is an unfolding of a drama in which the non-believers are persuaded to see the advantages of the new science. Mr. Helmsley, whom we can identify with Piddington, argued to convince the two sailors who initially rejected his knowledge of 'the new fangled science'. But gradually he demonstrated how only the new science has the 'right' to be accepted as the only form of knowledge. Helmsley concluded, 'I must affirm that it is you (the sailors) who have no right to deny what is plainly grounded on pure, though very simple, mathematical demonstration'.[57] In the end, the inevitable happened. The final triumph of modern science took place over the traditional one. The two sailors, initially such strong critics of the new science, accepted its wisdom. One of them finally exclaimed that this new science had to be learnt:

> ...so that our knowledge then would all be fore knowledge, both as to what had happened and what in all probability was going to happen. Well! That is certainly different from the time when we could only say that we were going to have a gale, and guess that the wind would veer so and so, in which the oldest and the cleverest of us often mistaken; but I think now that with a good look out on signs of the weather one can scarcely be caught unprepared.[58]

So the scientists' role was also to intervene and to propagate a new knowledge to change the existing one and also to convert the non-believers. Significantly, *Conversations* begin with this quotation from Bacon, '...those whose conceits are beyond popular opinions have a double labour; the one to make themselves conceived and the other to prove and demonstrate.'[59]

Science had adopted this particular responsibility in the modern world; this had given it a distinct identity particularly in the colonial territories. In fact, from the 18th century there was a definite shift in the European writings on the colonial world. Accounts of a more technical scientific nature were replacing the earlier general travellers' accounts of the natural world.[60] Even within the Asiatic Society, which had idealised a miscellaneous and pervasive survey of the Orient, had in fact perceived the two projects as discrete. Although never articulate clearly there was a consciousness that these had to be treated separately. William Jones in his inaugural speech had said, '...If now it be asked, what are the intended objects of our inquiries, within those spacious limits, we answer, MAN and NATURE, whatever is performed by the one, or produced by the other...'[61]

The 'Man' represented the Oriental self—its culture; language, tradition and poetry. 'Nature' represented the geographical contours of Asia—its

physical world, natural history. Both were the 'other' of Europe, in terms of their character, logic and aesthetics. But the two had to be perceived separately. Throughout Society's history this separation was maintained. Jones himself was involved in the study of Indian botany in accordance with the Linnuean model, which were distinct from his Orientalist studies. These studies are often overlooked within Orientalist scholarship. By the early 19th century, it was felt that a special body specifically for scientific research was needed within the society. In 1808, 7 September it was resolved that:

> ...a committee should be formed to propose such plans, and carry on such correspondence as might seem but suited to promote the knowledge of Natural history, Philosophy, Medicine, Improvements of the Arts, and Sciences and whatever is comprehended in the general tern physics.[62]

A committee was accordingly formed and meetings were held, but after sometime they were discontinued. Again towards the close of 1827, several members of the Asiatic Society felt that the ordinary meetings of the Society were held at intervals too remote and for purposes too miscellaneous to be conducive to promote scientific investigation. Thus on the 2nd January 1828 it was resolved at a General Meeting that a physical committee should be formed. Resolutions were passed at the same time empowering the committee to elect its own officers, to frame its own rules and to publish its proceedings as a distinct part of the *Asiatic Researches*.[63] This, along with the Calcutta Medical Physical Society (1823) played an important role in giving a specialised and professional shape to scientific researches in this country. Soon the *Asiatic Researches* was found to be too general for the specialised scientific studies. The *Gleanings in Science* was published for sometime from 1829 with the sole aim to encourage scientific researches in India and elsewhere.[64] Before very long, the entire orientation of the Asiatic Society was found 'too general' for proper scientific research. As a result of that scientific studies increasingly were carried on outside it in specialised government departments. The Society in turn came to be identified only with its Orientalist studies.

The second distinction between the two was in their links with Europe. For their enchantment with Indian culture it was possible for the Indological studies to attain their fulfilment at the spatial-cultural site of the Orient itself. The Orientalist texts appeared in Europe, as advertisements of Oriental culture—the reference points remaining the 'Orient'. Thus its links with Europe were at an indirect level. Science on the other hand, was more firmly devoted to Europe. As the dominant paradigm of modern European thought, science was its most treasured possession. In spite of its attachments with Indian nature, its intellectual and institutional activities were essentially focussed on that continent. In the domains of science Europe was the site of actual recognition and glory. While the Orientalist romanticisation of India reflected a search for th logic. This strong link with Europe of the scientific researches can be established at several levels.

THE LINK WITH THE CENTRE

Scientific researches in the colonies were a part of the European project of codifying nature on a global scale. Their researches were premised on conditions of universality. The fascination with Indian nature was thus partly an outcome of its liminality and partly a product of its association with the Indological project. This strong Centralist orientation explains why an institution like the Asiatic Society could be founded in the peripheries as early as 1784 (even before its London counterpart was born) while a purely scientific institution was yet to be found in the periphery.

The sudden rise of world-wide studies on earth science were a product of Europe's growing concerns with the shape and age of the earth and its expanding territorial possessions. The urge was to consider the earth and its place in the universe in a fully scientific manner. The age of maritime expansion had already raised the various problems of the motion, shape and gravity of the earth. By the 19th Century the new scientific tools aided by the Industrial Revolution and by the expansion of imperialism had revolutionised concepts of exploration, transport and mapping.

The early French scientific expeditions to equatorial South America as well as to the Arctic Polar Regions in 1735 were, for instance, the outcome of the European concern regarding the shape of the earth.[65] Since 1838, resolutions passed by the British Association for the Advancement of Science pressed the government many times to extend the ordinance survey maps at home and abroad and to keep mining records and surveys on file.[66]

I would take up the case of geology first to show how such researches in colonial India were products of European scientific concerns for a universalistic world-view.

Geology, the scientific study of the earth, during the late 18th century and early 19th century opened up a vast and unfamiliar sphere for observation. The study of rocks and fossils showed that the history of the earth had not covered the same stretch of time as the history of mankind, but extended back immeasurably before the appearance of man. The significant conclusion that was reached was that pre-human earth history had not been a single period of continuity, but a concatenation of successive worlds, i.e., of periods of geological history characterised by a particular extinct flora and fauna. A great chain of history appeared to unroll from the new understandings of rocks and fossils, analogous and complimentary to natural history.[67]

The reconstruction of pre-human periods of earth history was based on two separate areas of study. The first was linked to chemistry and consisted of the mineralogical classification of rock formations. Abraham Gottlob Werner initiated the

chemical analysis. The second area of study was linked to medicine. Through a study of comparative anatomy, extinct animals could be identified using fossil bones. Johann Friedrich Blumanbach, Professor of medicine at the University of Gottingon, initiated such studies. George Cuvier extended these studies greatly in the field of vertebrate palaeontology.[68]

Such studies began in France and Germany but by the 1820s this scholarship had made great strides in England particularly under William Buckland. English scientists came to be the finest and most sensational contributors to it. The English school of geology under the leadership of men like Buckland, Conybeare and Sedgwick was characterised by its work on the geology of England and Wales. These scientists were committed to diluvialism and to the progressivist synthesis of earth history in the 1830s.[69] Geology as a science in England rapidly rose to high status. In a little more than two decades geology or earth history with the help of inductive philosophy had climbed to the very top of hierarchy of scholarship in science. Herschel wrote in 1830, "geology, in the magnitude and sublinking of the objects of which it treats, undoubtedly ranks in the scale of sciences, next to astronomy".[70]

Thus geology consolidated itself as a discipline in the period between the 1750s to the 1830s. In 1743 the first geological map and in 1747 the first geological journal were published. In the period from 1790 to 1815 William Smith for the first time surveyed rock units over much of England and used fossils for the first time in that process. Soon fossil guided stratiography shifted to France and was applied to mapping Tertiary formation by Georges Cuviar and A. Brongniart. The year 1830 was marked by Lyell's publication of *Principles of Geology*, which in many ways first defined modern geology. It demarcated the limits of the subject. It clearly stated that the study of the geological situation of present times hold the key to the understanding of the vast changes which occurred in the past.[71]

In the same period there were important dimensions of change in the European scientists' understanding of themselves and their relation to the rest of the globe. It was marked by an orientation towards the intensive exploration and the construction of a global scale of meaning through the descriptive apparatus of natural history. A major part of colonial Indian geology could be seen in the context of this consciousness. Geological sciences were introduced in India around the same time that these above-mentioned changes in the philosophy of natural science were taking place in Europe. From the 1820s numerous natural history surveys based on the above mentioned premises had begun in different parts of the country.

In this atmosphere of emerging consensus about the purpose of the surveys both in Europe and the distant colonies, the Centre often tried to inform and instruct researches in the peripheral areas. In 1832 a short essay appeared in *JASB*, titled "Progress of European Science: Theoretical Geology".[72] This essay sought to elaborate to those in India the motives with which geology was pursued in Europe.

in Europe were trying to develop and test different theories of earth history through their surveys of rocks and fossils, it added—

> Thus geology has almost ceased to be the science of observation alone, as it was so long its boast to be called, and it now challenges a share in the physical speculation of the atmosphere, the dynamical calculation of the mechanical, and primeval chronology of the cosmologist and historian...[73]

With the introduction of this expanding vision of geology the article next put forward its main objective. That was to inspire those in India to 'initiate such studies'. The suggestion was that the global implication of such a science necessitated that it should be undertaken in India as well. The passage pointed out that M. Edie de Beaumont, by his own and others' recorded observations had proved that whole mountain chains have been elevated at one geological period and that great physical regions have partaken of the same movement at the same time. The confirmation of this hypothesis depended on further researches on the same line elsewhere.

> We must still look for evidence where on the synchronism of the elevation of these mountain may rest to our Indian geologists, whose exertion will naturally be stimulated to attempt the solution of the problem. Russia has been before hand with us in exploring their newly acquired portion of Asia,...
> ...It did not come within our purpose to particularise any practical geological researches, but we have digressed in this case, the ground trodden (by Russians) is closely connected with outr own Asiatic fields, and it may act as a useful stimulus to point out what our neighbours are about. The court of Directors have appointed to Madras an eminent geologist of whose researches in Sicily, the president of the Geological Society speaks in high terms, to him we look with great expectations, and when he enters the vast field, hitherto but partially visited by Voysey and Dangerfield...[74]

More specific guidelines were published in Indian journals. In one issue of *Gleanings in Science,* there were detailed directions for over 30 pages about the means of testing out different European geological theories in India.[75] Its objective was to provide the colonial geologists with information on recent theories of earth history, and thus stimulate similar researches here.

> When we see that many of the links wanting in one country to the chains of geological evidence are to be sought for in another; we cannot deny but that the progress of geology would be considerably accelerated by general and simultaneous effort on the part of our countrymen scattered over the eastern world...[76]

A set of directions from the Geological Society of London published in 1833 drew attention towards palaeontology and the significance for its studies in 'distant countries'. It said,

> The G.S. (Geological Society) begs to impress upon the minds of all collectors, that the chief object of their researches should be specimen of all these rocks, marks, or clays, which contain shells, plants, or any sort of petrifaction

> ...That it should be a general maxim with geological collection to direct their principal attention to the procuring of fossils, organic remains, both animals and vegetable. These are always of value when brought from distant countries, especially when their locations are closely marked...[77]

There were examples where geological theories developed in European landscapes were directly applied to Indian conditions. Captain Newbold attempted to apply the Glaciation and Diluvial Theory in South India.[78] Agassiz and Buckland introduced this major geological theory in Great Britain. It postulated the existence formerly of permanent snow, ice and glaciers over a large part of the Northern Hemisphere. Newbold showed that this theory was already tested in Central Russia and South and North America. The huge landmass of India was yet to be studied.

> General Briggs, perceiving that India was silent, while Europe, parts of the Asia and America in both hemispheres, were contributing to the general stock of knowledge on this head, applied to some of the local authorities in the east to lent their aid in eliciting information...[79]

According to Newbold, the total absence of boulders or drift formation in South India, supported the general theory that the masses of drifting ice on approaching warmer latitudes melted on their sides and surface and discharged their rocky freight long before reaching the equator.[80] In the glaciers of the Himalayas Messrs. Schlagintweit found evidences, which questioned the existing 'glacier theory', developed from studying the Alpine glaciers.[81] In similar fashion several researches on various rocks and minerals were undertaken to extent European theories here. Researches on gypsum in the Indo-Gangetic tract of mountains, diamonds in Panna, Bundelkhand, and the Deccan trap were all attempts to examine specific theories of the Centre.[82]

Lambton's Trigonometrical Surveys were extensions of similar surveys by Europeans elsewhere. The survey in England under Colonel Mudge was undertaken to obtain a correct plan of the island of Great Britain. The members of Swedish Academy were likewise conducting research in northern Europe. These researches, along with those in India would provide, Lambton conceived. 'The most extensive and most accurate data hitherto obtained for determining a question of great importance on physical astronomy, viz. the dimensions and the figure of the earth.'[83]

Many surveys were undertaken in colonial India on palaeontology and its involvement with the question of emergence of life. It is not to suggest that geological researches in the colonies were a product of instructions from the Centre. The emergence of geological researches in the colonies have also to be understood, as I have pointed out, in terms of the status of Asiatic Society and the liminal creative space available to the scientists in that institution. I mention these instructions here to illustrate that in spite of this distance between the Centre and the periphery the orientation of the researches were compatible. Th...

were published in the journals of the Asiatic Society shows the space available to the Centre to attempt to instruct, direct and channelise researches in the colonies. Similarly botanists in India were involved in Linnaeus' project of organising species into a coherent table.[84] The most influential figure in shaping that was Joseph Banks, the Director of the Kew Gardens in London. Through his influence and correspondences with the British and other naturalists scattered in different parts of the world Banks was able to direct British botanical endeavours. The other influential figures were William Jackson Hooker (1785-1865), Professor of Botany at the University of Glasgow, and Director of the Kew Gardens since 1841, and his son Joseph Dalton Hooker (1817-1911), as assistant director and later director of the Kew during 1855-85.[85]

In the 1830s William Whewell, the famous British scientist in a letter to *JASB* introduced his global scheme of determining the tidal variations along the coasts of the earth.[86] He provided suggestions for those who had the opportunity to make or collect observation on the tides at their place of residence. A few years later he published another memoranda in *India Review* for the same purpose.[87] Different people in various parts of the world took up these suggestions. Mr. J. Dias studied the daily tides at Singapore from 1st September 1834 to 31st August 1835. Lieutenant Siddons had started his studies of tides at Chittagong. Many others like W.T. Loius of Malacca, Mr. C.B. Greenlow (Secy. of the Marine Board) from Balasore, Dr. Barrister at Madras, M. Bedian from Pondicherry, Sir R.W. Harton from Bombay sent their reports to fulfil the project.[88]

It was also a question of shared passions and visions. The individual scientists working in the colonies, who learnt their science in the academia of Europe had imbibed values and sentiments similar to those of the scientists at the Centre. Hugh Falconer while working on the Siwalik fossils exclaimed, 'What a glorious privilege it would be, could we live back, were it but for an instant into these ancient times when these extinct animals peopled the earth!'[89]

In another brilliant essay he expressed his fascination for palaeontology, reflecting the same prophetic visions and the sub-terrainian imaginations that were storming contemporary European geology,

> We have only to light the torch of philosophy to seize the clue of induction, and like the prophet Ezekiel in the vision, to proceed into the valley of death, when the graves open before us and render forth their contents; the dry and fragmented bones sum together, each bone to his bone; the Sinews are laid over, the flesh is brought on, the skin covers all, and the past existence to the mind's eye starts again into being, decked out in all the lineaments of life...[90]

Both Falconer and Cautley carried out several surveys fired by this imagination. In 1830, they jointly wrote about a new fossil 'Ruminanta Genious', found in the Siwaliks, which they considered a major finding as it filled the crucial gap between the Ruminanta and Pachydermenta in the sequence of animal species.[91] In 1840 Cautley discovered another fossil-

Camellia' which proved, he argued, that the camel lived at the same time with Sivatherium, Anoplotherium-Simia, hippopotamus and rhinoceros. This two was a link between Pachydermenta and Ruminanta.[92] The fossil remains of the hippopotamus in the Siwalik hills helped to recognise the character which distinguished the Siwalik species not only from the existing ones in Africa, but also from those of Europe.[93] Falconer developed his theory of the geological formation of India based on these researches.[94] According to him the sub-continent of India at an early tertiary epoch, was a large island, situated in a bight formed by the Himalayas and the Hindu Kush ranges. Several upheavals took place in the course of which the plains of India were connected with the ancient continent, the Siwaliks were formed and the elevation of the Himalayas increased by many thousand feet. This event and the climatic changes that it involved caused the extinction of the Tibetan and Siwalik faunas. Elsewhere in the Narmada valley in central India, other scientists identified several fossils.[95]

In the 1840s, Dr. J. Adam, who was then working on the rock formation of Bundelkhand, clarified what geology meant to him, 'To trace the changes on the ever-varying surface of the globe, to compare the present with the past, and thus to study the history of its inhabitants in their several epochs of existence, from the shrub and insect upto man, the proud lord of all...'[96] In 1836, a colonial scientist expressed his reverence for this newly emergent discipline, 'It has been said that no man can be considered enlightened without knowing something of geology.'[97]

In terms of organisation too, the Centre loomed large on the periphery. Research institutes like the Botanical Garden in Calcutta was built closely following the pattern of Kew Garden of London. Scientific journals too were modelled on the European ones. Corbyn's *India Review* drew its inspiration from the *Records of Science, Philosophical Journal. The Mechanic's Magazine* and the *Repertory of Invention and Art*, etc.[98]

The emergence of the journal *Gleanings in Science* was in response to the changing orientations of the Central scientific research. The 1830s saw the emergence of the Declinists in Britain pressing their case against the research organisation of Royal Society. The most important figure among them was Charles Babbage who argued that the Royal Society's amateurish character of science had contributed to its decline vis-à-vis continental science.[99] He showed that the liberal membership patterns of Royal society led to a situation in which a majority of members were amateur gentlemen. In contrast to that members in the French and Prussian academies needed to have outstanding scientific achievements. James Herbert (a scientist in colonial India) launched his *Gleanings in Science* around the same time sympathising with Babbage's critique. He asserted that *Gleanings* would be a purely science journal ideal for serious men of science.[100] He also reviewed Babbage's book and suggested that the Asiatic Society suffered from the same problems that Babbage had identified for the Royal Society.[101] If the high tides of amateurish science of the Royal society had influenced the research orientations of the Asiatic Society in the 1830s critique of that in Europe had launched a similar movement in India—in either case the Centre thus getting confirmed. The other attempt to initiate a professional attitude was through the various committees like the Physical Committee.

THE CENTRE-PERIPHERY PROBLEMATIC

But if the Centre was seeking to instruct and shape scientific researches in the colony, it was simultaneously being questioned and challenged by the peripheral research experiences. I have already shown the extent to which the individuals at the periphery enjoyed a creative space and how geographical Euro-centrism had been questioned in the peripheral researches. Having discussed the transfer the flow of knowledge from the centre to the periphery, how do we conceptualise the reverse flow, that from the periphery to the centre? How did such instances of peripheral·creativity ultimately shape the nature of western science? How far were they accepted and rejected by the scientific elite of Europe? In this last section I will discuss some of the problems in conceptualising this particular transfer of scientific knowledge.

There has been some discussion on the question of the extent of influence that the knowledge collected from the periphery had on the knowledge of the Centre. The earlier writings of Donald Fleming and George Basalla looked upon scientific research in Australia and America from a centralist viewpoint.[102] They understand science in the colonies as a simple 'spread' of western science from centre to the periphery and peripheral researches as data gathering by 'second-rank academics', who carried through assigned tasks. The writings of Edward Lurie, A. Hunter Dupree, I. Bernard Cohen and particularly Roy Macleod on the other hand stressed the scientific genius of colonial personalities.[103] MacLeod stressed how metropolitan scientific communities were dependent on the discoveries made in the colonies. It is from this point of view that he develops his concept of a 'moving metropolis', a dynamic concept of imperial science. This is linked to MacLeod's dynamic concept of imperialism, which stressed its pervasive yet, unobtrusive character, the ability to recognise the vitality of the colony and yet maintain its leadership over the same. However, mere emphasis on the scientific creativity in the periphery misses the epistemological equation between the centre-periphery. Scientific activities in the periphery were admittedly creative and hybridised. But how do we conceptualise their influence over European scientific paradigms?

The issue is extremely complicated as it involves the important question of the nature of growth of scientific knowledge. Debates on the influence of colonial knowledge on the Centre must take into account how research in the colonies led to transformations in western scientific knowledge, whether there was any paradigmatic shift in any sense of the term, or whether these researches merely affirmed and elaborated on existing knowledge.[104]

As Kuhn has suggested, the acceptance or rejection of a new theory depends on the consensus within the scientific community. It is in that context that the primacy of the scientific community of the Centre on the shifts in scientific knowledge must be assumed. I will give an illustration of the acceptance of a very prominent theory developed in the periphery—J.N. Pratt's geodetic theory to illustrate my point. His researches were a part of the growing interest among the European scientific community regarding the depth of the earth, the density of the earth and the gravitational effects on the surface. The interest was also regarding the shift of gravity at various levels of the surface of earth. Pratt attempted the surveys at the base of the world's greatest mountain system, the Himalayas, during the first geodetic survey of the great Arc of the Meridian in India. He found that due to the great irregularities of the surface in terms of the mountains, the plains and long stretch of ocean till the South Pole, the plumb-line here hung northerly of the true vertical.[105] Pratt demonstrated that this shift was observable at other stations in the country.[106]

What is interesting is that a century earlier a French explorer Pierre Bouguer, working in yet another peripheral region in the Andes of South America had observed similar phenomena.[107] But his findings did not receive much attention within the scientific community of Europe. Pratt was fortunate because by his time, the effects of topographic features on the plumb line, were better understood. Pratt had much better topographical information with which to explain his findings. He explained the deviation in terms of a thick solid crust of the earth from where the mountain drew their mass by an extension and small expansion of the matter in those lower regions, causing the deviation in the density.[108] This was in opposition to the contemporary explanation suggested by of G.B. Airy whose work in English mines had convinced him that a thin solid crust covered the earth's surface. He explained this phenomena in terms of a hydrostatic equilibrium.[109] While Airy's ideas continued to be popular among geologists. Pratt's theory received acceptance among the physicists like William Thomson whose geomagnetic studies of 1863, showed that the hypothesis of complete internal fluid was untenable. The later developments on ideas of solid and fluid state gave rise to the idea that some materials can act as either one or the other, depending on the time scale of application of the deforming forces. This illustrated that the two theories were actually not in contradiction to each other.[110] This finally led to the general acceptance of both Pratt's and Airy's theories.

This single example shows the complicated route a peripheral experience took to gain acceptance at the Centre of science. Thus the evaluation of peripheral scientific research would require a detailed analysis of the politics, positions and status of contemporary European knowledge. Without such an analysis of the knowledge of the Centre the argument can be reduced to either centralist or a glorification of colonial enterprise. An analysis of such a mutation of scientific paradigms is beyond the scope of this paper. What

I have attempted here is to draw out the particular natureof centre periphery relationship within which the researches of the Asiatic Society were located. In doing so it has also revisited some of the questions of peripheral scientific experience and creativity.

In conclusion, the project of Asiatic Society was marked by a particular dualism, which was essential to its investigations. Its quest for truth, knowledge and enlightenment coexisted with an enchantment with the Orient. Thus its ingression engendered a certain fascination; its Euro-centrism co-existed with disenchantment with the Occident. This is where their search of science and for the Orient got fused, diverting it from the Centralist inclinations of metropolitan science. Orientalism had urged the colonial scientists that it was actually in this tropical site with all its geographical diversities that science could attain its true enlightenment.

But 'Orientalism of science' had its limits. These critiques were the marginal voices within the growing empire of science where the metropolitan logic and inclinations were predominant. While it was possible for the Indological studies to attain their fulfilment at the spatial-cultural site of the Orient itself, science was more firmly attached to Europe. Moreover, their critique of Euro-centrism of science was, like the Indological project, not only situated within the expanding European hegemony but ultimately enriching it. It helped Europe to relocate itself and acquire a more comprehensive and global reflection of its status. Situated in a colonial world, which was also a representation of the power of ideas and knowledge, the project of science was ultimately closely linked with European imperialism. The exploration of the tropical nature, the new classificatory schemes indicate the control of a new knowledge and language over distant geographical terrain.

Notes and References

1. Baconian inductivism (from data to hypothesis) formed the basic methodology for Royal Society's various research agendas and explorations. For the Baconian influence on the 19th century Royal Society, see R. Yeo, 'An Idol of the Marketplace: Baconianism in the nineteenth-century Britian', *History Of Science*, vol. 23 part 1, no. 59, pp. 5-31.
2. Charles Richard Weld, *A History of the Royal Society, with Memoirs of the Presidents Compiled from Authentic Documents*, vol. II, London, John. W. Parker, 1848, pp. 354-55. For a more recent and topical history of 18th century Royal Society see David P. Miller, "Into the Valley of Darkness" : Reflections on the Royal Society in the Eighteenth Century', *History of Science*, vol.27, part 2, no.76, 1989, pp. 155-66.
3. Steven Shapin, *A Social History of Truth : Civility and Science in Seventeenth Century England*, The University of Chicago Press, Chicago and London, 1994.
4. Christian philosophy formed a crucial aspect of Boyle's work. Shapin tends to see his Christian virtuosity as part of his identity as a gentleman rather than as important component of his work and thought. 'The *achieved* identity of this person (Boyle as a Christian gentleman) was made into a valuable

resource in securing legitimacy for the experimental enterprise and credibility for empirical knowledge-claims', *ibid.*, p. 189. Thus in his analysis only the experimental enterprise constituted Boyle's real project, not the Christian problematic. This fails to explain why only the former got legitimised as truth, while the latter was gradually marginalised as irrational.
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12. *Ibid.*, p. 125.
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15. *Ibid.*
16. Martin Rudwick, 'Geological Travel and Theoretical Innovation: The Role of 'Liminal experience' ', *Social Studies of Science*, vol. 26(1), 1996, pp. 143-59. The concept is used to describe a particular journey from the familiar to the distant and back.
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21. *AR*, vol. I, 1788, pp. 57-121.
22. Stephen and Lee, *Dictionary of National Biography*, vol. I, p. 970.
23. *I.R.*, vol. III, April 5, 1838, pp. 40-6.
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27. *Ibid.*, pp. 17-8.
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31. Charles Hudson in a letter to the Editor *I.R.*, 'The plenoerum on water Barometer', *I.R.*, July 1843, pp. 424-7.
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39. See Kejriwal, O.P., *The Asiatic Society of Bengal, and the Discovery of India's Past, 1784-1838*, OUP, Delhi, 1988. David Ludden, has worked on a general scheme of 'Orientalist empiricism' and 'colonial knowledge', which led to a 'factualised' statement on India but has only analysed the studies on Indian law, customs, etc. His study on Jones' researches in Hindu and Mohammedan laws fails to develop the empiricism of his botanical researches. Ludden does focus on Rennell's maps but that comes as an extension of the cultural studies on India. The questions of modern science and geography associated with such map making are not analysed. See, his 'Oriental Empiricism: transformation of Colonial knowledge', in Breckenridge et. al. edited, *Orientalism and the Postcolonial Predicament.* Matthew Edney's work on maps and colonisation does focus in detail on the scientific concerns that prompted such studies. He approaches the larger codification of a colonial world through two types of gazes that the British employed: the scientific, which was the examination and graphic reproduction of landscape and the picturesque, which, opposed to the graphic one was an aesthetic, glorified representation of the same landscape. Edney identifies the two as *complimentary* instances of 'observation', embodying their power over the 'observed'. However, the problem lies with his rather narrow categorisation of the 'picturesque', which refers only to the various European landscape paintings on India and not the Indological and textual studies. From that stand point the complicated interactions of the various projects remains to be analysed. See *Mapping on Empire*, pp. 53-63.
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63. *Ibid.*
64. 'It was thought that by establishing the practice of communicating to one another the various difficulties occurring in our pursuits of any enquiry, he new views which might strike us, or the criticism or detection of errors which might be forced on us in our references, a feeling might be created, which would tend, in some measure, to assist this effort, while to the student, the practice might afford an opportunity of obtaining information which he would otherwise seek in vain. It was thought, in fact, that by showing to the scientific community of India, small as it is, their own strength, and by suggesting and supporting a combination of effort, the apathy and indolence which are the bane of our Indian clime, might be in some measure counteracted', *Gleanings*, vol. 1, 1829, pp. 6-7.

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