The Vertical Globe

Altitude and Science in the Exploration of the Himalaya, 1800-1850

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Clare College, Cambridge

April 2019

This dissertation is submitted for the degree of Doctor of Philosophy.
DECLARATION

This dissertation is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text.

It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. I further state that no substantial part of my dissertation has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text.

It does not exceed the prescribed word limit of 80,000 words for the Degree Committee of the Faculty of History.

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Lachlan Charles Fleetwood
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SUMMARY

The Vertical Globe: Altitude and Science in the Exploration of the Himalaya, 1800-1850

In the first half of the nineteenth century, the Himalaya were finally being recognised as the highest mountains on the globe. Simultaneously, they were becoming the insecure northern frontier of the East India Company’s burgeoning Indian empire. This thesis examines the scientific, political and imaginative understandings of the Himalaya that emerged from this context. It traces two overlapping sets of arguments through the mountains. Firstly, it examines the laboriousness of scientific practice in the high spaces of the Himalaya, and the inherent dependency of European surveyors and naturalists on pre-existing networks of labour and expertise. Secondly, it details the role of global comparison in the rise of verticality as a framework for understanding both human and nonhuman worlds.

The thesis consists of five thematic chapters, each of which deals with a different type of science: measurement, physiology, geology, botany, and biogeography. By addressing a range of interrelated sciences rather than focusing on only one, it becomes possible to explain how the mountains became both spaces and subjects of scientific practice. Methodologically, the five chapters do so by examining the practical aspects of doing science in remote and often topographically challenging locations. They concentrate especially on the moments that instruments, bodies and practices broke down, which are revealing of the social relationships that underpinned the knowledge they produced. A close focus is also maintained on everyday interactions between travellers and their guides (especially Bhotiya, Tartar, and Lepcha), which often highlight the limits of imperial mastery. Tracing the reconfiguration of these networks and practices ultimately reveals the many ways that the mountains were rendered as marginal spaces in this period in relation to lowland norms.

More broadly, this thesis demonstrates the value of using geographical features as sites and scales for histories that transcend traditional national and area studies framings. By placing mountains at the centre of the analysis, it shows that travellers in the Himalaya were constantly measuring their experiences against expectations arising from the Alps and the Andes. It thus offers a methodology for examining the formation of what were inherently both sciences of the globe and global sciences in practice. At the same time, it shows that these global comparisons could be contradictory, often only adding to scientific and imperial uncertainties. Ultimately, this thesis thus argues that we need to pay attention to disconnection as much as connection in the making of supposedly global categories in the nineteenth century.
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Part of the research for this thesis (specifically material from Chapters 1 and 2, as indicated in the footnotes) has been published or is forthcoming in the journals History of Science and Itinerario. I thank the editors of these journals, Lissa Roberts and Carolien Stolte, and the anonymous reviewers, for their enthusiastic engagement with my work, and for their insightful and incisive feedback on my submissions.

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LIST OF ABBREVIATIONS

DC = Director’s Correspondence  
DDn. = Dehra Dun Volume  
EIC = East India Company  
Fdbk. = Fieldbook  
JDH = Joseph Dalton Hooker Collection  
Mss. Eur. = European Manuscripts  
NAI = National Archives of India  
SOI = Survey of India Records  
WD = Western Drawings

NOTE ON SPELLING, TRANSLITERATION AND LANGUAGE

All quotations from primary materials are reproduced verbatim, with the exception of the archaic long ‘ſ’ which I have replaced with the modern short ‘s’ for convenience. I have usually avoided using ‘[sic]’, except to note errors that might otherwise be misleading. The transliterations of the names of some of the Asian actors have been modernised i.e. ‘ee’ becomes ‘i’ and ‘oo’ becomes ‘u.’ When referring to the early nineteenth century, I have nevertheless retained the contemporary colonial spellings of names for places (e.g. Calcutta rather than Kolkata), in order to avoid anachronism. Except where specified, all translations from the French are my own.
THE VERTICAL GLOBE
Altitude and Science in the Exploration of the Himalaya, 1800-50

Introduction

While surveying on the edge of the Tibetan plateau in 1821, East India Company officer turned surveyor Alexander Gerard became concerned he was about to be stopped by Tartar border guards at the behest of the Qing empire. As he later wrote, ‘upon the surrounding heights near the Pass are many shughars or piles of stones sacred to the gods, and which at a distance exactly resembled men.’¹ Gerard continued that ‘the instant my people observed them, they said they were the Tartars waiting for me; I thought the same, as they had a very suspicious appearance from below,’ and ‘I could not divest myself of the belief (although the guides assured me that they were shughars) till I looked through the glass.’² Fears assuaged by the deployment of his telescope and ‘seeing clearly that the supposed Tartars were stones,’ Gerard went on to admit some hopes of penetrating further into what was becoming one of the most pressing ‘blank spaces’ on European maps.³ These were quickly dashed, however, as he crossed the altitude sickness-inducing high pass only to meet a group of Tartars – real, this time, rather than illusory – who had some time ago learned that he was coming, and were waiting to politely but firmly send him back to the lowlands.

This episode reveals much about the nature of Himalayan exploration in the first decades of the nineteenth century: the limits of knowledge and mastery, the dependence of European travellers on local guides and pre-existing networks of labour, and the growing insecurity of the East India Company (EIC) about the mountains to the north of their burgeoning Indian empire. Meanwhile, the shughars or cairns – piles of stone and cloth which served as both waymarkers and shrines to the mountain spirits – are a reminder that whatever the state of imperial knowledge in this period, these had long been lived and inscribed landscapes. Because the Himalaya have frequently captured European romantic, imperial and scientific imaginations, they are a particularly productive setting in which to explore knowledge production and scientific practice, and especially its cross-cultural

² Lloyd and Gerard, Vol 2, 120-1.
³ Lloyd and Gerard, Vol 2, 121.
dimensions. Within the vertiginous mountain locales and sweeping valleys of the Himalaya, geographies – both real and imagined – played central roles in the experiences of European naturalists and travellers and in their interactions with Himalayan peoples in the first half of the nineteenth century.\(^4\) Spanning some two thousand four hundred kilometres in a roughly crescent shaped band across Asia, the Himalaya are one of the most striking geographical features of our planet. They would not, however, have necessarily been recognised as a cohesive space by those who made their lives in the mountains, even as they engaged with the European surveyors, naturalists, travellers and administrators who were busy trying to constitute the Himalaya as an imperial and scientific frontier. Taking a mountain-centric approach thus allows for the examination of the Himalaya as both a space and a subject of science. Altitude is treated here as both an object of study and a factor with particular implications for scientific and cross-cultural knowledge-making – simultaneously ‘the where and the what’ of scientific practice.\(^5\)

In this thesis, I trace science, intermediated exploration, and imperial border insecurities across the Himalaya from 1800 through until 1850. Although notably understudied compared to the mid- and later-nineteenth centuries, this period deserves more attention, not least because of the extent to which the production of knowledge was beset by uncertainties around the sheer magnitude of the mountains. Indeed, these decades saw the necessity of accounting for what were, at the turn of the nineteenth century, unprecedented if not unimaginable heights. Attempts by surveyors and naturalists to address the ongoing scientific, political and imaginative incoherence of the Himalaya is reflected, I will show, in the reconfiguration of practices and theories. As Charlotte Bigg, David Aubin, and Philipp Felsch argue in the case of mountains, ‘the strategies, resources, and techniques for surviving in this challenging environment are inseparable from the strategies, resources, and techniques for producing knowledge’ about that environment.\(^6\) In what follows, I consider especially the moments that instruments, bodies and practices broke down, which are revealing of the social relationships that underpinned the knowledge they produced.\(^7\) I do so across five thematic chapters, each of which deals with a different type of science: measurement, physiology, geology, botany, and biogeography.\(^8\) Unlike studies of knowledge production in empire which limit themselves to a particular branch of science, I argue that it is necessary to address a broad range of sciences in relation

\(^4\) The phrase ‘real and imagined’ follows from Peter Bishop, The Myth of Shangri-La: Tibet, Travel Writing, and the Western Creation of Sacred Landscape (Berkeley: University of California Press, 1989), 84.


\(^6\) Bigg, Aubin, and Felsch, 314.

\(^7\) As Simon Schaffer argues, ‘a familiar argument holds that when a tool breaks, its character and recalcitrance become evident. Much can be gained from historical study of instruments’ breakages, defects, and recuperation.’ Simon Schaffer, ‘Easily Cracked: Scientific Instruments in States of Disrepair’, Isis 102, no. 4 (2011): 706.

\(^8\) This list is by no means exhaustive, and other sciences (broadly conceived) which might have received chapters in a larger project include medicine, ethnography, zoology, and meteorology.
to the mountains and verticality in order to understand this context. In particular, addressing a range of interrelated sciences rather than focusing on only one allows me to demonstrate the many ways that the mountains were made and remade through the lens of global comparisons, especially with the Alps and the Andes.

While global in outlook, this thesis nevertheless maintains a central focus on the particular spaces of the mountains, and the roles and presences of Asian actors in European scientific and expeditionary practice. These demonstrate the overwhelming extent to which Himalayan exploration depended on pre-existing local routes, expertise and labour. As Alexander Gerard’s encounter with the shugars indicates, even while ostensibly exploring and measuring the mountains, surveyors were almost never stepping off paths that had existed for millennia prior to their scientific interest. As remains true in the context of Himalayan mountaineering and trekking even today, foreign travellers would not have gotten very far or very high if they had not been able to rely on Himalayan peoples to identify the correct routes, transport their instruments and supplies, and share (or sometimes assume) the not insignificant risks of mountain travel. In what follows, we will meet an eclectic cast of brokers, including Mohan Lal and Pati Ram, guides such as Ram Singh and Bhauna Hatwal Khasiah, and technicians like Hari Singh and Murdan Ali, as well as a large number of (usually unidentifiable) ‘Bhotiyas,’ ‘Lepchas’ and ‘Tartars’ who served as interpreters, porters and guides. In examining practical, everyday interactions within expedition parties, we will see the ways these relationships were central to the making of the mountains. More broadly, these interactions mattered because they shaped the subsequent relationships of Himalayan peoples to empire, and later to the postcolonial Indian state. In tracing the reconfiguration of practices and relationships, this thesis thus demonstrates the many ways that the mountains were ultimately constituted and consolidated as marginal spaces and peripheral places by imperial agents – politically, culturally and environmentally – in relation to the lowlands.


10 These terms for ethnicity are problematic, often reflecting inexact colonial designations and homogenising different groups of people. Alternatives are nevertheless often difficult to read out of the colonial documents, even as their imprecision was acknowledged by some contemporary travellers. For example, Joseph Hooker noted that, ‘the inhabitants of these frontier districts belong to two very different tribes, but all are alike called Bhoteeas (from Bhote, the proper name of Tibet).’ Joseph Dalton Hooker, Himalayan Journals; Or, Notes of a Naturalist in Bengal, the Sikkim and Nepal Himalayas, the Khasia Mountains (London: John Murray, 1854), Vol 1, 215. For more on these issues, see Felix Driver, ‘Hidden Histories Made Visible? Reflections on a Geographical Exhibition’, Transactions of the Institute of British Geographers 38, no. 3 (2013): 425; Christoph Bergmann, The Himalayan Border Region: Trade, Identity and Mobility in Kumaon, India (Dordrecht: Springer, 2016), 7–10.
Fig. 0.1. ‘The Snowy Range from Tyne or Marma,’ published in George Francis White’s Views in India (1838). This is a typically romanticised image of Himalayan exploration, centred on a European traveller gazing heroically out to the mountains through a telescope. The Bhotiya porters in the foreground nevertheless inadvertently reveal the way the explorer depended heavily on local expertise and labour.

THE ARGUMENT

This thesis traces two related sets of arguments through the mountains and across the first half of the nineteenth century. Firstly, it presents a close study of the laboriousness of scientific practice in the Himalaya and the inherent dependency of travellers on pre-existing networks of labour and expertise, arguing for the necessity of further decentring the spaces of science. Secondly, it details the role of global comparison in the making of the mountains, and especially highlights the need to trace both connection and disconnection in understanding the rise of a vertically-oriented view of the world. It is worth now considering these two sets of arguments separately and in turn, before reflecting on the way that together they help us to understand the trajectories and implications of imperial global sciences in the nineteenth century.

Displacing ‘centres in the periphery’

As David Livingstone and Charles Withers have argued, places ‘are very far from being just matters of physical location and symbolic meaning. They are also constitutive of social exchange, enabling or constraining activities that carried out within their confines.’ This thesis follows from the ‘spatial

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turn,’ a broadening body of scholarship that recognises the situatedness rather than placelessness of scientific practice, and increasingly acknowledges the analytical benefits to mapping out the geographies of science.¹¹ In what follows, the high spaces of the Himalaya – the mountainous topography, the social and cultural geography, the human and nonhuman dimensions – are cast in protagonistic roles. In so doing, I argue for further decentring the spaces of scientific practice. Scholars have already convincingly broken down classic diffusionist models of the spread of scientific knowledge from Europe to colonial peripheries, and effected a reorientation to India-centred perspectives on scientific practice.¹⁴ The dismantling of these older paradigms, as brought about by Kapil Raj through the notion of ‘circulation,’ and by scholarship that emphasises networks and webs (especially by considering knowledge production in Indian scientific ‘centres’ like Calcutta) has been an important step.¹⁵ However, I seek to facilitate a further move away from overwhelmingly viewing peoples and practices in science outside of Europe through, to use Pratik Chakrabarti’s term, ‘centres in the periphery.’¹⁶ More needs to be done, I argue, to effect a further displacement away from privileging major South Asian scientific ‘centres,’ especially Calcutta, Madras, Benares and Bombay.¹⁷

¹¹ For an overview, see David N. Livingstone, Putting Science in Its Place: Geographies of Scientific Knowledge (Chicago: University of Chicago Press, 2003).
¹⁶ Pratik Chakrabarti, Western Science in Modern India: Metropolitan Methods, Colonial Practices (Delhi: Permanent Black, 2004), 48; 94. Chakrabarti develops this idea in relation to attempts, if largely unfulfilled, to develop the Asiatic Society in Calcutta as an ‘alternative centre’ of science. Tony Ballantyne makes a similar argument in elaborating on his ‘web’ metaphor for imperial networks: ‘Calcutta, for example, might be seen as being in a subaltern position in relation to London, but it in turn might be a sub-imperial centre where important lines of patronage, accumulation and communication flow out into the South Asian hinterland and beyond to South-East Asia or even the Pacific.’ Ballantyne, Orientalism and Race, 15.
¹⁷ For a related idea, see Thomas Trautmann, who argues that Brian Houghton Hodgson ‘turned to advantage his double displacement from the centre of metropolitan science, from Europe to British India, and from the British Indian capital, Calcutta, to its northern frontier (Kumaon, Darjeeling) and beyond (Nepal).’ Thomas Trautmann, ‘Foreword’, in The Origins of Himalayan Studies: Brian Houghton Hodgson in Nepal and Darjeeling, ed. David Waterhouse (London: Routledge Curzon, 2004), xviii.
As French naturalist and traveller Victor Jacquemont (1801-1832) wrote in the early 1830s: '[at] the distance at which I am not only from Europe, but also from Calcutta and Bombay, nothing is so much a matter of chance as the arrival of my letters' (let alone journals or books with up-to-date scientific information).  As he continued, with perhaps a touch of bombast: ‘I am waiting with great impatience for news … [but] it is fourteen thousand miles from Calcutta to London, and fifteen hundred from hence to Calcutta’ and moreover ‘the post in India goes on foot, and tigers sometimes eat the letter-carg.  A central pillar of this project is thus outlining not only the unevenness with which information was disseminated out of the Himalaya, but also the unevenness with which up-to-date information was available to the eclectic array of naturalists, surveyors and travellers tasked with mapping and measuring what were only just becoming recognised were the globe’s highest mountains.

Scholars have not been insensitive to the tendency to seek out new scientific ‘centres’ (not least for archival reasons), but attempts to address the implications of these in creating ‘peripheries in the periphery’ have been less forthcoming. This thesis works to redress this by producing a sustained account of operating in displaced, disconnected and unevenly-resourced locations using the example of the high spaces of the Himalaya. At the same time, I seek to move beyond simply delineating the relationship between science, adventure and authority in the ‘field.’ Instead, I demonstrate the potential of a mountain-oriented approach to understanding these spaces as both imperial and scientific frontiers. We are increasingly reminded that frontiers mattered, often in unexpected ways. As David Ludden argues, in searching for the bigger picture, scholars have tended to look out from the centre, but ‘most people experience, visualise and engage the process of empire in frontiers and peripheries.’ He thus argues that ‘when the process rather than structure of empire becomes the

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19 Jacquemont, Vol 1, 301.
20 Pratik Chakrabarti, for example, notes the ‘creative possibility of remote spaces’ for science. He indicates how Hugh Falconer and Proby Cautley, operating in Dehra Dun and Saharanpur, ‘were away from all living scientific authority and books on comparative anatomy; they thus devised their own methods,’ but does not elaborate why this matters. Chakrabarti, *Western Science in Modern India*, 38–39. Similarly, David Arnold argues that a ‘want of standard reference works, up-to-date journals and accessible herbaria for consultation, figured repeatedly’ in complaints and ‘the vast distances within the subcontinent made even Calcutta, India’s scientific capital, appear to naturalists like Wight, a thousand miles away in South India, as remote as London,’ but does not go on to make a sustained interrogation of the consequences of this. Arnold, *The Tropics and the Traveling Gaze*, 169.
subject of historical study, peripheries become central sites for research. In a similar vein, Thomas Simpson demonstrates that ‘frontier regions were crucial to the cultural and political development of British India as the East India Company expanded its territorial dominion.’ My chapters thus extend this work on margins and peripheries, emphasising the way frontiers circumscribed the limits of knowledge and mastery in the early nineteenth century, and became conducive to particular forms of scientific practice and imperial ambition.

Pratik Chakrabarti is nevertheless right to remind us that surveyors and naturalists, however peripherally they were located, were motivated by the understanding that they were participating in ‘Western’ science, and that ‘somewhere in their minds, the centrality of Europe remained overwhelming. The centre was the final site of fame, recognition, and support,’ even if these would more often than not prove elusive. In what follows, I trace a heterogeneous mix of surgeons and naturalists, including William Griffith and George Govan, adventurers such as William Moorcroft, ‘Mrs’ Hervey and James Baillie Fraser, and Bengal Infantry officers seconded as surveyors and administrators, including William Webb, James Herbert and Alexander Gerard. In most cases, rather than institutionally or state-sponsored explorers, these were EIC employees eclectically grafting their scientific proclivities onto institutional duties. The way these surveyors and travellers positioned themselves – from necessity and also choice – vis-à-vis both Calcutta and London thus becomes an important facet of the story. Disproportionately, they made their careers mostly or wholly in Asia rather than Europe. Some were born there, many learned their science there, and a significant number died there – hoping but perhaps not fully expecting to see England, Scotland or France again. This study does feature exceptions like Hugh Falconer (1808–65) and John Forbes Royle (1798–1858) who transitioned to metropolitan circles with some success, or those such as Victor Jacquemont who achieved widespread (albeit posthumous) fame in Europe. Even in these cases, however, it was their experiences, and the scientific practices and theories they developed in the Himalaya that they were able to leverage for their success, and with which their intellectual

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24 Chakrabarti, Western Science in Modern India, 81.
reputations were bound up. We therefore need to take seriously that for many of the actors in this study, it was not just ‘alternative centres’ like Calcutta, but the displaced spaces of the Himalaya that were overwhelmingly the tableaux on which their scientific orientations played out.

This thesis thus seeks to explain how, in locations isolated even from Calcutta, let alone London, naturalists, travellers and surveyors adapted – or devised new – instruments, practices and theories using the knowledge, techniques and resources they had available to them, and the varying degrees to which they were successful. Central to this was the materiality of the mountains, and the ways that both the human and the nonhuman worlds were affected by altitude. Instruments and bodies functioned differently – often badly – in the mountains, and plants, topography and geology were arranged in particular ways. At the same time, while the challenges naturalists and surveyors dealt with in the high mountains were real, I also show that they often sought to emphasise logistical difficulties and physiological hardship. Indeed, I pay particular attention to moments when travellers exaggerated the idiosyncrasy of their surroundings, either to excuse their failings or to leverage their ability to overcome these difficulties and produce authoritative knowledge. As we will see, accounts of scientific practice in the Himalaya from this period are rife with explanations of, and a sometimes almost desperate insistence on, challenges that could supposedly only be resolved by those who had firsthand experience of the high mountains.

*Mountain Science as Global Science*

These stories of labour and practice form, in turn, part of a larger story; indeed, they underpin a second key set of arguments around comparison, and the rise of verticality as a framework for understanding scientific phenomena on a global scale. As much as it is a close study of everyday scientific practice and intermediated exploration in the high spaces of the Himalaya, this is thus also a global history of mountain sciences. Measuring altitude with any real degree of accuracy had never really been necessary or even desirable before about the late eighteenth century. As the nineteenth century dawned, however, accurate measurements of elevation were becoming a critical variable in many of the sciences of the period, including biogeography, physiology, and geology. Observations and elevations above sea level became intertwined. Altitude was made an essential characteristic, a point of data without which a given specimen had only a limited use in advancing the cause of natural

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history. By the mid-century, altitude was pervasive. As Bengal Infantry officer Henry Strachey (1816-1912) put it when describing Western Tibet in 1853: ‘having sketched the general plan of Nari in horizontal extension, I must now explain its vertical relief, as this is developed on such a gigantic scale that no true idea of the country could be formed without equal attention to the third co-ordinate.’ This thesis is thus the story of growing recognition – and insistence – that mountain environments were commensurable, and that natural phenomena needed to be understood and mapped in three dimensions. In other words, accounting for the Himalaya ultimately meant accounting for a globe that was not only round, but also vertical. These changing perceptions give shape to the imagined ‘Vertical Globe’ of my title, and point to the increasing importance of this framework in organising and understanding both human and nonhuman worlds.

This vertical reorientation had its origins in the second half of the eighteenth century when, as Marie-Noëlle Bourguet argues, ‘the powerful image of the mountain as an ideal microcosm’ became ‘a common theme in the literature of natural history, and a scheme that framed travellers’ perceptions.’ Janet Browne similarly illustrates how in this period mountains came to be characterised as ‘hemisphere[s] in miniature, where the floral zones of earth were found repeated on a vertical scale.’ As these perceptions were increasingly adopted in the first half of the nineteenth century, they had to be adapted as improved methods for accurately measuring elevation, and innovative techniques for mapping data, were brought to bear on new parts of the globe. In 1800, the Andes and Chimborazo had been considered, respectively, the highest range and mountain in the world. By 1850 they had been comprehensively usurped by the Himalaya and Dhaulagiri and Kangchenjunga in turn (Everest would not be definitively identified as the highest until 1856). The addition of the Himalaya to the vertical globe in the first decades of nineteenth century thus transformed it both rapidly and radically.

28 As Marie-Noëlle Bourguet notes, ‘in Humboldt’s view, any specimen or observation that could not be referred to a precise determination of the corresponding height and other local conditions was useless.’ Marie-Noëlle Bourguet, ‘Landscape with Numbers: Natural History, Travel and Instruments in the Late Eighteenth and Early Nineteenth Centuries’, in Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century, ed. Marie-Noëlle Bourguet, Christian Licoppe, and H. Otto Sibum (London: Routledge, 2002), 116.
30 Bourguet also suggests that an argument could be made to push this back even further, and ‘the representation of the mountain as a natural scale … was by no means a novelty at the end of the eighteenth century.’ Bourguet, ‘Landscape with Numbers’, 103.
32 Bernard Debarbieux and Gilles Rudaz suggest that it was only in the early nineteenth century, with Alexander von Humboldt, that ‘altitude also came to be considered a useful concept for defining and circumscribing mountains. The world’s mountains could now be compared in terms of a single value.’ Debarbieux and Rudaz, The Mountain, 26. Jon Mathieu meanwhile notes that: ‘this rapid spread of measuring activity was not, however, evenly distributed around the globe and this offers us objective clues about the development of mountain perception.’ Mathieu, The Third Dimension, 29.
In this period, attempts to develop a topography, physiology, geology and biogeography of the mountains unfolded alongside – and diverged from – broader themes in nineteenth century science, including an emphasis on precise instrumental measurement, an accelerating shift from amateur to professional practice, the geological time revolution, and increasingly pressing questions around human origins. However, studies of science and surveying in the Himalaya have overwhelmingly gravitated towards mid-century figures, especially the Schlagintweit brothers and the 'Pundits,' which have both been the subject of substantive recent scholarship.13 The activities of Joseph Dalton Hooker (1817-1911) and Brian Houghton Hodgson (1801?-1894) in the late 1840s have also received considerable attention.14 While particularly concerned with Hooker and Hodgson, David Arnold nevertheless provides the most eloquent exception, even if his interest in the Himalaya is often subordinate to that of delineating science in India more broadly. As he notes, especially from the 1830s onwards, far 'from being a remote, almost spectral, appendage to India, the Himalayas began to appear as a crossroads, a point at which, ethnographically as well as botanically and zoologically, China, Europe, and the Malay world met and mingled in bizarre and unexpected ways.'15 In this thesis, I argue we need to pay as much attention to the period before 1830 as after it, when new instruments and practices were brought to bear, the true scale of the mountains became apparent, and their basic formulations as scientific and imperial frontiers were imagined and laid down. While Hooker and Hodgson make appearances, they are thus treated as part of a longer and larger project of grappling with altitude and the makeup of the globe’s tallest mountains, rather than as exceptional.

In particular, the early nineteenth century matters because accounting for the Himalaya was an inherently comparative process. Travellers were constantly measuring their expectations and experiences against other mountain ranges, especially the Alps and the Andes.\textsuperscript{36} Here they were occasionally drawing from personal experience, but more usually from written descriptions. These comparisons could be inevitable and automatic, as well as deliberate strategies to aid explanation. For example, as EIC surveyor and administrator Richard Strachey (1817–1908) wrote, ‘it will assist with the apprehension of the magnitude of these Himalayan masses if, before proceeding further, I compare a portion of them with the [Swiss Alps] with which so many of my European readers will be familiar.’\textsuperscript{37} Such comparative lenses was so widely adopted that in this period a ‘Mont Blanc’ came to be a de facto unit of measurement, and a scale to which all other heights were referred. This of course did several kinds of work, on the one hand assisting in appropriating the mountains into a framework of European geography, but also helping explorers render explicable to themselves and to audiences at home the sheer scale of the Himalaya. Indeed, as Richard Strachey continued: ‘it is a remark that I have constantly made … that what in Europe would be called a mountain, [in the Andes or the Himalaya] we look upon as a mere spur of hill, and that the whole scale of our nomenclature is shifted in a similar manner.’\textsuperscript{38} Across the first half of the nineteenth century, measuring Himalayan mountains thus required determining where they should be placed on an imagined vertical globe that was already crowded with the likes of Teneriffe, Chimborazo and Mont Blanc.

Making this accounting possible nevertheless first (or perhaps simultaneously) required the development of the Himalaya as a coherent territory – or high mountain ‘type’ – that could be deployed as a unit of long-distance comparison. Indeed, without laborious measurements, made possible by imperial frameworks and resources, meaningful global comparisons were impossible. However, comparisons did not automatically bring clarity, and the recognition of the commensurability of mountain environments in South America and Europe could serve to increase, as much as to alleviate, the uncertainty around scientific phenomena such as altitude sickness or the line of perpetual snow.\textsuperscript{39} I am thus especially interested in moments when theories and understandings of mountains derived from norms established in the Alps and the Andes failed to transfer easily or broke

\textsuperscript{36} As Peter Bishop notes, in eighteenth-century texts relating to the Himalaya, ‘no direct comparisons were made with the Alps. Only with increasing Alpine familiarity in the nineteenth century do we find them constantly invoked as Europeans attempted to come to terms with the aesthetic challenge posed by the more immense Himalayas.’ Bishop, \textit{The Myth of Shangri-La}, 45.


\textsuperscript{38} Strachey, f29.

\textsuperscript{39} For a related argument, see Mathieu, \textit{The Third Dimension}, 10. Cultural comparisons could also be misleading, and as Mathieu reminds us, in South America ‘the historical lowland-upland relations were nearly the reverse of those observed in Southeast Asia. The center of South America’s indigenous population and power lay in the mountains, not in the lowlands.’ Jon Mathieu, ‘Long-Term History of Mountains: Southeast Asia and South America Compared’, \textit{Environmental History} 18, no. 3 (2013): 562–63.
down in the Himalaya. These reflect the inherent unevenness of global comparisons, and who had access to what information and when. More broadly, these moments echo growing calls to pay attention to both connection and disconnection in global history. As Sujit Sivasundaram argues: ‘connected histories will uncover the web of linkages and the intermediaries that made science travel. Yet there were disconnections in the history of science as well – generated, for instance, out of resistance and secrecy – and so there should be room for multiple stories and perspectives.’

In tracing the origins of the vertical globe and its inherently comparative dimensions, this thesis seeks to historicise the formation of what were both sciences of the globe and global sciences in practice. While many recent histories of global science have shied away from larger, universal framings, preferring microstudies – and indeed my chapters do the same – this project is nevertheless a global history with the globe in it (or at least the parts of the globe that are significantly above the sea level). It is thus intended as a contribution to new methodologies for writing global histories of science, which while increasingly attractive, have not been without caveats. In what follows, I address the idea of ‘the global’ on multiple levels. This includes a material dimension in the imperial circulation and movement of enormous quantities of things – specimens, inscriptions, drawings and personnel. However, I also particularly examine the imaginative dimension, considering the way surveyors and naturalists envisioned and positioned their science in relation to mountains in other parts of the globe. In so doing, I argue that imagining and representing the world in three dimensions in this period, with heights precisely quantified by new instruments and techniques, had long term implications for the political and economic positioning of mountain peoples and mountain environments. In the first half of the nineteenth century, the way naturalists, surveyors and administrators thought about and imagined upland environments and peoples as aberrations from horizontal norms, and Himalayan spaces as deviations from exemplar mountains in the Alps and the


Andes, all mattered. The application of these visions ultimately did a particularly insidious kind of imperial work, paving the way for the scientific, aesthetic and political appropriation of the mountains.

SPATIAL AND TEMPORAL DIMENSIONS

The Himalaya

This thesis is about a place both extraordinary and ordinary. It is about a region central to imperial imaginations, but peripheral to empires. A place at once always there, and yet one that was constantly reconfigured and recreated. In what follows, I understand the 'Himalaya' in an inclusive sense, drawing in the Hindu Kush, Tien Shan, Pamirs and Karakoram, as well as sub-Himalayan ranges, including the Pir Panjal and the Siwaliks. Such subdivisions are to some extent arbitrary – the transhimalaya are, after all, the result of the same geophysical processes, being formed only relatively recently in geological time by the collision between the Indian and Eurasian tectonic plates.

Fig. 0.2. Satellite image showing the contiguous nature of the transhimalayan belt. The borders of the modern nation states that encompass the Himalaya are traced in white. This image also clearly shows the divide between the lowland monsoonal plains to the south of the range, and the high-altitude deserts that characterise the north.

For a succinct overview of Himalayan geography and sub-classifications see Maurice Isserman and Stewart Weaver, Fallen Giants: A History of Himalayan Mountaineering from the Age of Empire to the Age of Extremes (New Haven: Yale University Press, 2008), 1–8.


As Fig. 0.2. shows, the transhimalayan belt spans what is now Pakistan, China (including the Xinjiang and Tibet Autonomous Regions), India, Nepal and Bhutan, as well as touching on Afghanistan, Tajikistan and Myanmar. As we follow surveyors, naturalists and guides across the mountains, we will encounter moments that contributed to the genesis of these modern state borders. Though worth keeping in mind given that they are the settings for ongoing and intractable conflicts and the legacies of empire, these borders are nevertheless not always a useful way to engage with the region even today, let alone in the nineteenth century. Here I follow Dan Smyer Yü, who argues for a revisioning of Himalayan scholarship by ‘acknowledging the ecogeological contiguity of the great Himalayas [and] emphasizing [their] ethnohistorical integrity’ while nevertheless ‘studying the inherent convertibility of the cultures, empires, civilizations, and modern states to the formation of the current geopolitical cartographies.’ Ultimately, the edges of the Himalaya remained much fuzzier than those of the states that came to ostensibly contain them, and people and goods regularly moved into and out of the mountains – spaces in which imperial and state power was anyway often difficult to bring to bear. Similarly, even generalised observations about the Himalayan mountains – for example, that they tend to be sparsely inhabited or feature harsh environments – are not uniformly true. Studying ‘the Himalaya’ holistically might thus inadvertently perpetuate lowlanders’ perspectives, and reflect vestiges of an older romantic, orientalist and imperial fascination with Asia’s notoriously ‘mysterious’ and ‘exotic’ mountains – though these framings, too, have their histories. In what follows, we will see that there is not just one Himalaya but many, and that experiences and understandings of the mountains could and did vary greatly among those who interacted with them.

While the Himalaya began to take on new imaginative, political and scientific importance for Europeans in this period, they had long held particular semiotic significances for Asians, whether residents of the mountains, or from the subcontinent and beyond. The word ‘Himalaya’ has its etymology in Sanskrit, with ‘Himā’ meaning snow, and ‘alāya’ house or abode. The entire construction is thus usually translated as the ‘Abode of Snow,’ an intermittently apt descriptor but only one name among many. The Himalaya hold key places in Buddhist, Jain, Sikh and Hindu


47 As David Arnold notes, prior to European interest, ‘even the remotest parts of the mountains were far from being culturally uncolonized.’ Arnold, The Tropics and the Traveling Gaze, 102.

48 Isserman and Weaver, Fallen Giants, 1–2. This translation has also been adopted in Western literature, for example: Andrew Wilson, The Abode of Snow: Observations on a journey from Chinese Tibet to the Indian Caucasus, Through the Upper Valleys of the Himalaya (Edinburgh: William Blackwood and Sons, 1875); Mason, Abode of Snow. This etymology also helps explain why I prefer the singular ‘Himalaya’ when referring to the region, rather than the plural ‘Himalayas’ (which I nevertheless use when referring to the peaks collectively). As Maharaj Pandit points out, the pluralised
cosmology. Himalayan peaks and lakes feature extensively in South Asian religious tradition and are important sites of pilgrimage. Mount Kailas, for example, serves as the resting place of the gods in the Hindu epics Mahabharata and Ramayana and is also the setting of the Buddhist classic The Hundred Thousand Songs of Milarepa. The Himalaya also feature in the Puranas, especially in the Skanda Purana in which the narrator warns the reader that ‘in a hundred ages of the gods I could not tell thee of the glories of Himachal, where Shiva lived and where the Ganges falls from the foot of Vishnu like the slender thread of the Lotus flower.’ As this indicates, the Himalaya had long been recognised as the source of the rivers – specifically, the Ganges, Sutlej, Indus and Brahmaputra – which are crucial to agricultural production and hence life on the subcontinent. Both historically and in the present, these texts have also frequently been used to support the idea of the Himalaya as a ‘natural’ barrier. Indeed, as Nayanika Mathur notes, references to the ‘delimiting of Hindustan by the mountain chain’ appear as far back as the first century BCE where the Vishnu Purana refers to them as the ‘shield of India.’

These longstanding framings of the Himalaya, by both Asian uplanders and lowlanders, were very apparent to early European visitors, even if attempts to record them were riddled with misunderstandings and mistranslations. In the case of rivers, for example, Irish-born officer and botanist Edward Madden (1805-1856) wrote that, ‘we may consider the Himalaya as nature’s vast reservoir for the irrigation of empires … it is probable, that a portion of the Hindoo veneration for the range is owing to its containing the springs of so many of the rivers which fertilize their country.’

In understanding European scientific and imaginative appropriations of the Himalaya, it is important to remember, as Sujit Sivasundaram reminds us in the context of Sri Lanka, that places ‘did not emerge straightforwardly out of a blank slate, an unknown or unnamed landscape.’ As he continues, ‘even when a landscape’s iconography is studied, what often emerges are the layers of embedded signification … readings of and terms for nature found their place on top of existing ones.’ In this thesis, I thus examine the many ways that Asian conceptions of the Himalaya, in their myriad and dynamic permutations, continued to exist alongside, interact with, compete against, resist, and

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50 Quoted in Isserman and Weaver, Fallen Giants, 2.
52 Edward Madden, ‘Diary of an Excursion to the Shatool and Boorun Passes over the Himalaya, in September, 1845’, Journal of the Asiatic Society of Bengal 15 (1846): 112.
54 Sivasundaram, 142.
influence European attempts to categorise the mountains in this period. These, in turn, meant that
global visions based on the Alps and the Andes, and the commensurability and universality of
mountain environments, could only ever be unevenly and imperfectly applied, even if these
applications could have pervasive consequences.

The role of imaginative geographies in the histories of exploration, science and empire owes
much to seminal work on aesthetic appropriations of place by Paul Carter, who took as his starting
point that travellers ‘invented places, rather than found them,’ and that in naming and historicising
places into European knowledge frameworks, these inventions were inherently insidious. Writing
about India more broadly, David Arnold is adamant that ‘ideas of landscape, far from being peripheral
to the exercise of power or merely reflective of a material reality, formed a central and integrating
element in the wider constitution of colonial knowledge and a critical ingredient in the larger
colonizing process.’ This tension maps particularly well onto the Himalaya in the early nineteenth
century, a time in which European knowledge production was wrapped up in attempts to bring the
mountains within the purview of empire, while simultaneously framing them as frontiers. In terms of
mountain aesthetics, early nineteenth century imaginative renderings drew especially on romanticism,
the picturesque and the sublime. Marjorie Hope Nicolson’s classic trajectory traces the shift from fear
and avoidance of mountains to fascination and aesthetic appreciation in the eighteenth and nineteenth
centuries – or from ‘mountain gloom’ to mountain glory – a transition that has been expanded on by
scholars like Robert Macfarlane and Ann Colley. European naturalists, surveyors and travellers
brought these aesthetic traditions with them to the Himalaya, and the material practice of science is
thus impossible to separate from the discursive appropriation of the mountains in this period.

Time Period

While framed around the particularities of space, topography, terrain and landscape, this thesis is also
about the Himalaya at a particular time. As much as for scientific edification, mapping and measuring

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56 Paul Carter, The Road to Botany Bay: An Exploration of Landscape and History (Minneapolis: University of Minnesota
Press, 1987), 51. For more on imaginative geographies and a critique of Carter, see Simon Ryan, The Cartographic Eye:
How Explorers Saw Australia (Cambridge: Cambridge University Press, 1996). And see, of course, Edward W. Said,
57 Arnold, The Tropics and the Traveling Gaze, 5. These appropriations were nevertheless far from being simply and
effectively applied, and Matthew Edney, in a now seminal study of the Great Trigonometrical Survey demonstrates
that ‘the surveys were exercises in negotiation, mediation, and contestation … so that knowledge which they
generated was a representation more of the power relations between the conquerors and the conquered than of some
topographical reality.’ Matthew Edney, Mapping an Empire: The Geographical Construction of British India, 1765-1843
58 Marjorie Hope Nicolson, Mountain Gloom and Mountain Glory: The Development of the Aesthetics of the Infinite (Ithaca:
Cornell University Press, 1959); Macfarlane, Mountains of the Mind; Ann C. Colley, Victorians in the Mountains: Sinking
the Sublime (Farnham: Ashgate, 2010).
59 As Sujit Sivasundaram puts it: ‘physical topography cannot be extracted from political structures or discursive
greater and greater heights in the Himalaya in the first half of the nineteenth century was motivated by growing fears around the lack of information about the northern frontiers of the East India Company’s territory in India. This was coupled with mounting concerns about the relative impenetrability rather than impermeability of the range, which meant that the mountains increasingly took on the role of a threatening ‘blank space’ at the edges of the empire.60 Indeed, despite the meanderings of several Jesuits, and the trade missions of George Bogle (1746–1781) and Samuel Turner (1759–1802) to Tibet in the late eighteenth century, European knowledge of the Himalaya in 1800 remained sparse and fragmentary. As Peter Bishop argues, ‘the immense verticality of the mountains, with their steep contrast between perpetually silent, snow-clad peaks and dark, densely vegetated valleys, echoed the intense horizontal mystery of the frontier’ in this period, but ‘as yet … the “frontier” lacked imaginative coherence.’61 It was only in the 1820s (earlier in India), that the Himalaya were finally being accepted as the highest mountain range in the world, displacing the Andes. The uncertainty – and briefly, outrage – around this revelation is indicative of the extent of the limits of knowledge among EIC naturalists and administrators when it came to the mountains at the north of their ever more rapidly expanding Indian empire.62

European scientific and imaginative interactions with the Himalaya were thus inextricably bound up with the machinations of politics and empire, both regional and global. Indeed, a key reason for the delay in recognising that the Himalaya towered over even the Andes was that, as a result of frontier politics, measurements were initially only taken from the plains looking up, rather than from within the mountains themselves. While the EIC was consolidating its power in the lowlands of South Asia, it remained significantly less capable of bringing this growing imperial confidence to bear in the uplands. This was in part because of the challenging topography, but also as a result of the ongoing autonomy of powerful rulers such as Ranjit Singh in the Punjab.63 Similarly, and to their immense and ongoing irritation, the British were almost entirely blocked from entering Tibet, while also facing ongoing resistance from the Kingdom of Nepal. This latter opposition continued even after the Anglo-


Gurkha War of 1814-16, which although ostensibly a British victory, saw the Gurkhas maintain considerable autonomy (for example in limiting the British Resident to the Kathmandu Valley). The Anglo-Gurkha War is nevertheless significant to this story as it resulted in the British acquisition of the provinces of Kumaon and Garhwal, and hence relatively easy and reliable access to a much higher elevation cross-sectional profile of the Himalaya than they had before. Throughout the period of this study, access to the mountains was thus dictated by fluctuating alliances and conflicts, which could result in gains like Kumaon and Garhwal, or Jammu and Kashmir following the Anglo-Sikh wars beginning in 1845, as well as major reversals such as in Afghanistan in 1842. When considering the intermediated nature of exploration, it is therefore important to remember that to a significant extent it was negotiations with indigenous states, rulers and even villagers that dictated the possibilities for travel and science in the Himalaya.

As well as checks by regional political entities, increasing imperial ambitions on the subcontinent brought attendant concerns about Chinese and Russian activities to the north and northwest of the Himalaya respectively. Initially, the sheer verticality of the mountains had seemed reassuring. Early European travellers echoed the supposed impenetrability of Himalaya, with Samuel Turner remarking of Bhutan that: ‘these rugged and impracticable ways, certainly lessen the importance of those military posts, we so lately passed … the Bootees cannot possibly have a better security, than in such a chain of inaccessible mountains, and in the barrenness of their frontier.’ However, such comforting rhetoric quickly became unsustainable and as Bengal secretary John Garstin wrote in 1812: ‘there are many passes into the hills from which … the inhabitants of the Mountains might make excursions into the Plains, carrying destruction in their train, and return with impunity from our want of knowledge of the roads leading to their fastness.’ The surveyors seconded to the mountains were clearly aware of the potential military implications of their journeys, many having served within the ‘enormous dells and craggy heights’ while personally involved in the hostilities with Nepal, and had experienced first-hand the porosity of the ‘frontier which was

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64 Alastair Lamb, British India and Tibet, 1766-1910 (London: Routledge & Kegan Paul, 1986); Arnold, The Tropics and the Traveling Gaze, 99–100; Bernardo A. Michael, Statemaking and Territory in South Asia: Lessons from the Anglo-Gorkha War (1814-1816) (London: Anthem Press, 2012); Christoph Bergmann, ‘Confluent Territories and Overlapping Sovereignties: Britain’s Nineteenth-Century Indian Empire in the Kumaon Himalaya’, Journal of Historical Geography 51 (2016): 88–98. Bergmann nevertheless notes that this control was partial and ‘British imperial sovereignty, similar to that of older regimes in the area, remained malleable and contested within the wider relational field of the Bhotiyas’ trans-Himalayan trade.’ Bergmann, The Himalayan Border Region, 23.


66 Samuel Turner, Account of an Embassy to the Court of the Teshoo Lama in Tibet, Containing a Narrative of a Journey through Bootan and Part of Tibet (London: W. Bulmer and Co., 1800), 190.

67 John Garstin to Charles Wright Gardiner, 7 March 1812, NAI/SOI/DDn. 128, f74.
penetrated at different points by the invading columns. As Peter Bishop eloquently puts it: ‘as the century progressed closer attention to these mountains revealed a veritable honeycomb of passes … the closer the British engaged with the mountains, the more passes appeared.’

The untangling of the Himalaya thus became intimately linked with the so-called ‘Great Game’ and fears about Russian aspirations for India. Bengal infantry surveyor William Spencer Webb (1784–1865), for example, was rather put out to learn in 1816 that a friend had obtained from St Petersburg a publication describing his having crossed the Himalaya, ‘regardées comme inaccessibles’ but ‘par lesquelles on peut ouvrir une route par la Tartarie jusqu’en Russie.’ Compounding environmental, social and political factors meant that the frontiers remained insecure, both on the ground but especially – perhaps even mostly – in the imperial imagination. These concerns operated on multiple fronts. Indeed, with the annexation of Kumaon and Garhwal, the East India Company had also inherited, for the first time, a frontier with Tibet, albeit one that was immediately and firmly closed to EIC ambitions. Practicing science in the mountains could thus be a political act in and of itself, and surveyors had to be particularly wary about using their instruments near the edge of Tibet, lest they arouse the suspicion of the watching agents of the Qing Empire.

68 Lloyd and Gerard, Narrative of a Journey, Vol 1, 110.
69 Bishop, The Myth of Shangri-La, 88. Bishop also notes that ‘here is the beginning of a fundamental tension that would extend, with varying intensity, from one end of the Himalayas to the other. Were the numerous passes the gateways to China, to the fabled gold mines, to a lucrative trade with the vast, untapped markets of Central Asia, or were they the almost undefendable back doors into the always vulnerable British Indian Empire, its Achilles heel? Such contradiction and paradox was basic to the imaginative creation of the Himalayan frontier.’
71 Webb to Colin Mackenzie, 2 December 1817, NAI/SOI/DDn. 150, f27. [‘regarded as inaccessible’ but ‘by which a route can be opened through Tartary to Russia’]
72 This thesis largely examines exploration of the Himalaya that originated from the south, a lens that serves to highlight the uncertainties and insecurities of the contemporary actors as to what was occurring in the north and northwest. Chinese interactions with the Himalaya from the north were nevertheless not wholly dissimilar to those playing out from the British Indian side, as administrators dealt with geographical uncertainties, unruly informants, the complexities of border-making and a growing awareness of a foreign power flexing its might on the opposite side of the mountains. For Chinese interactions with the Himalaya at this time, see Matthew W. Mosca, From Frontier Policy to Foreign Policy: The Question of India and the Transformation of Geopolitics in Qing China (Stanford: Stanford University Press, 2013); Ulrike Hillemann, Asian Empire and British Knowledge: China and the Networks of British Imperial Expansion (Springer, 2009). Exploration from the northwest, especially by Russians like Ivan Vitkevich (Jan Prosper Witkiewicz), might also form a component of this story. Vitkevich, for example, though mostly engaged in political efforts rather than scientific practice, acted as translator for Alexander von Humboldt during part of his Central Asian travels. See, among others, Hopkins, The Making of Modern Afghanistan; Morrison, ‘Twin Imperial Disasters. The Invasions of Khiva and Afghanistan in the Russian and British Official Mind, 1839-1842’; Svetlana Gorshenina,
At the same time, however much surveyors’ paranoia, dependency on local networks, and self-policing of their instrumental practices often demonstrate the limits of imperial mastery, these early itinerant surveys had consequences. Wherever they are evoked, ‘blank spaces’ have an aspirational dimension for empires. This is perhaps best explained by D. Graham Burnett, who outlines the inherent tension that faced surveyors between ‘boundary making … and boundary crossing.’\(^{73}\) The challenge presented by ‘blank space’ and the insecurity this generated was ultimately essential in clearing away indigenous presences and subsuming older local and regional borders, even if this could only be haphazardly achieved. Insecurity propelled knowledge production, although the knowledge returned sometimes served to increase as much as alleviate imperial insecurities. In this thesis, the idea of insecurity is thus intended to signal a relative lack of knowledge and the threatening nature of this lacunae, something that evolved and fluctuated, but was never really overcome during the course of the nineteenth century.\(^{74}\) This earlier period nevertheless matters, as Kalyanakrishnan Sivaramakrishnan argues for Indian landscapes more broadly, because ‘the observations and writings of official, scientific and commercial travellers in the early nineteenth century created the language and representational repertoire for the consolidation of empire.’\(^{75}\) Indeed, the imagining of the mountains both by and as a result of the surveys and travels examined here had long-term consequences for the way the mountains were woven into the imperial tapestry as peripheral places.\(^{76}\)

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\(^{73}\) D. Graham Burnett, Masters of All They Surveyed: Exploration, Geography, and a British El Dorado (Chicago: University of Chicago Press, 2000), 255.


\(^{75}\) Kalyanakrishnan Sivaramakrishnan, ‘Science, Environment and Empire History: Comparative Perspectives from Forests in Colonial India’, *Environment and History* 14, no. 1 (2008): 47.

\(^{76}\) Here I draw on B.D. Hopkins conceptions of the ‘imperial mind’ in relation to Afghanistan: ‘the Company’s conceptual framework was the intellectual discourse with which it defined the Afghans for the purposes of its own comprehension. This was not an uncontested monolith … instead, it was continually challenged and contested both by the Afghans as well as by the British themselves, giving rise to multiple understandings and misunderstandings … the legacy of the conceptual framework producing that flawed understanding remains with us still.’ Hopkins, The Making of Modern Afghanistan, 1–2.
METHODOLOGY

Spatial History and Geographical Features

The ‘Himalaya’ is not the only possible term with which to engage Asia’s most famous mountains. The designation ‘High Asia’ or ‘haute-asie’ – as especially used in Francophone scholarship – might at times be better. It has the advantage of highlighting the key shared feature of what is otherwise a hugely diverse area; namely, significant elevation above sea level, the implications of which – both for scientific practice, and as an object of study in and of itself – lie at the heart of this project. Speaking of High Asia also automatically avoids any questions about sub-classifications and the place of, say, the Karakoram. ‘Inner Asia’ might also be considered, though it has lacked consistent application, and implies a larger region including Mongolia, not all of which has altitude above sea level as a key characteristic. Perhaps most relevant is the recently proposed term ‘Northern South Asia,’ which while lacking simplicity, helpfully reflects the way that this thesis largely considers exploration and interactions with the Himalaya originating upwards and from the south. Nevertheless, imperial and scientific imaginations were fired not by these scholarly neologisms, but by the semiotic connotations of ‘the Himalaya’ as the highest mountains on the globe, and for the most part I follow the contemporary actors in using this term.

Another useful concept for thinking about this region – not to mention spatial and transnational histories more broadly – is that of Zomia. As proposed in its original form by Willem van Schendel, this metaregion included much of the Himalaya. Both the idea of Zomia and its scope have subsequently been debated and revised, with perhaps its most famous adoption being that by James Scott (albeit with a more limited focus on the upland parts of Southeast Asia). The creation of Zomia was intended to highlight areas and peoples ‘otherwise neglected as merely peripheral, exotic, or backward’ in the traditional area studies divisions of South, Central, East and Southeast Asia. For Scott and others, it has subsequently been about giving agency back to marginalised peoples and describing the non-state spaces given little attention in traditional histories that follow the contours of empires and nations. For all this, Zomia is not without its limitations and has not been uncontroversial. It is, after all, entirely artificial, and just as there has never been a Zomia, there are no ‘Zomians.’ As Jean Michaud has pointed out, concepts like Zomia ‘have never been needed by the

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subjects themselves’ because ‘that scale of things simply does not make sense, either practical or symbolic, for highlanders.’ The application of Zomia to the Himalaya has its own more specific caveats. As Sara Shneiderman argues, for reasons both ‘empirical and political,’ the Zomia concept may not map onto the Himalaya as readily as we might like. This is partly because, rather than being state-free, the Himalaya has seen powerful indigenous states over the centuries, especially in Tibet, but also in Nepal, Bhutan and Afghanistan. Shneiderman nevertheless goes on to argue for the value of ‘Zomia-thinking,’ even if the Himalaya are better conceived ‘as a “multiple-state space,” comprised of the territory of all of the nations and states in question, yet transcending the individual sovereignty of any single state.’ Christoph Bergmann meanwhile builds on Shneiderman’s formulation, considering ‘High Asia as a continuous zone and an agentic site of political action’ in order to ‘argue that confluent territories and overlapping sovereignties are key to understanding imperial frontiers in the Himalayan region.’ As an analytical tool for moving beyond traditional political or national histories, Zomia thus has considerable appeal, sufficient to at least partially overcome objections over its artificiality and lack of intelligibility to the actors living within its imagined borders. In this thesis, ‘Zomia-thinking’ helps to frame the perspective of the Himalaya when viewed from the subcontinent and vice versa (even while acknowledging heterogeneity within these perspectives). Ultimately, it points to the mutual formulation of the Himalaya and the subcontinent, and the way that the mountains could, in a sense, only exist when constituted simultaneously and in contrast with the lowlands.

Writing about the Himalaya (as with Zomia), nevertheless requires special sensitivity to the way that such a wide lens can have a flattening effect, potentially ignoring diversity and difference and obscuring local experiences. Such a framework runs the risk of geographic determinism or essentialising Himalayan peoples that are better characterised by their heterogeneity. However, as with Zomia, the advantage is an alternative arrangement of the world as a way of escaping a focus on a particular region, state, or group of people. This is not to say that all parts of the Himalaya will be looked at in equal detail, or even at all. This study – even if moving away from some of the most well-known stories – still follows the contours of political events and the itineraries of travellers (and the archives they generate), inevitably privileging certain places. Given the limitations of access to Nepal

83 Sara Shneiderman, ‘Are the Central Himalayas in Zomia? Some Scholarly and Political Considerations across Time and Space’, Journal of Global History 5, no. 2 (2010): 290. She also notes that ‘due to its emphasis on altitude and ecology as primary factors in shaping the cultural worlds of highland groups, the Zomia concept can sound uncomfortably similar to such past attempts at identifying commonalities through ecological association at the expense of examining political histories.’
85 Bergmann, The Himalayan Border Region, 17.
and Tibet, European scientific interest in the period 1800-50 tended to cluster initially on Kumaon, Garhwal and Ladakh, as well as later on Kashmir, Xinjiang, Afghanistan, and Sikkim. It is also worth noting that while explorations were unfolding at the same time, experiences in the Eastern Himalaya (especially Assam and Myanmar) are not addressed in the same way or to the same extent here. These regions demand sometimes quite different frameworks for understanding both their topography and politics, and are thus beyond the scope of this project in its present form.

While smaller moments and specific, sometimes local, vignettes make up the chapters, together these contribute to thinking broadly about the role of verticality in shaping scientific practice in the Himalaya, and the development of global mountain sciences. Taking a wider view of the Himalaya also has the advantage of counteracting the tendency, especially in Western scholarship, of using the Himalaya as a shorthand for Tibet.\(^{87}\) Indeed, the way that Tibet has loomed large among both Himalayan studies scholars and historians (not to mention a wider Western audience), might be seen to be perpetuating nineteenth-century orientalist fascinations with Tibet and Buddhism, as most famously distilled in the enduring myth of Shangri-La. The fleetingness of Tibet’s appearances are partly an attempt to redress this, but in more practical terms are also a consequence of focusing on a time period in which Europeans were almost wholly excluded from the mountain kingdom.

Much as transnational geographic regions like Zomia have aroused the interest of scholars, geographical features themselves are increasingly being employed as productive scales for global and transnational histories. Scholars have adopted oceans and seas in particular (Mediterranean, Atlantic, Indian, Pacific), and successfully used these to disrupt older nationalist historiographies.\(^{88}\) Other geographical features, whether rivers, islands, or beaches, have allowed scholars to tell important and often previously invisible transnational, transimperial and translocal stories.\(^{89}\) Sujit Sivasundaram, for example, argues that in the case of Sri Lanka ‘an island-centred approach may reveal better the local entanglements of natural knowledge.’\(^{90}\) This thesis contends that a mountain-centred approach may

\(^{87}\) Though the subject of many laudable studies, Tibet has arguably been singled out at the expense of other parts of a diverse and multifaceted region. The trope of writing about ‘Tibet and the Himalayas’ — which even scholars like Peter Bishop fall into — is symptomatic of this, and has the effect of homogenising and marginalising any parts of the Himalaya that are not Tibet. For examples of excellent scholarship that nevertheless focuses on Tibet, see Lamb, *British India and Tibet*, 1766-1910; Bishop, *The Myth of Shangri-La*; Stewart, *Journeys to Empire: Enlightenment, Imperialism and the British Encounter with Tibet*; Neuhaus, *Tibet in the Western Imagination*.


\(^{90}\) Sivasundaram, ‘Islanded: Natural History in the British Colonization of Ceylon’, 130.
do the same. Indeed, as Ruth Rogaski argues, ‘putting the mountain at the centre of inquiry not only allows us to understand the interaction between humans and their environment, but also facilitates examination of human-to-human interactions.’ Mountains have nevertheless been less quickly co-opted into this trend of framing research around geographical features than oceans, islands and rivers. This is perhaps because whereas watery bodies seem to emphasise movement and flow, mountains might appear to have the opposite effect. However, despite tropes casting the Himalaya as ‘impenetrable’ or the ultimate barrier to travel and communication, the range was – and long had been – highly porous. Extensive trade networks had operated within and through the Himalaya for millennia prior to European interest. Much as European appropriation of knowledge of the subcontinent and the Indian Ocean followed networks of exchange mapped onto existing trade networks, European science and exploration in the Himalaya advanced by following the routes and advice of traders, migrants and pilgrims.

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especially in their Western reaches, the Himalaya had long been a global space of contact, exchange and movement – both vertical and horizontal – as the so-called ‘crossroads’ of Central Asia. This is not to say that Himalayan travel and trade did not present some substantial and particular difficulties – material as well as cultural and political – with valleys and passes dictating routes, and altitude placing limitations on the sorts of goods that could be moved, and on the speed of travel. Movement could also be highly seasonal, regulated by the opening and closing of key high passes. Ultimately though, we need to move beyond semiotic assumptions about mountains as barriers and limiters, which are insufficient to explain the roles of the Himalayan mountains as borderlands, and as spaces of trade, migration and cross-cultural exchange. Mountains, I will argue, are thus eminently suitable for co-opting into this trend of using geographical features as sites and as scales for conducting world history, and for telling global stories.
Mountains and Verticality

Scholarship on mountains is characterised by its fragmentation across multiple disciplinary homes, including history, the history of science, geography, anthropology, and literary and cultural studies.\textsuperscript{94} One consistent strand has followed mountaineering which, never far from the popular imagination, has also recently been the subject of sophisticated scholarship.\textsuperscript{95} To be clear though, while this is a very much a history of mountains, it is not a history of mountaineering. Even if already being enthusiastically developed in the Alps, mountaineering as a sporting pursuit, shorn of scientific pretensions, was still decades away from reaching the Himalaya when this study takes its leave.\textsuperscript{96} Nevertheless, some of the themes the new historiography of mountaineering has pursued, especially the visibility of social relationships in extreme environments, can be usefully co-opted into describing the sociability of Himalayan exploration.\textsuperscript{97} Another approach to the history of mountains, especially in continental scholarship, has been to interrogate their political and discursive functions. Bernard Debarbieux and Gilles Rudaz take as their starting point that ‘the mountain, far from being a given of nature on which these representations and imaginations come to be grafted, deserves to be studied as a notion in itself, as the product of a social and political construction.’\textsuperscript{98} They readily concede that this hardline constructivist approach may be taken as a ‘provocation,’ but perhaps a useful one. Taking a different way in, Veronica Della Dora argues that ‘the history of mountains is deeply interlaced with our cultural values, with our aesthetic tastes and scientific practices … mountains, one might argue, are geological forms as much as they are social constructs. Yet there is something elemental about mountains that exceeds and transcends our attempts to ascribe meaning to them.’\textsuperscript{99} This tension between the ‘real’ physical or material reality of mountains and their representational and imaginative existences is one that reappears throughout this story and, as we will see, is one that was echoed by the contemporary actors as much as it is by modern scholars.


\textsuperscript{95} Peter Hansen, for example, uses mountaineering in the Alps as an alternate window into the story of enlightenment and modernity in Europe. Peter H. Hansen, \textit{The Summits of Modern Man: Mountaineering after the Enlightenment} (Cambridge, MA: Harvard University Press, 2013).

\textsuperscript{96} Occasionally, these early travellers framed their experiences in terms that would later be common in the annals of mountaineering. For example, Welsh officer William Lloyd wrote the following of an ascent of Burendo: ‘I sat down on the summit of the peak. I was alone, and how elevated! … above me was the deep splendour of the heavens, around me the winning beauty of serenitude [sic], beneath me the all-gorgeous magnificence of the world! … I trust it was an excusable vanity, but I was very much pleased that I had been the first European who had ever stood on the summit of the western Peak of the Boorendo, as well as at having attained a greater elevation than Mont Blanc.’ Lloyd and Gerard, \textit{Narrative of a Journey}, Vol 1, 248–9.

\textsuperscript{97} Michael Reidy, for example, argues that mountains offer ‘the perfect physical geography to discuss issues of race, class, nationalism, civilization, modernity, morality, and physical ability,’ and especially gender, as ‘mountains became a preferred site for the cultivation of all that was considered masculine.’ Michael S. Reidy, ‘Mountaineering, Masculinity, and the Male Body in Mid-Victorian Britain’, \textit{Osiris} 30, no. 1 (2015): 160–61.

\textsuperscript{98} Debarbieux and Rudaz, \textit{The Mountain}, 2.

The relationship between mountains, science, and scientific practice has also received intermittent – though increasing – attention, even if scholars have tended to gravitate to the later nineteenth and early twentieth centuries (and to activities in Europe and the Americas). Notable exceptions have been made for savants like Horace-Bénédict de Saussure, and most extensively for Alexander von Humboldt, whose biography is never far from the story of mountain sciences. Indeed, this thesis builds on recent work on both mountains and verticality by Jon Mathieu, Michael Reidy and Bernard Debarbieux, all of whom deal, to a greater or lesser extent, with Humboldt. Bernard Debarbieux argues that for Humboldt, ‘mountains are the living expression of this fundamental interplay among natural and human phenomena,’ and ‘provided comparable settings useful to his project of building a global knowledge.’ Jon Mathieu meanwhile suggests that Humboldt was the central figure in ‘the historical genesis of a “mountain world” stretching all around the globe’ and Michael Reidy extends this to point to argue that ‘a larger vertical consciousness … engulfed science in the early nineteenth century.’ Here Reidy is referring to oceans as much mountains, and elsewhere he argues that ‘the Victorians reorganized global environments both horizontally and vertically, and in turn … this massive rewriting of three-dimensional space transformed the results of science.’

In this thesis I take such contentions seriously, but look to go beyond a standard narrative that features a trajectory from Alexander von Humboldt to Joseph Dalton Hooker and Charles Darwin,

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100 See especially the essays in the special issue of Science in Context following Bigg, Aubin, and Felsch, ‘Introduction’, Francophone scholars have tended to pay more attention to the longer history. See for example Jean-Claude Pont and Jan Lacki, eds., Une Cordée Originale: Histoire Des Relations Entre Science et Montagne (Chêne-Bourg: Georg, 2000); Baud, Forêt, and Gorshenina, La Haute-Asie telle qu’ils l’ont vue. See also Veronica Della Dora and Denis Cosgrove, for whom high places are defined as having either high altitude or high latitude. Denis E. Cosgrove and Veronica Della Dora, High Places: Cultural Geographies of Mountains, Ice and Science (London: I.B. Tauris, 2009). Indeed, aspects of the extremes of topography and climate encountered in the high Himalaya, including cold, snow, and wind, were not necessarily unique to mountainous spaces. Such extremes were also encountered by European scientific travellers in the Arctic or Antarctic. While there are certainly parallels, I nevertheless prefer to disaggregate mountains and polar regions in order to pay closer attention to mountain-specific aspects of sciences like physiology and biogeography, and the ways that mountains were understood in relation to the lowlands they were constituted in opposition too.


without considering the essential transformations of the intervening decades.104 In discussing the scientific imagining of mountains in this period, the name of Humboldt is of course inescapable, even if exactly what Humboldt meant and to whom is sometimes harder to quantify. The writings of European naturalists who worked in the Himalaya, such as John Forbes Royle, Victor Jacquemont and Thomas Thomson and, indeed, Hooker himself towards the mid-century, are peppered with deferential references to ‘the great Humboldt,’ ‘the high authority of Humboldt,’ and most frequently ‘the illustrious Humboldt.’105 Humboldt also looms large in the way questions around the global commensurability of mountain environments saw the development of innovative charts and diagrams for representing and visualising altitudinal relationships.106 As a result, the knowledge production examined here in relation to altitude might be considered to some extent ‘Humboldtian science.’ However, the scholarly conceit of ‘Humboldtian science’ is not, I will show, the best lens to examine the scientific practices of EIC employees and itinerant travellers in the Himalaya.108 What follows

104 Reidy offers highly useful conceptual tools for understanding verticality, and quite rightly stresses the imperial character of these. However, in discussing Joseph Hooker’s justification for his visit to the Himalaya, Reidy takes him at face value in stating that ‘European naturalists had failed to study the flora and fauna of the Himalaya because of their extreme climate and supposed unfriendly natives … the sheer vertical expanse of the mountains and their untouched character were what excited Hooker most about his pending trip to India’ and ‘the extreme limits of vegetation in the Himalaya had never been studied.’ Reidy, ‘From the Oceans to the Mountains: Spatial Science in an Age of Empire’, 28; 30. As this thesis demonstrates, Hooker’s claim is an exaggeration, and in fact he had to settle for Sikkim because it remained relatively unvisited by naturalists compared to other parts of the mountains like Kumaon, Garhwal and Kashmir. This is not to say that incompleteness, uncertainty and insecurity did not very much characterise the scientific picture of the Himalaya at the mid-century, and that Tibet and Nepal did not remain largely off limits. It does, however, demonstrate that the mountains and mountain biogeography cannot be considered ‘untouched’ at the time of Hooker’s arrival, and his reliance on local experts like Hugh Falconer and Brian Houghton Hodgson makes this even clearer.

105 John Forbes Royle, Illustrations of the Botany and Other Branches of the Natural History of the Himalayan Mountains (London: W.H. Allen & Co., 1839), Vol 1, 3; 87; 113; 147; 191; 281; 283; 284; 375; 394; Thomas Thomson, Western Himalaya and Tibet: A Narrative of a Journey through the Mountains of Northern India during the Years 1847–8 (London: Reeve and Co., 1852), 474; Hooker, Himalayan Journals, Vol 2, 401; Jacquemont, Letters from India, Vol 1, 49; 59; 165; 237; 239; 311; 332.

106 Even if not invented by Humboldt, these graphical styles received considerable impetus from his attentions in the first decades of the nineteenth century, no more famously than in the sea-to-summit profile of Mount Chimborazo. See Alexander von Humboldt and Aimé Bonpland, Essai Sur La Géographie Des Plantes (Paris: F. Schoell, 1807).


108 Even taken on its own terms, David Arnold suggests that Royle ‘was in many respects a poor representative of “Humboldtian science,”’ in particular because of his limited travelling and instrumental programs. Arnold, Science, Technology and Medicine in Colonial India, 52.
instead traces some attempts to apply Humboldt’s science by those in displaced locations lacking many of Humboldt’s resources, and the greater and lesser degrees of success that resulted. Put differently, rather than the extent to which the activities of European naturalists in the Himalaya were ‘Humboldtian,’ I am more interested in the way Himalayan travellers read and positioned themselves in relation to Humboldt. To this end, I demonstrate that the pervasiveness of Humboldt’s ideas, especially those developed in relation to Andes, could sometimes cause interpretive problems in early encounters with the Himalaya. For example, Humboldt’s early laws with regard to elevation, latitude and the line of perpetual snow failed, more or less utterly, to translate to the Himalaya. Indeed, the ‘high authority’ of Humboldt sometimes delayed recognition of problems with theories, and estimates of scale, when it came to explaining Asia’s mountains.

While I will mostly resist the temptation to take the idea of verticality from science, terrain and topography and apply it to social relationships, this is at times too tempting. Verticality and the metaphors of ‘people in high places’ or ‘high circles’ map rather well onto the social hierarchies of surveyors and naturalists vis-à-vis the EIC and the empire, and guides and porters vis-à-vis their employers. Such metaphors also help explain the economics of knowledge production in marginal spaces. David Ludden suggests that resource limits were endemic in peripheries because of ‘the low rank of frontier sites and officials. Imperial priorities gravitate toward higher interests and higher purposes. (Again, divine authority comes to mind).’\(^{109}\) This meant that ‘imperial investments must travel imperial space that is horizontal (geographical distance) and vertical (status ranks).’\(^{110}\) Tensions could thus emerge between geographical and social verticality. In what follows, we often observe lower status EIC employees attempting to shore up their contributions to both the Company and scientific knowledge, and exaggerating peculiarities to excuse their limitations (though sometimes also to expose the ignorance of ‘high authorities’ like Humboldt or William Buckland). In terms of metaphors, the sacred is also often associated with height and being elevated, and I trace the sometimes garbled ways that surveyors drew on existing understanding of high places in South Asian cosmology, even while placing themselves and their epistemologies higher than those of their guides and informants.

In thinking about the economics and sociology of peripheries, this emerges as, in some respects, a British story – or at least one that is bound up in the tribulations of the British Empire. The majority of the European actors who appear were British (a notably high proportion Scottish), though not exclusively so, and Frenchmen like Victor Jacquemont or Danes like Nathaniel Wallich also appear. The British empire in its guise as the East India Company is nevertheless omnipresent in this

\(^{110}\) Ludden, 139.
story in at least one important respect, in that surveyors and naturalists shared in common complex relationships with the Company hierarchy – whether as their employers, or as gatekeepers in granting permission to travel.\footnote{For more on transnational scientific careers in the EIC, see David Arnold, ‘Globalization and Contingent Colonialism: Towards a Transnational History of “British” India’, \textit{Journal of Colonialism and Colonial History} 16, no. 2 (2015).} Although there were occasional outbursts of xenophobia towards foreigners masquerading as fear of scientific discoveries being usurped, or of finding military service with Indian rulers, these rarely spilled over from rhetoric into real hostility towards the presence of ‘foreign’ scientific travellers in the ‘blank spaces’ of the high mountains.\footnote{For the argument that British chauvinism played a larger role, especially around jealously over French scientific patronage, see Andrew Grout, ‘Geology and India, 1770-1851: A Study in the Methods and Motivations of a Colonial Science’ (PhD Dissertation, School of Oriental and African Studies, 1995), 123–33. Sometimes, being ‘foreign’ could actually be an asset, such as in accessing parts of Kashmir controlled by Ranjit Singh that were off limits to the British (through contacts with Singh’s French generals), or in approaching the Tibetan frontier with (self-proclaimed) impunity. Victor Jacquemont, for example, was well aware of this and exploited it heavily. See Jacquemont, \textit{Letters from India}, Vol 1, 298; 364. See also Nigel Leask, \textit{Curiosity and the Aesthetics of Travel Writing, 1770-1840: From an Antique Land} (Oxford: Oxford University Press, 2002), 194–95.} The EIC nevertheless at times limited foreign access, and most notoriously turned down Alexander von Humboldt’s multiple requests to visit. Initially sounding out the idea in 1808, he formally requested access while visiting London in 1814 and again in 1817. Denied his Himalayan dream, Humboldt instead travelled through parts of Central Asia (with Russian permission) in 1829, a journey that resulted in the three-volume consolation prize \textit{Asie Centrale} (1843).\footnote{Jean Théodoridès, ‘Humboldt and England’, \textit{The British journal for the History of Science} 3, no. 1 (1966): 39–55. While the EIC’s reasoning is unknown, scholars have speculated that Humboldt’s anticolonial sentiments or links to Russia played a role. See Richard Grove, \textit{Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860} (Cambridge: Cambridge University Press, 1995), 374–75. The Company nevertheless did eventually allow the Schlagintweits to visit in the Himalaya in the 1850s on Humboldt’s explicit recommendation (even if this mission would later result in nationalistic umbrage). See Sarkar, ‘Science, Surveying and Scientific Authority’.} This was later lamented by some EIC employees in the Himalaya, and as Richard Strachey put it: ‘men of science will still long have to regret that this illustrious traveller was prevented from visiting the east; Englishmen alone need remember that he was prevented by them.’\footnote{Richard Strachey, ‘On the Snow-Line in the Himalaya’, \textit{Journal of the Asiatic Society of Bengal} 18, part 1 (1849): 287.} The greatest counterfactual to this story thus remains how different it might have looked if the EIC had not said no to Humboldt.

\textbf{Exploration and Intermediaries}

Histories of exploration largely fell out of fashion in academic circles in the 1960s, though heroic – and occasionally anti-heroic – depictions of individual explorers have remained staples of popular writing.\footnote{See Dane Kennedy, ‘British Exploration in the Nineteenth Century: A Historiographical Survey’, \textit{History Compass} 5, no. 6 (2007): 1879–1900; Dane Kennedy, ed., \textit{Reinterpreting Exploration: The West in the World} (New York: Oxford University Press, 2014).} The re-emergence of scholarly interest in exploration in the 1990s, especially in the Arctic,
Antarctica, Africa and Australia, has been articulated around the necessity of placing individual explorers firmly within their social, cultural and political contexts, as well as the production and reception of texts, and the role of institutions like the Royal Geographical Society (founded in 1830). Felix Driver, one of the leading figures in rehabilitating exploration scholarship, sums this up in his assertion that exploration needs to be ‘understood as a set of cultural practices.’

Another key theme to come out of this scholarship is the relative vulnerability of European explorers, and their reliance on local assistance and cooperation. Scholars have demonstrated that although agents of an often brutal imperialism, explorers ability to act out their supposed superiority was often limited in remote regions. Showing that explorers were confused and exploration was contingent nevertheless brings with it the risk of diminishing the horrific and inherent violence of colonial practice, and the imperial implications of these journeys for the peoples who assisted European travellers, surveyors and explorers in delimiting the borders of the empire. Michael Robinson goes further, arguing that there is an additional caveat in that ‘ironically, developing a global framework for exploration means acknowledging the asymmetries of science and exploration as Western cultural practices.’

However, just as we need to emphasise the heterogeneity of the Asian intermediaries involved in the production of knowledge about the Himalaya, we also need – as Sujit Sivasundaram reminds us – to fragment the Western side. Alexander Gerard and Joseph Hooker, for example, both made significant contributions to the scientific and imaginative constitution of the mountains in this period. They did so, however, with very different resources – both material and social – and it would be wrong to suggested they were part of coherent project. Tracing these stories is not without methodological challenges, and the archival record for some individuals – especially Bengal Infantarymen like Gerard – is often sporadic. In particular, personal correspondences are few and far between. Many of the activities of the surveyors and surgeons must thus be pieced together and read out of the archives of those better known, and more socially elevated, such as William Hooker at Kew. As a result, this thesis draws especially on articles published in nascent India-based scientific journals, including the Asiatic Researches, Gleanings in Science and the Journal of the Asiatic Society of

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118 Michael Robinson, ‘Science and Exploration’, in *Reinterpreting Exploration: The West in the World*, ed. Dane Kennedy (Oxford: Oxford University Press, 2014), 32. He elaborates that ‘one might reasonably argue that they [exploration and science] shouldn’t be applied as frameworks for understanding non-Western cultures because they would impose an artificially Western structure upon them … if the story of travel and knowledge are ubiquitous to all eras and cultures the historiography of exploration does the reverse: defining historical traditions so narrowly that they guarantee science and exploration is a story exclusive to the West.’ Robinson, 31. Dane Kennedy argues similarly that this does not mean ‘that other societies did not engage in what can be broadly construed as exploration. What it meant to suggest is that exploration is a concept and a practice that carries a particular set of cultural, social, and political valences, and they originate in the European historical experience.’ Kennedy, *Reinterpreting Exploration: The West in the World*, 1.
Bengal, all of which also contributed to the production of ‘centres in the periphery’ like Calcutta.\textsuperscript{120} Similarly, it makes extensive use of official correspondences, survey fieldbooks, maps and specimens in order to ascertain collective experiences, even while acknowledging that what survives for many of the individual surveyors is haphazard and incomplete.

If reconstructing the activities of surveyors can be challenging, this is even more so for the Asian members of expeditions. In recent decades, scholars of science, empire and exploration have increasingly recognised the critical roles of intermediaries, informants and ‘go-betweens’ in imperial knowledge-making, administration and science, though this project remains far from complete and is often characterised by methodological angst.\textsuperscript{121} In discussing cross-cultural knowledge production, it is still essential to acknowledge Mary Louise Pratt’s now seminal concept of the ‘contact zone,’ even if we might prefer Kapil Raj’s extension of Pratt’s ideas to characterise this as ‘a space constituted both of constraints and possibilities.’\textsuperscript{122} In this vein, Raj suggests that we need to understand ‘the making of scientific knowledge through co-constructive processes of negotiation … resulting as much in the emergence of new knowledge forms as in a reconfiguration of existing knowledges and specialized practices on both sides of the encounter.’\textsuperscript{123} In terms of the production of knowledge in cross-cultural contexts, notions of hybridity and joint- or co-production have had considerable appeal, and more attention is now being given to the slippages and overlaps between knowledge traditions, and the way boundaries – if there are boundaries – might be characterised as fluid and open to active renegotiation.\textsuperscript{124} David Arnold nevertheless argues that ‘such a reassuring view of the intellectual openness of the colonial encounter stands in stark contrast with the idea that the colonial interest in knowledge was almost entirely self-serving’ and even further ‘that colonialism represented not just physical coercion and enforced, social, economic, and political change but also profound cultural disjuncture and a high degree of “epistemological violence” directed against indigenous forms and systems of knowledge.’\textsuperscript{125} There has also been recognition that while Europeans might actively

\textsuperscript{120} Many of the Indian articles (often abridged) later also made their way into the \textit{Asiatic Journal}, \textit{Edinburgh Philosophical Journal} and \textit{Edinburgh Journal of Science}, or were translated for the likes of the \textit{Bulletin de la Société de géographie}.


\textsuperscript{123} Raj, \textit{Relocating Modern Science}, 223.


\textsuperscript{125} Arnold, \textit{The Tropics and the Traveling Gaze}, 8.
appropriate knowledge, operating in these spaces was as much about accidental transfer. As Fa-ti Fan explains, ‘the very action to explore the foreign land and to appropriate the indigenous knowledge entailed the influx of hybrid knowledge that resisted the naturalists’ efforts to categorize and discipline.’ Fan thus prefers the idea of ‘cultural borderlands’ as helping to highlight ‘the problem of asymmetry.’ As well as ‘contact zones’ and ‘cultural borderlands’ we might also turn to the concept of the ‘go-between,’ which Simon Schaffer and others have elaborated on, and which provides a helpful analytical lens. This is because the ‘go-between’ is not a ‘simple agent of cross-cultural diffusion, but someone who articulates relationships between disparate worlds or cultures by being able to translate between them.’

In spite— or perhaps because— of the urgency of questions around intermediaries and indigenous knowledge, significant debates and caveats have emerged in the scholarship. Scholars are increasingly sensitive to the way that often ‘local’ knowledge, as Felix Driver notes, ‘could hardly be characterised as ‘local’ or ‘indigenous’ in any straightforward sense.’ This is an important consideration in the Himalaya, where guides accompanied and assisted travellers for diverse reasons, and were notably heterogeneous: sometimes local youths hired to point out the way to the next village, at other times professional or semi-professional itinerants travelling with an expedition from entirely different parts of the mountains (or in some cases even from the lowlands). Indeed, intermediaries in the Himalaya could find themselves geographically, culturally and linguistically almost as far from home as the European travellers they were guiding. As Driver continues, ‘seen in the broader context of late-Victorian ideas about race and culture, the presentation of locally created knowledge as ‘indigenous’ or ‘native’ could be considered from a postcolonial perspective as a deeply colonial move,’ because ‘at the same time as they were airbrushing the role of non-Europeans out of their narratives, colonial travellers were also constructing visions of indigeneity and of local knowledge designed, in a sense, to keep the others in their place.’ Another key concern is that studying ‘indigenous’ knowledge may serve to either unhelpfully reify it, or alternatively, as Sujit Sivasundaram argues, to create an artificial and problematic dichotomy in which it is cast as opposite to— and if not inferior, at least essentially different from— ‘Western’ knowledge.

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130 For the *longue durée* history of ‘native’ explorers, see Mathur, ‘How Professionals Became Natives’.
132 Sivasundaram, *Islanded: Britain, Sri Lanka, and the Bounds of an Indian Ocean Colony*, 174. Similarly, Fa-ti Fan argues that with scholarly focuses on ‘science and imperial domination, so much scholarship tends to dichotomize and
The reconstruction of the roles of Himalayan peoples in exploration and scientific practice is also challenging in practical terms, because individual intermediaries are often rendered invisible or homogenised into obscurity, becoming ghosts in the narrative and silences in the archive. This is sometimes also perpetuated in modern scholarship, which might feature faceless ‘guides’ and ‘assistants’ defined by function and lacking personality or idiosyncrasy. These issues are compounded by the way that the written records for early nineteenth-century exploration and science in the Himalaya are overwhelmingly European and colonial. Indeed, it is travel narratives, journals, articles, fieldbooks and correspondences, written predominantly by Europeans – and only in few exceptional cases by Asians – that form the central body of sources for this project. In terms of the erasure and silencing of intermediaries, interrogating these texts becomes crucial, because as D. Graham Burnett notes, ‘writing defined the explorer in the field (he wrote, the crew did not) and in the metropolis (where he existed as a stream of narratives).’ This also points to the way travel narratives need to be examined as textual productions that present particular experiences of the spaces of the high Himalaya, even while these experiences underwent significant curation – both in terms of the self-fashioning of their authors, as well as massaging by metropolitan publishers and editors. Writing about intermediaries thus involves acknowledging the methodological questions arising from the use of colonial archives. In reconstructing non-European perspectives from European sources, we might employ techniques of reading against the grain, and the use of alternate sources, both material and visual, even while acknowledging the limits of viewing the world through these colonially-tinged lenses.

In addressing these caveats, I take a methodological approach that pays close attention to the practical, everyday aspects of doing science in remote locations. Here I follow insights from the history of astronomy, where Alex Soojung-Kim Pang argues that when examining expeditionary science it is important to ‘recapture the emotional texture of science along with the messy details of its practice,’ while Joydeep Sen emphasises the value of focusing on ‘the practical engagement essentialize power relations between the West and the Rest,’ and he seeks to ‘modify this perspective by exploring how the historical actors negotiated their identities and the boundaries between different cultural traditions.’ Fan, British Naturalists in Qing China, 4. See also Arun Agrawal, ‘Dismantling the Divide Between Indigenous and Scientific Knowledge’, Development and Change 26, no. 3 (1995): 413–39.

133 For the many levels at which silences are introduced to archives, see Michel-Rolph Trouillot, Silencing the Past: Power and the Production of History (Boston: Beacon Press, 1995).
between Europeans and Indians’ in order to get at the ‘experiential texture’ of doing science. I follow these scholars in tracing the realities and travails of the practice of science in spaces characterised by the crushing effects of altitude sickness, sensory derangement, and cross-cultural tensions, and the ways these textures affect how we should understand the knowledge produced in and of the Himalaya. In other words, I examine European engagement with local knowledge in a dangerous and unfamiliar environment, less from an epistemological or ontological standpoint, and more from one grounded in everyday practice and the complexities of expedition sociability. Here objects and specimens, be they instruments, tents, or even firewood, also have interesting stories to tell. In tracing these, I ultimately aim to show that Himalayan peoples and knowledge systems were not incidental to the way Europeans pursued altitude sciences in this period, and demonstrate the extent to which the agency of European explorers might be resisted and subverted in ill-understood and challenging high spaces and frontiers.

OUTLINE OF CHAPTERS
The arguments outlined above are advanced across five chapters, which unfold in thematic rather than chronological fashion. Chapter 1 considers Measurement and the instruments and practices developed to determine altitude accurately, even while highlighting the problems of breakage and sensory derangement. In examining the tools necessary to make altitude a basis for imposing commensurability, this opening chapter sets the scene for the mapping of all kinds of natural historical and ethnographical knowledge on a globe both vertical and round. Chapter 2 then examines Physiology and early understandings of medical topographies of high mountains, in particular by considering altitude sickness and expedition sociability. It focuses on the politics of bodily comparison between European travellers and their Bhotiya and Tartar guides, demonstrating that this is often revealing of dependency. Chapter 3 turns to Geology, considering especially how frontiers circumscribed the limits of knowledge, and the uneven ways that pre-existing networks moved material from the uplands to the lowlands. It focuses on the materiality of specimens and the role of labour, as well as new understandings of time in explaining the upheavement of mountains and the retreat of glaciers (in the latter case drawing on the memories of Himalayan peoples). It also considers overlapping cosmological understandings of the mountains, in particular by looking at fossils that were both ritual objects and scientific specimens. Chapter 4 focuses on Botany, shifting the lens from itinerant

137 Alex Soojung-Kim Pang, Empire and the Sun: Victorian Solar Eclipse Expeditions (Stanford: Stanford University Press, 2002), 5; Joydeep Sen, Astronomy in India, 1784-1876 (London: Pickering & Chatto, 2014), 9. See also Fan, who argues that ‘yet, scientific imperialism had to be carried out on the ground, in everyday activities, and along the matrix of human relations. As we have seen, fieldwork in natural history provided a point of entry for explorations into the day-to-day practices of scientific imperialism in cultural borderlands. Once we get to the ground, so to speak, we see that the pattern of power relations was complex, dynamic, and localized. It involved constant negotiations among different parties, and the outcome was not uniformly in favor of the naturalists.’ Fan, ‘Science in Cultural Borderlands’, 224.
expeditions to institutions by examining the East India Company gardens at Saharanpur and Mussoorie. In focusing on the ambiguous position of these gardens – straddling the uplands and lowlands – this chapter stresses the inherent haziness in attempts to graduate the vertical globe. It also demonstrates the central role of Asian gardeners and collectors in the making of the mountains.

Chapter 5 considers Biogeography, and traces debates around the elevational limits of flora and fauna, as well as the vertical dynamics of the human and nonhuman worlds of the Himalaya more broadly. In so doing, it emphasises the insidiousness of borrowing of horizontal norms to explain the vertical, and the way that theories developed in the Alps and the Andes, such as the line of perpetual snow, might fail to account for the Himalaya. Finally, in the conclusion to the thesis, I expand the lens by examining comparative tableaux of mountains in European atlases. In so doing, I consider the way that universality and global commensurability were imperfectly imposed onto mountain environments in this period. In particular, I argue that the process of making mountains global obscured both the laboriousness of scientific practice and the roles of Himalayan peoples. Before the Himalayan peaks could be made commensurable within the framework of European natural history, however, they had to be measured and recognised as the highest on the globe. This is the story of the first chapter, to which we now turn.
Chapter One

MEASUREMENT

In high mountain spaces, the senses are scrambled and scale is elusive. In October 1818, Scottish brothers Alexander (1792–1839) and James Gilbert Gerard (1793–1835) found themselves high in the Himalaya after a sleepless and freezing night on the upper slopes of Reo Purgiyl. Almost overcome by fatigue, the brothers – both surveyors attached to the Bengal Infantry, Alexander as an officer and James as a surgeon – persevered upwards as they ‘wished much to see the barometer below fifteen inches.’ As they climbed, they were wracked by the constant and disturbing symptoms of altitude sickness. James Gerard suggested these were ‘similar to the sedative effect of intoxication,’ and included near-constant headaches, difficulty of breathing, insomnia, loss of appetite, weakness, lethargy, and hypoxia. These bodily debilitations haunted the Gerards efforts at precise measurement, and were especially problematic given that they could not necessarily trust their senses in the high mountains where scale and distance are extremely difficult to judge. In his journal, Alexander continued, ‘it was 4 p.m. when we gained the summit, so we had no time to make half the observations we wished.’ This was exacerbated because their ‘hands were so numbed, that it was not until we had rubbed them for some time that we got the use of them.’ While Alexander fumbled with their theodolite, struggling to adjust it through bulky gloves, James had more success, getting readings from three homemade ‘mountain’ barometers, which all agreed at 14.675 inches. Even recording these precious measurements in the fieldbook was far from trivial, as ‘the ink froze, and I had only a broken pencil, with which I could write very slowly,’ a significant limitation given how

1 A version of this chapter focusing on the period up until 1830 has been published as Lachlan Fleetwood, “‘No Former Travellers Having Attained Such a Height on the Earth’s Surface’: Instruments, Inscriptions, and Bodies in the Himalaya, 1800–1830”, History of Science 56, no. 1 (2018): 3–34.
5 Gerard, 292.
crucial notetaking was in a world that placed hypoxic stresses on the mind and memory. Whatever the difficulties attached to precise, embodied and instrumentalised measurement in a world in which the senses were assaulted and untrustworthy, the impetus to keep moving upwards was nevertheless pressing. Indeed, the Gerards’ ascent occurred at a key moment not just for the science of measuring altitude, but also for the imaginative and political constitution of the Himalaya as the northern frontier of British India.

In this chapter, I examine surveyors’ instrumental practices in the Himalaya across the first half of the nineteenth century. I situate these practices in a context of growing insecurity around the lack of information about the mountains to the north of the East India Company’s territory, and the realisation that the Himalaya were the highest mountains on the globe. I do so by focusing especially on three types of instruments associated with measuring altitude – mountain barometers, boiling-point thermometers, and fieldbooks – and on the social performances required to render the knowledge they produced of the high mountains credible. In particular, I focus on the moments in which limits were exceeded, and instruments were found to be inadequate, or broke down and were repaired. These are revealing of the importance instruments played in establishing scientific personas and authority in a world in which the senses were unreliable. The centrality of instruments is evident in the way that, later and from the relative luxury of the lowlands, Alexander Gerard compiled an unpublished note titled ‘Memoir of the Construction of a Map of Koonawur,’ in which he reflected at length on the technical aspects of the measurements taken on Reo Purgyil. Using the readings from the barometers (those from the theodolite were no good), he calculated that the high point he and his brother had reached was not less than 19,411 feet, and likely more than 19,500 feet above the level of the sea. As he continued, ‘I have discussed the elevation of this station at some length, because the subject is interesting, from the circumstance of no former travellers having attained such a height on the earth’s surface.’

In making this claim (shared with an archivally invisible and unknown number of Tartar guides and porters), Alexander Gerard was thinking specifically of Alexander von Humboldt, whose high point on Chimborazo during his famous ascent of 1802 made him the previous holder of this distinction. By engaging with Humboldt, Gerard was seeking recognition for what was an essentially

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8 Alexander Gerard, ‘Memoir of the Construction of a Map of Koonawur,’ 1826, British Library, Mss. Eur. D137, f200. This minor peak was significantly below Reo Purgyil’s true summit (or summits, with twin peaks causing some confusion), which Alexander calculated geometrically to be 22,630 feet. This would not be reached until 1933.
9 Gerard, f200. Early balloonists had, of course, reached greater heights above the earth’s surface.
10 Neither Humboldt’s nor the Gerard brothers’ high points were ever actually the records they believed they were. Indeed, we now know (although the Gerards and Humboldt did not) from the archaeological evidence provided by
arbitrary record. Indeed, as Humboldt chided, ‘these mountain ascents, beyond the line of perpetual
snow, however they may engage the curiosity of the public, are of very little scientific utility.’ 11 Who
could go the highest (and instrumentally verify it) was a question that was nevertheless beginning to
play out on a global canvas, even while the lack of demonstrable scientific relevance meant this was a
distinction that continued to be regarded with a degree of (perhaps feigned) ambivalence. 12 This
chapter thus highlights one of the many ways that travellers in the Himalaya were compelled to
compare and contrast their experiences with expectations arising from accounts of the Alps and the
Andes. 13 In so doing, it emphasises the laboriousness of the instrumental measurements necessary to
impose — if incompletely — a form of universality that made comparisons possible. 14 New instruments
and practices for measuring altitude accurately are thus central to the story of a rising sense of global
verticity in this period, and are why this chapter comes first.

Indeed, growing interest in altitude and science saw increased scrutiny around methods of
accurately determining elevation above sea level, and the Gerards’ claiming of a new high point thus
represents an illuminating episode. In Alexander Gerard’s extended discussion of his instrumental
practices, we will see that, in effect, the brothers had to ascend to their record-breaking height on
Reo Purgyil in two different ways — first physically with their instruments, and later socially in their
descriptions and defence of their methods. Questions around credibility were unavoidable in the high
mountains, as devices originally conceived in Europe usually needed to be reconfigured — often in ad

the frozen bodies of the so-called ‘ice maidens,’ that Incas had reached the summit of Llullaillaco in the Andes several
centuries before the Gerards ventured into the Himalaya, an altitude that was significantly higher at 22,110 feet.
Chinese travellers had almost certainly been higher as well. See Walt Unsworth, Hold the Heights: The Foundations of
Mountaineering (London: Hodder & Stoughton, 1993), 191. The Gerards were accompanied to this high point by at
least one Tartar, although Alexander’s account downplays the copresence of his Asian companions. As Alexander
recorded, during the ascent, eventually the ‘the man who carried the bundle of sticks [to make a fire in order to
measure the boiling-point of water] sat down and said he must die, as he could not proceed a step further, and neither
threats nor the promise of a handsome reward could induce him to move; we accordingly left him, and after an ascent
of 700 feet, attained the top of the peak, 19,411 feet above the level of the sea.’ Gerard, Account of Koonawur, 291.’

12 The Gerards’ height ‘record’ would not be definitively broken again until 1855 by the Schlagintweit brothers,
although Jean-Baptiste Boussingault possibly went higher on Chimborazo in 1831. For this and the continuing
reflexivity towards Humboldt in the Himalaya, see Finkelstein, ‘Conquerors of the Kûn lûn? The Schlagintweit
Mission to High Asia, 1854–57’. Joseph Hooker is also sometimes credited with going higher than Humboldt in 1848
or 1849, with the Gerards overlooked. See for example Browne, The Secular Ark, 44; Stephen T. Jackson,
(Chicago: University of Chicago Press, 2013), 14. Indicative of the difficulty of determining altitudinal priority,
James Gerard likely (in 1827) reached an even higher altitude of 20,400 feet (measured by two barometers). Unlike
for the ascent of Reo Purgyil, details and sources are obscure, perhaps explaining why this was never picked up by
Humboldt or other later commentators. See James Gilbert Gerard, ‘Observations on the Spiti Valley and the
Circumjacent Country within the Himalaya’, Asiatic Researches 18, no. 2 (1833): 254–55; Gerard, Account of Koonawur,
180.
13 See for example John Hodgson’s discussion of refraction in James Herbert and John Hodgson, ‘Description of
14 For the broader context, see Marie-Noëlle Bourguet, Christian Licoppe, and H. Otto Sibum, Instruments, Travel and
Science: Itineraries of Precision from the Seventeenth to the Twentieth Century (London: Routledge, 2002).
hoc ways – before they could be useful in spaces that placed immense stress on both bodies and instruments. Reconfigurations might be physical and reflect the terrain, enabling instruments to survive the rigors of mountain travel and labour conditions, or make them easier to operate in the face of bodily debility. However, these reconfigurations were just as often conceptual, and were linked to uncertainties around the true scale of the mountains and the need to measure what were, at the beginning of the nineteenth century, unprecedented heights. By focusing on the moments when the limits – of bodies, of technologies and of imperial mastery – were exceeded, often simultaneously, we can most clearly see the social practices and positioning upon which they rely.

In all instrumental truth claims – as Simon Schaffer, Steven Shapin and others have shown – credibility depended on the status of the observers as much as the instruments. In this chapter, I focus especially on the practices of a group of largely overlooked actors, represented alongside the Gerard brothers by William Webb, John Anthony Hodgson (1777-1848), James Dowling Herbert (1791-1833), Thomas Thomson (1817–1878), and another set of brothers, Henry and Richard Strachey. These individuals were all members of the Bengal infantry – employed as army officers and surgeons – but seconded to surveys in the Himalaya, where they combined many of the characteristics of professional technicians with amateur scientific interests, albeit with variable success. While these surveyors sometimes travelled alongside the army, they usually operated autonomously within the tracts they had been assigned to survey. For the most part limited to traverse rather than trigonometrical surveys, their activities were not part of the Great Trigonometrical Survey proper, and the early Himalayan surveys were not subsumed into this project until closer to the middle of the century. Here Matthew Edney has demonstrated the ‘epistemological confusion which characterized the relationship of the Great Trigonometrical Survey with the Company’s other mapmaking activities,’ even if they shared the same political and economic imperatives for constituting frontiers and minutely mapping imperial domains.

While the physiological and psychological trials surveyors faced in the high mountains were real, this chapter demonstrates that they nevertheless needed to emphasise bodily hardship and sensory deprivation, and even exaggerate the idiosyncrasy of their surroundings, in order to elevate their authority. Accounts of instrumental practice in the Himalaya are intertwined with descriptions of, and an insistence on, challenges that could only be solved by those with direct experience of high mountain spaces. Surveyors worked to establish their credibility by showing instances when scientific and instrumental practices could not be transferred unmodified from those developed for the lowlands.

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16 Edney, Mapping an Empire, 116–18. On revenue and traverse surveys see Burnett, Masters of All They Surveyed; Arnold, Science, Technology and Medicine in Colonial India, 22–29.
and hope to be effective. The use and reconfiguration of instruments thus required an insistence on distance from metropolitan centres, reflecting not only a disconnect between the realities of scientific practice as understood between Europe and India, but also between Calcutta and the high spaces of the Himalaya.\(^{17}\) Indeed, this chapter furthers one of the central pillars of this thesis, which is the way scientific practice in the Himalaya — with its combination of challenges including assaults on the senses, logistics of porterage, border politics, and ongoing inadequacies in instrument design — was often construed as not only displaced from London, but also from India’s ‘centres in the periphery’ like Calcutta and Bombay.

Even if the conditions experienced in the Himalaya might have been less idiosyncratic than surveyors often insisted that they were, extreme mountain environments nevertheless did test the relationships between instruments, inscriptions, bodies, and authority.\(^{18}\) Underlying this was the problem of un-instrumentally mediated senses in high places. As John Hodgson, one of the most prominent of the Bengal Infantry surveyors (and later Surveyor General of India) mused, ‘whether it be from the changes in the atmosphere on high mountains, or the inconvenience of being exposed to severe cold & high winds, I find my observations never agree a fourth part so well as on the plains.’\(^{19}\)

The ability to see greater distances and a lack of referents like trees or buildings meant that scale and proportion were extremely difficult to judge and ‘every one knows the extreme vagueness and liability to error in judging of the heights and distances of mountains merely by the eye.’\(^{20}\) Nor were European senses the only ones on trial, as Alexander Gerard reveals in his description of the Shatul Pass:

> It is reckoned by the people of the country far more lofty than Boorendo; but the difference of elevation is only 450 feet … it is not surprising that a few hundred feet should create a belief of a much greater altitude, since their ideas are formed upon local circumstances, such as the distance of the ascent, absence of trees, and quantity of snow, added to the difference of level from which they set out.\(^{21}\)

Impaired judgment applied not only to sight, but also hearing as, ‘the diminution of the intensity of sound in a rarefied atmosphere is a familiar phenomenon to those who are accustomed to ascend very high mountains.’\(^{22}\) In the Himalaya, the senses could thus not necessarily be relied upon to provide a

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\(^{18}\) For the problems of estimating scale in mountainous spaces, and the possibility of calibrating one’s senses with practice, see Bourguet, ‘Landscape with Numbers’. See also Cosgrove and Della Dora, *High Places*, esp. 9–12.

\(^{19}\) John Hodgson, ‘Field Book of April 1816,’ NAI/SOI/Fdbk. 87, f73.


trustworthy interface with the environment, and the social performances required to establish credible knowledge were complicated accordingly. Instruments could extend the senses, mediated by the inscriptions necessary to record them, but this was an unstable complex. Instruments, inscriptions, and bodies, when functioning together, had the potential to bring about coherence in the mountains, but because they were all prone to failure, the accumulation of this coherence was haphazard and contested.

Recently, there has been something of a resurgence of scholarly interest in scientific instruments and in instrumental practice. Within this, maritime and astronomical instruments have received the most attention. Studies of maritime instruments in particular have interesting parallels with this story of mountain instruments, with marine barometers prone to breaking and ongoing tensions around ship’s officers owning their own instruments. However, in this chapter I shift the focus away from ships and observatories and into the spaces of the high Himalaya, to examine the spectrum of relationships between instruments, inscriptions, and bodies in a different sort of challenging environment. Doing so allows us to gain a fuller understanding of the rhetorical strategies required to establish credible knowledge of remote locations which strained the limits of both bodies and technologies. This follows from the way that, as Charles Withers has shown, ‘concerns over method and conduct’ in developing instrumental practices on a global scale were tied to tensions over the status of the field as a site of observation, such that ‘inscription and regularity of performance was both a scientific and a moral necessity.’ Beyond their practical applications, scholars have demonstrated how instruments served multiple rhetorical functions in the accounts of European explorers, as justifications for their travels and as guarantors of their scientific credibility. As Nigel Leask suggests, instruments ‘represented talismans of authorial veracity,’ and separated scientific travelers from tourists. This was nevertheless a complex relationship, and Dorinda Outram has pointed to the way that measuring with instruments did not automatically confer objectivity or universality in the first half nineteenth century, and ‘even if he used instruments to extend and calibrate sense impressions, what the explorer himself saw was crucial to establishing the truth-status of his observations’ and thus ‘instruments were thought of as enhancing human sense impressions rather than replacing them.’ In a similar vein, John Tresch argues for the social relationship between

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23 See Fraser MacDonald and Charles W. J. Withers, eds., Geography, Technology and Instruments of Exploration (Farnham: Ashgate, 2015), 4–5. See also special issues of Osiris (Volume 9, 1994) and Isis (Volume 102, No. 4, 2011).
25 Leask, Curiosity and the Aesthetics of Travel Writing, 73.
bodies and tools, and just as bodies could become instruments, so too instruments could become extensions of the body. Even further, ‘they not only extended his senses . . . they were embodiments of his relations with others and his place in the natural and social world.’ As this chapter demonstrates, however, embodied instrumental practice in the Himalaya needs to be looked at through the lens of the limits of the senses as much as the disciplining or extension of them. Here the human and nonhuman elements are analysed together, because to do otherwise would be to ‘reassert an artificial dualism of things and actions’ and as such ‘the distinction between corporeal and material, machine-like, devices is not relevant.’ Instruments could be metal and glass, or flesh and blood, and inscriptions might carry the traces of both bodily debility and congealed ink. Bruno Latour suggests that ‘objects, by the very nature of their connections with humans, quickly shift from being mediators to being intermediaries,’ but in the high mountains, where the senses were scrambled, this process was neither quick nor linear.

Despite the sensory derangement that came with the territory at high altitude, the human body itself might on occasion still directly become an instrument, if a potentially highly unreliable one. This was most famously the case for Alexander von Humboldt, who used his body as a barometer during his ascent of Chimborazo (see also Chapter 2). Such impressions could hardly be trusted, however, as Scottish surgeon and naturalist Hugh Falconer demonstrated, when he ‘found the elevation to be 15,822 feet’ which was ‘considerably less than I imagined, as many of our party were attacked with the symptoms of distress about the head which extreme altitude brings on.’ In coming up against the limits of their senses, the surveyors might be seen as participating in what Charlotte Bigg describes as the ‘on-going philosophical preoccupation with the role of sensory evidence in the constitution of

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30 For more on instrumentalised bodies see Livingstone, Putting Science in Its Place: Geographies of Scientific Knowledge, 75.
31 Hugh Falconer to [Thomas] Currie, 18 April 1839, British Library, IOR/F/4/1828/75444, para 17. Indeed, Bourguet, Licoppe and Sibum note that ‘instruments’ meanings are constituted by human performances; instruments and body techniques work together. Regimes of mutual trust and sociability help secure the complex entanglement of performance and instrument. In controversies, however, the bodily performance is often analytically split from the instrument, then called into question.’ Bourguet, Licoppe, and Sibum, Instruments, Travel and Science, 7. Henry Strachey argued the opposite, however, calling on his own experience of altitude to argue for the validity of his measurement over that of a previous surveyor: ‘Manson makes his own measurement of Unta-Dhura “about 17,500 ft” but, according to my computation, it is not less than 18,200 ft and the latter elevation agrees much better with my own personal experience of the pass and adjacent places.’ Henry Strachey, ‘Narrative of a Journey to Cho Lagan (Rakas Tal), Cho Mapan (Manasarowar), and the Valley of Pruang in Gnari, Hundes, in September and October 1846’, Journal of the Asiatic Society of Bengal 17, part 2 (1848): 533.
knowledge’ characteristic of this period. Experiences of sensory derangement were of heightened interest in the early nineteenth century, as is especially evident in the viewing of panoramas, which might induce dizziness and ‘seasickness,’ as well as sublime reflections on mortality. Rather than something to be avoided, these sensory challenges were sought out, and in pursuing ‘embodied modes of spectating’ mountains and mountain views were prominent themes. Though describing simulated rather than real danger, this literature is nevertheless helpful in conceptualising the way Himalayan surveyors responded to sensory derangement in a world in which their bodily reactions could be unreliable and imprecise. Instruments and inscriptions had the potential to serve as anchors in an environment known for playing tricks on the eyes and placing hypoxic stresses on the mind, but this potential was limited when they too were often strained to the point of failure.

In what follows, I examine tensions around the failures of bodies, instruments, and inscriptions in four sections. In the first, I consider insecurity around instrumental practice at or beyond the high frontiers. I then examine responses to damaged and destroyed instruments, focusing especially on moments in which instruments were found to be not functioning or inadequate, and how modifications and repairs might be effected or not in the mountains. This is followed by an examination of surveyors’ fieldbooks and inscriptive practices, which brings together the dual problems of the fragility of senses and the fragility of instruments in high mountain spaces. Finally, I consider ongoing problems – both conceptual and physical – with instruments designed in Europe but intended for the highest mountains on the globe. I argue that the staggered recognition of the true scale of the Himalaya reveals multiple levels of displacement in the understanding of scientific practices; that is, between actors in the mountains, in Calcutta, and in London. Throughout, I demonstrate the central role that social performances around the fragility of instruments, inscriptions and bodies – directed at both Calcutta and London – played in the Bengal infantry surveyors’ ability to establish their authority in a world of increasingly elevated scientific and political significance.

**Instruments and Insecurity**

Deploying instruments in the mountains was often politically fraught, and surveyors had to be especially careful taking measurements near the frontier with Tibet. As Alexander Gerard wrote while near Shipke, ‘we did not think it advisable to use the theodolite in the presence of the inhabitants, knowing their extreme jealousy.’ He was duly chastened and sent back, recording this in

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34 For Chinese interactions with the Himalaya at this time, see Mosca, From Frontier Policy to Foreign Policy.
35 Gerard, Account of Koonawur, 284.
his journal as a carefully choreographed performance of the limits of empire. Indeed, having already lowered his ambitions to a rough route survey by compass and wheel – rather than a more precise trigonometrical survey using the theodolite – Gerard was unsuccessful even in this more modest aim. This sort of self-policing of instrumental practice near the borders is indicative of the limitations that remained on British power and imperial mastery in the Himalaya, even while they were moving towards political dominance in the lowlands. These political realities are reflected in a map Alexander Gerard produced from his surveys, which abruptly ends in ‘blank space.’ This termination is marked with ‘stopped here by the Chinese,’ as seen in Fig. 1.1:

![Map of Koonawur](image)

Fig. 1.1. Detail from the upper right corner of ‘A Map of Koonawur,’ which was made following British acquisition of Kumaon and Garhwal. Reo Purgyil (here ‘Purgeool or Turheegung’) is clearly marked in the bottom right corner. Alexander Gerard, *Account of Koonawur, in the Himalaya*, ed. George Lloyd (London, 1841). With kind permission of the Syndics of Cambridge University Library.

Bengal infantry surveyors made multiple attempts to visit Tibet, though never to any avail, as Tartars with strict orders were always waiting to politely but firmly turn them around. As Alexander Gerard wrote: ‘I reached the limits of their country in four different quarters, but was not allowed to advance a step farther.’ 36 These meetings – which included the one following his paranoid encounter with the shughars – were intricate acts of diplomacy, and Gerard described the Tartar Lafa he negotiated with as

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‘inflexible in his determination’ though he ‘met me with an air of openness and good humour seldom equalled.’

All of Gerard’s attempts at negotiation were for naught, and neither letters of introduction nor the offer of substantial bribes were effective. The reality was that if he had decided to resort to violence, the Tartars would not have been able to stop him. He records the Lafa acknowledging this: ‘we will post ourselves on the road, but you have a sufficient number of people to force the passage, for we will not fight; we, however, trust you will not attempt it without permission.’

After the duplicitous and unsanctioned use of disguises by English adventurer William Moorcroft (1767-1825) to reach Lake Manasarovar in 1812 – which Gerard cited as a precedent for tensions – further diplomatic incidents were not something the East India Company was in a position to entertain, and the Bengal infantry surveyors were thus forced to check their instrumental ambitions at the Tibetan frontier.

These political concerns were ongoing in the 1840s, and even while the imaginative coherence of the Himalaya evolved as more travellers returned and more knowledge proliferated, the frontiers mostly remained assumed, ill-defined and resistant to instrumental fixing. Indeed, Bengal infantry officer Henry Strachey, along with his guides – a Bhotia named ‘Rechung or Rechu, Padhán of Kunti’ and Kumaoni named ‘Bhauna Hatwá Khasiah’ – made another attempt to reach the sacred lakes of Rakas Tal and Manasarowar in 1846.

In his journal, Strachey records carefully prioritising his geographical and instrumental aims for the trip, noting that when operating in the borderlands ‘there

Gerard, *Account of Koonawur*, 104–6. *Lafa* was, according to Gerard, a generic term for chief.

Gerard, 104.


Strachey, ‘Narrative of a Journey to Cho Lagan’, 111, 129. Strachey’s interactions with Rechu and Bhauna reveal much about the recruitment of expedition parties. As he explained for Bhauna: ‘he was introduced to me, unexpectedly only the day before I left Almora … but having heard previously of his qualifications, I engaged him to accompany me on this expedition; never having been to the lakes by the out-of-the-way route I am now taking, he is nothing of a guide, but promises to be useful as informant generally, and negotiator [sic] in case of any untoward collision with the Hunias; also as interpreter.’ Strachey, 129–30. Strachey also noted that he believed Bhauna was ‘the only native of British Kumáon or Garbwál not a Bhótia, that has any personal intercourse with Húndés. For many years past he has been engaged in a small trade chiefly with Pruang, either on his own account or as agent for some of the Almora merchants’ and ‘in quest of Pearls and Coral and other merchandise for Húndés, Bhauna has been often to Jaipúr and sometimes as far as Calcutta and Bombay, and he is probably the only man now living who has visited those places and Gartokh.’ Strachey, 129. At one point, Strachey was also assisted by Rechu’s brother and son (named, respectively, Tanjan and Tashigal) and later by ‘Anand, a young relation whom Bhauna has thought proper to bring with him, to assist in cooking dinner, etc: though as this is Anand’s first visit to Húndés, or southern Bhote even, he is likely to be of small use in manual service.’ Strachey, 131. These moments indicate how familial networks and connections often shaped the makeup of surveyors’ expedition parties. Strachey explained this in some detail: ‘when first asked who were to accompany me, I said that I left Rechu to bring whom he chose from his own village, (as I thought the most simple and convenient plan) but the men of Kunti raised objections, and after much discussion, it was settled … that the service should be equally distributed (like the supply of baggage cattle, provisions, &c.) each village furnishing one man, and then the separate villagers began to assert their independence of one another, and of Rechu, who was mere Pudhan of Kunti they said, and of no authority out of his own village. They will cool down a bit I hope, when I get them well into the snow.’ Strachey, 131.
was constant risk of an untimely end to our expedition, should we be detected, by the intervention of the Lhassan authorities.' The shadow of Moorcroft’s ill-received excursion in 1812 still hung over the frontier, even as Strachey employed similar tactics in attempting to disguise his appearance: ‘I have of course adopted the Hindustani “Dhab” of costume, just enough to pass muster in the distance, and nothing more, as I have not attempted to disguise the Feringi complexion of my face and hair.’ Strachey also took care to hide his instruments, even if this meant compromising his cartographic ambitions: ‘I was about to take bearings of this and other points when the alarm was given of a horseman ahead, which obliged me to pocket my compass … depriving me as I afterwards found of a most valuable observation for my survey.’ At the same time they were struggling with the limits of bodies and instruments, the surveyors simultaneously found themselves coming up against the very real – if ill-defined – limits of empire and of British imperial mastery in the mountains.

Fig. 1.2. ‘Lake of Rakas-Tal or Tso-Lanak, 15,200 feet’ which Richard Strachey noted, was ‘about 750 feet lower than the summit of Mont Blanc.’ Such serene images of instrumental practice are often undermined by fieldbook accounts of breakage, inadequacy and repair. Here the surveyors were also forced to adopt native dress, indicative of the limits of imperial mastery on the high frontiers. Plate XIII from Richard Strachey, “The Physical Geography of the Himalaya,” 1854 (unpublished). British Library, Mss. Eur. F127/202. With kind permission of The Society of Authors as agents of the Strachey Trust.

41 Strachey, ‘Narrative of a Journey to Cho Lagan’, 152–53. At the Lake of Rakas Tal, Strachey hoped to make a circuit, but fearing the chances of detection were too high, his guides engaged in creatively resisting this plan. As Strachey describes, ‘in the evening, Rechu, with a well assumed air of distress, reported that both the ponies had strayed from our camp, and one of the Bhótias in search of them for the last hour not yet returned. I have a strong persuasion that this was a contrivance of my worthy companions to put a spoke in the wheel of my parkarma [circuit]; for being rather sulky, I had not yet informed them of my consent to abandon that design: their clumsy artifice would certainly not have stopped me, if I had resolved upon it, as my own plan had been to go without the horses, riding one of the Zhobus when I could not walk.’ Strachey, 167. The next day, he continued ‘the ponies not yet found, reported Rechu this morning, either to make sure (as he might think) of me and my Parkarma, or to preserve the vraisemblance of his own stratagem; and besides the Bhótia already detached two others had walked off, as they pretended to enquire for mutton at Tokar, but in fact more probably straight back to Byáns, for they never showed themselves again to the end of our journey.’ Strachey, 167.


43 Strachey, 146.
Fragile Instruments, Fragile Methods

Returning now to Alexander Gerard on Reo Purgyil, we find that when recording that he had reached a new high point on the surface of the earth, he was well aware that this claim was not without the need for some pre-emptive defence. In a justification in which competitiveness and scientific utility blur, Gerard wrote that:

\[\text{As everything depends upon the accuracy of the instruments employed, I shall observe, that the barometers used by my brother and myself in 1818, which were the first successfully carried through this quarter of the hills, were manufactured by a native of India, and every precaution was taken to ensure precision.}^{44}\]

These instruments, made from tubes blown by a local craftsman and fitted up by the brothers with scales made from fir rods, had become necessary replacements when a set of mountain barometers they had ordered from London had been smashed in the process of being shipped from London. They were nevertheless excellent instruments, and when later compared, the Gerards’ makeshift barometers were found in one case to differ ‘only two feet from that deduced in the following year by Dollond’s mountain barometer; and the discrepancies are rarely thirty feet.’\(^{45}\) This remark points, however, to a key problem with the brothers’ country-made barometers; specifically, a rhetorical one. The recognizable name of Dollond – one of the most respected of the London instrument makers – conveyed an authority that the Gerards’ India-made devices never could. Indeed, Alexander Gerard felt compelled to return to the hypoxic and frightening heights in 1821 to confirm some of his earlier readings, this time with a pair of Dollonds acquired especially for the purpose, even while showing that they were not necessarily more accurate or precise.\(^{46}\) There was a tension between instruments from the workshops of reputed metropolitan artisans that provided credibility but were ill-suited to the scale and challenging topography of the Himalaya, and India-made, modified, and repaired instruments that functioned well in mountainous spaces, but lacked rhetorical claims to authority.

Taking altitudes by barometer was becoming preferred by the 1820s, and the go-to solution when logistics or terrain prevented trigonometry, having the advantages of relative simplicity and reasonable accuracy.\(^{47}\) Using mercury filled tubes to measure air pressure was a well-established

\[\text{\(^{44}\) Gerard, } \textit{Account of Koonawur}, \text{ 161.}\]
\[\text{\(^{45}\) Gerard, } \text{164.}\]
\[\text{\(^{46}\) James Gerard returned to the Reo Purgyil high point itself in 1820, and made additional barometrical measurements. With the Dollonds in 1821, Alexander only took measurements of lower stations, but used the comparisons to argue for the accuracy of the homemade barometers used in 1818. Gerard, } \textit{Memoir of the Construction of a Map of Koonawur}, \text{ f200-1.}\]
\[\text{\(^{47}\) Despite increasing reliance on barometers, they did not as yet instil as much confidence in scientific audiences as altitudes determined geometrically. Alexander Gerard was aware of this, noting that the Reo Purgyil station ‘being a principal point, and I believe the greatest height ever attained on the earth’s surface, either in India or any other country, I was at some pains to determine it … by trigonometry.’ Gerard, } \textit{Account of Koonawur}, \text{ 176. However, applying trigonometrical methods in the Himalaya had its own rhetorical issues around refraction, was arduous and resource intensive, and in many cases was simply unfeasible in the first decades of the nineteenth century. The continuing development of trigonometrical methods thus occurs in parallel with this story, even while I focus here on}\]
practice, dating back to the seventeenth century, and barometers explicitly intended for measuring height – ‘mountain’ barometers – had been in use since the eighteenth century, with Horace-Bénédict de Saussure carrying one to the summit of Mont Blanc in 1787, William Kirkpatrick using them in the Himalayan foothills of Nepal in 1793, and Humboldt deploying them on Chimborazo in 1802.\(^48\) The biggest limitation of barometers, however, was that they were inherently fragile and easily damaged (or destroyed) by the rigors of travel. Rates of attrition were high, and as Alexander Gerard recorded: ‘two barometers were left at Soobathoo [as controls], and out of the fourteen which we took with us, only two returned in safety.’\(^49\) Beyond their fates in the mountains, barometers were often broken during shipping from Europe, and arrived in India already unserviceable. John Hodgson lamented, for instance, that his new barometers had all arrived smashed to pieces and pleaded that, ‘whenever barometers are sent, there should be to each at least 6 spare tubes filled in England by the maker & these should be carefully packed in separate cases of copper or wood lined with flannel.’\(^50\) Even those that made it to India intact could still be destroyed on their way from Calcutta to Himalayan staging grounds like Saharanpur or Subathu. James Herbert, for example, recorded that a long-awaited barometer he had ‘looked forward to’ was damaged on the dawk journey from Calcutta, though by reboiling it he was able ‘to restore its value.’\(^51\) No sooner had it been repaired, however, than it was smashed again, this time in a definitive fashion – ‘broken by the carelessness of the servant who had charge of it and rendered utterly useless’ – a loss ‘much to be regretted independent of its pecuniary value’ as it was irreplaceable so far from the workshops of London.\(^52\) While at Saharanpur, Herbert was forced to attempt to manufacture an alternative, using ‘tubes which are constructed here by Native Glass men.’\(^53\) In these instances, Indian instrument makers were usually reduced to rote laborers rather than artisans, with surveyors appropriating credit for providing the instruction, which was also essential to establishing the credibility of the final product.\(^54\)

The fragility of barometers was partially addressed by developing methods for repairing and replacing tubes in the field. However, as Hodgson recorded in his fieldbook of May 1817 – while

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\(^49\) Gerard, *Account of Koonawur*, 162.

\(^50\) John Hodgson, ‘Field Book of May 1817’, NAI/SOI/Fdbk. 91, f170. Makers of marine barometers faced similar problems, as the sloshing of the mercury in rough seas also tended to break tubes.

\(^51\) Herbert to Charles Lushington, 7 February 1827, British Library, IOR/F/4/1068 no. 29191, f31–2.

\(^52\) Herbert, f32.

\(^53\) Herbert, f33.

\(^54\) ‘Literary and Philosophical Intelligence’, *Asiatic Journal* 11 (1821): 377. Occasionally Indians might be considered artisans, the most prominent example being Mir Mohsin who worked as instrument maker in the Surveyor-General’s office for the better part of two decades. See Sen, *Astronomy in India*, 1784-1876, 85–89.
being rocked by earthquakes as he struggled to become the first European to reach the source of the Ganges – boiling tubes was a vexing endeavour and ‘none but a professed artist can expect to succeed in this difficult business, once in ten times.’\textsuperscript{55} The difficulty of boiling tubes in the mountains was frustrating given this had the advantage of overcoming the lag-time of potentially more than a year when ordering instruments over from Europe (not to mention the ongoing problem of pre-filled tubes arriving already broken). In these moments though, the embodied observers might prove as fallible as the instruments, and Hodgson admitted to being ‘too much tired to attempt to boil the mercury in the tubes today,’ while the ‘frequency of the earthquakes made us very anxious to get out of our dangerous situation in the bed of the river.’\textsuperscript{56} Hodgson made use of his imperfect barometer anyway, insisting that it was still of value and: ‘with the unboiled mercury there must be an error but I should not think it can affect the height more than 200 feet & generally not 100 feet & as under the present circumstances we cannot do more.’\textsuperscript{57} In examples like these, as Charles Withers, Innes Keighren, and Bill Bell argue, the fact that observers ‘had tried, if not succeeded, was nevertheless central to their self-positioning as credible, scientifically minded observers.’\textsuperscript{58} Even when boiled successfully, questions over whether a barometer was of the same value once it had been repaired or modified were unavoidable. French traveller and naturalist Victor Jacquemont, after vilifying his Asian assistant for breaking one of his barometers, noted that anyway ‘Il n’était déjà plus comparable avec l’étalon de l’observatoire de Paris, puisque j’en avais changé le tube,’ and subsequently never trusted the instrument the same way.\textsuperscript{59} These moments are revealing, leading to what Simon Schaffer has called the importance of ‘managing states of disrepair’ in instrumental practice, something that was especially critical in far-flung, displaced locations like the high Himalaya, where replacements and expert repairs were not readily available.\textsuperscript{60} In turn, managing disrepair required emphasising the dangers and difficulties faced in order to justify the use of less than perfect instruments, and to establish the credibility of any claims made using them. The fieldbooks of the Bengal infantry

\textsuperscript{55} John Hodgson, ‘Field Book of May 1817’, NAI/SOI/Fdbk. 91, f169. A version of this account was also published as John Hodgson, ‘Journal of a Survey to the Heads of the Rivers, Ganges and Jumna’, \textit{Asiatic Researches} 14 (1822): 60–152.
\textsuperscript{56} John Hodgson, ‘Field Book of May 1817,’ NAI/SOI/Fdbk. 91, f167; 171.
\textsuperscript{57} Hodgson, f169.
\textsuperscript{58} Keighren, Withers, and Bell, \textit{Travels into Print}, 97.
\textsuperscript{59} Victor Jacquemont, \textit{Voyage Dans l’Inde Pendant Les Années 1828 à 1832} (Paris: Firmin Didot frères, 1841), Vol 2, 156. [‘it was no longer comparable with the standard of the Paris Observatory, since I had changed the tube’]. By the 1840s such procedures were more commonplace, as Richard Strachey indicates: ‘I unfortunately broke my barometer on the top of the pass, and was therefore unable to make any certain measurement of its height … [but] we reached Laptel about half-past three, and I immediately set to work to restore the barometer … I had taken a spare tube already filled in case of accidents, so I soon got this into its place, and I had no more disasters afterwards.’ Richard Strachey, ‘Narrative of a Journey to the Lakes Rakas-Tal and Manasarowar, in Western Tibet, Undertaken in September, 1848’, \textit{The Geographical Journal} 15, no. 4 (1900): 165–67.
\textsuperscript{60} Schaffer, ‘Easily Cracked’, 709.
surveyors are rife with descriptions of improvised and ad-hoc instruments, complete with almost desperate insistence by their observers that the readings they were producing were of value.

Given the difficulties with barometers, one possibility was to turn to a different class of instruments entirely. While barometers were deservedly popular, determining altitude by calculating the falling temperature of the boiling point of water had long been known – ‘an experiment exhibited in every class where natural philosophy is taught’ – as a reasonably accurate method of determining elevation above sea level. The smaller boiling-point thermometers were somewhat less fragile than the larger barometer tubes, cheaper, and relatively straightforward to use. On the other hand, the boiling-point method could never deliver as high a degree of accuracy, reliability or precision.

According to Alexander Gerard, John Hodgson was ‘the first person in India who thought this method sufficiently accurate for determining heights,’ and his opinion carried significant weight once, his constitution shattered from the brutal work of the survey, he moved from the mountains to Calcutta to take up the job of Surveyor General in 1821 and had the opportunity to apply his direct experience of the high places. Indeed, the boiling-point method was enthusiastically advocated by Hodgson, who acknowledged that even if it was ‘only approximative’ this was to a ‘very desirable degree in many cases.’ (It also had, as English orientalist scholar James Prinsep noted, the benefit of allowing one to simultaneously practice science and brew oneself a reinvigorating cup of tea.) The boiling-point was thus often considered a secondary method and a useful backup, such as when a parties’ barometers had all been broken or were with straggling porters and not to hand. Indeed, thermometers were only approximative instruments and even if they ‘very seldom indeed gave the altitude 300 feet different from the barometer,’ the rhetorical work required to establish their credibility exceeded that of barometers.

Thermometers nevertheless became widely used, especially by those who came later with more modest instrumental ambitions, and who often relied more on previous travellers than their own practices. As Thomas Thomson wrote in 1852: ‘the heights of places given in the work have been derived from very various sources. Those in the earlier part are chiefly from the extremely accurate observations of the Gerards; for others I have to thank my fellow travellers.’ Indeed, as he went on

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62 Gerard, 177. Hodgson was Surveyor General from 1821-23, and again from 1826-29.
63 Herbert and Hodgson, ‘Description of Passes in the Himalaya’, 589.
64 James Prinsep, ‘Table for Ascertaining the Heights of Mountains from the Boiling Point of Water’, *Journal of the Asiatic Society of Bengal* 2 (1833): 200. Elsewhere, Joseph Hooker supplemented his instrumental practices with stronger stuff: ‘I boiled water at the most advantageous position I could select, and obtained an elevation of 16,522 feet. It was snowing heavily at this time, and we crouched under a gigantic boulder, benumbed with cold. I had fortunately brought a small phial of brandy, which, with hot water from the boiling-apparatus kettle, refreshed us wonderfully.’ Hooker, *Himalayan Journals*, Vol 2, 90-1.
to confess of his own numbers, most were derived ‘from my own observations of the boiling-point of water, and do not therefore pretend to great accuracy. Still the thermometer which I used (by Dollond) was a very good one’ and he pronounced himself satisfied that his elevations ‘may be depended upon to within three or four hundred feet as an extreme error.’ Thermometers and barometers were also often used in parallel, and Joseph Hooker, even with access to improved mountain barometers in the 1840s, thought that ‘the use of the boiling-point thermometer for the determination of elevations in mountainous countries appearing to me to be much underrated,’ even if often overcome by practical difficulties at very high altitudes. A key issue was the necessity of having firewood to hand (and the ability to make a fire in an extreme environment) to boil the water. Indeed, the journal of Henry Strachey, in which he took elevations in the manner ‘common with ill-equipped private travellers’ is littered with remarks like ‘fuel being scarce and Bhotias dilatory, I was unable to boil the thermometer here’ or there ‘was so little fuel forthcoming that I could not boil my Thermometer.’ His brother Richard commented on this issue, and the way it might be partially addressed by ad hoc modifications: ‘the greatest difficulty is constantly met with in managing the fire in the rarefied air and violent winds of high passes’ and noted that ‘my brother’s apparatus – which he tells me was the only one that he found thoroughly efficient and satisfactory in all exposures – was made by himself from a small tin lantern, which was fitted with a spirit lamp.’

In spaces where terrain and logistics frequently exposed the inherent fragility of the available apparatuses of science, self-sufficiency and the ability to repair or modify instruments with rudimentary supplies, or find Indian craftsmen who could, was critical to the required skill set of the Bengal infantrymen. As a pseudonymous contributor to *Asiatic Journal* of 1818 wrote, if a young surveyor:

received some instruction in this country that might enable him to replace a screw, or any similar defect, in an instrument, to replace the glass tube to a barometer, in filling a spare tube with quicksilver, it may become … of the greatest importance in a distant survey, for it would be in vain, then, to think of aid from the mathematical instrument-makers residing in Europe, or even of any that might, or might not happen to dwell in Calcutta.

For those operating in locations displaced not only from London but also far removed from Calcutta, innovation and self-reliance were essential. Hodgson argued, admittedly from a position of pride as he

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67 Thomson, iv–v.
stepped down from his second brief tenure as Surveyor General, that ‘the best geographers have not been issued from the learned universities and academies’ and instead:

are, and will be, the officers of the native army, Captains and subalterns, men accustomed to march from one extreme of this vast country of Hindoostan to the other; observers of localities and manners, and learning in the school of necessity & experience how to adapt means to ends.\(^{72}\)

In the 1810s, members of the Government in Calcutta proposed employing professionals rather than seconded army officers for the Himalayan surveys, but Hodgson was dismissive because those specialist engineers ‘who possess sufficient local knowledge to make them useful as surveyors have more pleasant and profitable duties open to them,’ and suggested that ‘nothing but necessity or a strong bias towards the science ever made any man serve in the dangerous and arduous work of surveying.’\(^{73}\)

Beyond the risks and physical hardships were significant expenses, especially those associated with the large parties that surveyors had to travel with to transport their instruments. Costs meant limitations, and Alexander Gerard, as a working surveyor rather than a gentlemanly traveller, complained that he had an allowance of only 250 rupees a month ‘whilst the wages of the porters alone, for my baggage and instruments, (exclusive of my own Servants & expenses) amounted to upwards of 400 Rps per month, I had not the means of extending my journey longer.’\(^{74}\) The instruments themselves also represented a financial burden, often purchased and owned by surveyors personally, with significant potential to be lost, stolen or broken in the mountains. William Webb wrote in 1815 that he had ‘no instrument, of any description, belonging to Government, and have, including barometers, expended nearly £1200 on instruments, a great proportion of which arrived (or have since been) broken.’\(^{75}\) Though official instruments existed and ‘there were occasions when Government instruments were issued on loan or payment,’ the tools supplied by the government tended to be of inferior quality ‘sent by contractors trying to maximise their profits’ and in some cases ‘so bad & rough’ as to be hardly worth the ‘expense of carriage for them.’\(^{76}\) James Prinsep remarked, for example, that ‘on some standard thermometers in the Surveyor General’s office … we found the boiling point erroneous two degrees,’ a margin of error that meant heights could be off by as much as 1000 feet.\(^{77}\) The expenses for essential but inherently fragile instruments were partially reimbursed

\(^{72}\) Hodgson to Duncan Montgomerie, 30 November 1826, NAI/SOI/DDn. 220, f219; Hodgson to William Casement, 24 January 1829, NAI/SOI/DDn. 231, f262-3.

\(^{73}\) Hodgson, f260-1.

\(^{74}\) Gerard, ‘Memoir of the Construction of a Map of Koonawur’, f206.

\(^{75}\) Webb to Colin Mackenzie, 8 October 1818, NAI/SOI/DDn. 150, f69.

\(^{76}\) R.H. Phillimore, *Historical Records of the Survey of India* (Dehra Dun: Survey of India, 1954), Vol 3, 211-22; Hodgson to Colin Mackenzie, 1 July 1816, NAI/SOI/Memoir 60, f273. For more on issues around inferior instruments being sent to India, see Schaffer, ‘The Bombay Case’.

\(^{77}\) Prinsep, ‘Table for Ascertainiing the Heights of Mountains’, 198.
through the Company’s unwieldy surveying allowances system, but this was rarely sufficient. The protracted struggles of the Bengal infantrymen to make administrators in Calcutta and London understand the instrumental challenges they faced in the high mountains highlights the ongoing imaginative disconnect between those in the Himalaya and those lower down on the vertical globe. These concerns also further illustrate the tensions around the professional status of Himalayan surveyors as employees of the East India Company, and their amateur grafting of scientific interests onto official duties, pointing to the sometimes uneasy relationship between the East India Company and the unofficial and idiosyncratic networks of scientific patronage that functioned within it. These tensions were exacerbated by insecurity around the lack of information about the high frontiers, but for knowledge to make its way out of the mountains it first had to be written down. This was far from straightforwardly achieved in a world in which bodies, senses and instruments were all pushed to their limits and beyond, as we will see in the next section.

Notebooks and Inscriptive Practice in the Mountains
In August 1822, James Gerard once again found himself high in the Himalaya, this time atop the Shatul Pass, which he calculated by barometer to be 15,500 feet above the sea. He had returned to the Shatul because he was hoping to recover some fieldbooks and instruments (a telescope and a thermometer) which had been lost during a prior expedition. In September 1820, they had vanished into the Himalayan snows after the boy carrying them and another porter had frozen to death at midday, the result of exposure and wind-chill during an unexpected blizzard. Gerard described his search for the fieldbooks in a letter that was later published, writing that after first discovering the ‘bones and clothes of the Brahmin who carried a bundle of sticks’ he continued down until:

We came upon the body of the little boy who carried the field-book and all the papers of the route. He was half buried under the snow. He lies at 13,500 feet. We searched in vain for traces of the books, so that they are for ever lost. This being a chief object of my tour, and one I had much at heart, it made me look forward to the rest of it with less interest, but I had determined to ascertain the correct elevation of the cave, and continued descending.

The freezing conditions had left the body preserved – ‘with all his clothing on, and his corpse untouched’ – a reminder, not that Gerard needed one, of the fragility of bodies in an extreme environment. Gerard’s lament points to the way that fieldbooks, and the instrumental data they

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80 Gerard, ‘A Letter from the Late Mr J.G. Gerard’, 313–14. They had better luck with the telescope, which was recovered and put back into service. In fact, it was the very same telescope that Alexander Gerard used to convince himself he was looking at *shugars* rather than Tartar guards during the episode that opened this story. This is revealed in a footnote *‘By the by, the glass has suffered no injury from its being buried under the snow for nine months.’* Lloyd and Gerard, *Narrative of a Journey*, Vol 2, 121.
81 Gerard, ‘A Letter from the Late Mr J.G. Gerard’, 314. See also Colley, *Victorians in the Mountains*, 220.
contained, could have especial, almost talismanic, significance to the surveyors, and the loss of information comes across as more poignant than the loss of life. Instruments, inscriptions, and bodies, which needed to work together to establish the credibility of claims about the high mountains, were all fragile and prone to failure in high places. The social performances required to overcome these were somewhat different for fieldbooks than they were for barometers, as this section demonstrates, focusing on the moments when both writing materials and inscriptive practices broke down.

Measurements using precision instruments were of little value if the data they produced could not be successfully transmitted out of the mountains, and the fieldbooks – fragile and idiosyncratic – were the sometimes shaky cornerstone of the relationship between bodies, senses, and instruments in the high Himalaya.

In 1818, and only shortly before becoming Surveyor General himself, John Hodgson was scolded by the Surveyor General’s Office in Calcutta for failing to lodge his fieldbooks in a timely manner. In response, he noted that all his fieldbooks were:

Digested and compiled from the rough notes taken as I proceed and written briefly in the open air and often in the rain and snow so as frequently to be hardly intelligible to any but the writer … they are interspersed in various books with miscellaneous matter of tentative calculations, extracts and tables copied from scientific works … almost illegible owing to the circumstances under which they were written. 82

Fieldbooks, being made of ephemeral materials like paper, card, and parchment, were by their nature vulnerable. As well as being effaced by snow and rain or in river crossings, they might be lost entirely, as in the case of James Gerard’s fieldbooks on the Shatul, or Herbert who ruefully had to report that: ‘the total distance to the [Gunas] pass I have no means now of ascertaining, for the last few leaves of the route-survey … were afterwards blown from the book on the stormy summit of the pass.’ 83 As much as a broken barometer might render a surveying expedition a waste of time, the inability to write or failure of writing materials might have the same effect. Indeed, like barometers and thermometers, fieldbooks would be developed as a technology of exploration, so that by 1854 the authors of ‘Hints to Travellers’ could recommend that: ‘writing and drawing materials, stationery, scales, tapes, and register-books, should be carried in convenient cases – water-tight, if possible.’ 84

The inclusion of fieldbooks alongside other scientific instruments in this chapter follows recent interest in the practices of inscribing observations in the field, and the relationships between memory, writing and editing practices. Here Marie-Noëlle Bourguet has shown that ‘the rationale for travel note-taking derived from the twin dangers of an unruly observation in the field and an unreliable

82 Hodgson to Charles Lushington, 12 December 1819, NAI/SOL/DDn. 145, f69-70.
83 Phillimore, Historical Records of the Survey of India, Vol 3, 42.
Bodily movement and inscription were intertwined, and good notetaking practice involved disciplined, daily writing coupled with an attention to intelligibility. However, this was more often the ideal than the reality in the face of the extreme topography, and Herbert confessed that often while traveling in the mountains, 'the fatigue is so great that it is impossible after arriving at the ground to set down immediately, to copy field books, or protract.' Bodily limitations meant that rough field jottings usually needed to be transcribed and edited before they were useful, and most calculations were not performed on the spot but worked up later. Notetaking discipline was also important in a more morbid sense, as fieldbooks could, assuming they were intelligible, serve to transmit data in a manner that might transcend the unfortunate deaths of their makers. This is evident from a moment in which it went wrong. In 1842, having recovered several of James Herbert’s fieldbooks following his untimely death, the assistant commissioner of Kumaon, John Hallet Batten (1811-86), lamented that several were: ‘badly written, and parts of them are very obscure. One of the vols. is written topsy-turvily, *i.e.* one set of observations are recorded on one side of a page, and another set on the other, and large *lacunae* intervene.’ As he continued though:

> Luckily this volume relates to Kumaon, and British Gurhwal, tracts with which I am intimately acquainted, and my local knowledge enables me to decipher the names of places, and connect the threads of the narrative. I assure you that nobody at Calcutta can possibly interpret the volume in question.

In these volumes, lack of discipline and good notetaking practice diminish the value of Herbert’s books, and increase the difficulty of extracting useful knowledge. Batten’s social performance nevertheless rests on explicitly claiming distance from those in Calcutta, and asserting that only someone with direct experience of the displaced spaces of the Himalaya might be able interpret the imperfectly inscribed notes (and if those in Calcutta would struggle, what hope for interpreters in London?). Here, as in other social performances by the Bengal infantrymen, it is a deliberate

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88 J. H. Batten, ‘Letter to Henry Torrens, 8 February 1842’, *Journal of the Asiatic Society of Bengal* Vol 11, part 1 (1842): 583. At the time of his death Herbert was serving as astronomer to the Nawab of Oudh. He had also served as the founding editor of the short-lived journal *Gleanings in Science*, which James Prinsep took over and relaunched as the *Journal of the Asiatic Society of Bengal* in 1832.
89 Batten, 583. As he continued: ‘James Prinsep gave up the task in despair, and I would not keep the vol. in question for a day, if I thought that his successor in Calcutta could really make any thing out of the MS.’ Batten also noted that these problems were exacerbated by the way that the manuscript had suffered material damage: ‘in its present state I defy any one, who has not been at every spot named, to decipher the words, and to fill up the gaps caused by moths and white ants.’
insistence of the idiosyncrasy of Himalayan spaces that elevates Batten’s contribution to the increasingly pressing questions around the true scale of the Himalaya.

Reliable and immediate inscription, and disciplined notetaking practice, were especially critical in an environment that induced extreme fatigue and the stresses of altitude sickness. As Joseph Hooker recorded while descending the Yangma Valley in 1848: ‘lassitude, giddiness, and headache came on as our exertions increased, and took away the pleasure I should otherwise have felt in contemplating by moonlight the varied phenomena, which seemed to crowd upon the restless imagination.’90 However, as he continued, ‘happily I had noted everything on my way up, and left nothing intentionally to be done on returning.’91 Indeed, as he further explained, in what was also a rhetorical strategy to reassure the reader of the reliability of his observations:

I always carried my note-book and pencil tied to my jacket pocket, and generally walked with them in my hand. It is impossible to begin observing too soon, or to observe too much: if the excursion is long, little is ever done on the way home; the bodily powers being mechanically exerted, the mind seeks repose, and being fevered through over-exertion, it can endure no train of thought, or be brought to bear on a subject.92

Against the sensory assaults of the mountains, fieldbooks could be examined and held up as talismans of authority, and as bulwarks against later failings of memory, editorial meddling or hindsight rejigging. Indeed, fieldbooks might have noteworthy afterlives, such that transparency in method, recognition of potential sources of error, and the provision of the raw uncorrected measurements – ‘for those persons who may wish to re-calculate them’ – was an important consideration.93 This was especially so given the status of the Bengal infantrymen as working surveyors rather than gentlemen, and the way they sometimes awkwardly combined the characteristics of amateur enthusiasts and professional technicians. The tension around the surveyors’ status was very apparent when it came to the controversy surrounding the true height of the Himalaya, and their supremacy over the Andes. As James Herbert wrote:

I would first observe, that this survey involves as a principal point the determination of the height of the Himmaleh now acknowledged to be the highest range of mountains in the world by all except such as at home think science confined to Europe & that it is impossible for an officer in the Company’s service to measure the height of a mountain.94

Herbert continued that:

In the determination of this point I think I may say the national honor is concerned as well as that of the Bengal Army. To satisfy such prejudiced … judges it is evident that something more is required than the more routine work which it is the lot of most surveyors to furnish … no determination of heights will ever satisfy the curious in Europe that is not

90 Hooker, Himalayan Journals, Vol 1, 247.
91 Hooker, Vol 1, 247.
92 Hooker, Vol 1, 247.
93 Gerard, Account of Koonawur, 165.
94 Herbert to Colin Mackenzie, [nd] 1819, NAI/SOI/DDn. 152, f130.
accompanied with ample details as to the original observations as well as a full exposition of
the methods of calculation.95

The fieldbooks of raw data, alongside careful justifications of the instrumental practices developed and
the conditions they were used under, become essential. Hodgson and Herbert went on to sum up
their findings by placing an emphasis on their authority by distance and their ability to operate in a
physiologically extreme and sense-scrambling world:

While we deprecate the theorists pronouncing too decidedly on the value of results, which
may appear to him, much too discordant, we feel confident that in the eyes of the practised
observer, who will consider the nature of our instruments, and the difficulties with which
we had to contend, these very discrepancies will prove our strongest claim to his
confidence.96

The making available of fieldbooks was a rhetorical strategy for claiming credibility, even if this also
implies that interpreting the data might rely on first-hand experience of particular places. Herbert and
Hodgson are, like Batten, claiming distance from not just London but also Calcutta, and thereby
establishing their privileged ability to produce knowledge of displaced spaces from within them. Their
challenge to the ‘theorists’ is nevertheless muted because, in carefully laying out the particulars of
their practices and instruments, it is ultimately the acceptance and approbation of these gentlemen
that they are seeking.

Beyond the precious data they carried – the raison d’être of heading into such extreme
environments at all – fieldbooks were also crucial to Himalayan surveyors (specifically those
answering to the Bengal Presidency) in a more practical sense, in that they needed to be furnished to
be reimbursed for surveying allowances. Regulations stated that fieldbooks had to be sent back
monthly, though this was often an impossible ask in the mountains. Sometimes, Hodgson resorted to
sending a summary: ‘I call it a field book to entitle me to my allowance as I am in debt for the
expenses of my extra hill carriage.’97 Surveyors frequently complained at the impracticality of having
copies made in the mountains, and the limited availability of trained scribes.98 The problem was that
the regulations were designed for the plains, and failed when they came to the mountains where
labour and porterage were more expensive, copyists scarcer, and repairing or obtaining replacement
instruments a much slower process. In an extended critique of the fieldbook regulations, Hodgson
cited as his most glaring example of this disconnect that:

by the regulations all surveys are to be discontinued during the rainy season, and the full
allowance of a surveyor cease, but it is in that season alone, when the snow is to a certain

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95 Herbert, fl 30-1.
the Heights and Positions of the Principal Peaks of the Himalaya Mountains’, Asiatic Researches 14 (1822): 211.
98 Hodgson to William Casement, 6 November 1827, NAI/SOI/DDn. 231, f77.
degree melted, that we can best explore these deep recesses of the Himalaya, where the rivers originate.\(^9\)

Fieldbook regulations were unpopular and were ongoing sources of friction between those in the mountains and those in Calcutta, further highlighting the disconnect in the understanding of the conditions and bodily hardships associated with scientific practice in the high mountains. By the time Hodgson descended from the mountains to take up the post of Surveyor General in 1821 and had the opportunity to apply his direct experience to redressing the regulations, the problem was urgent. As William Webb argued, ‘no person would undertake the fatigues, risks, and exposure of those alpine journeys, with the chance of being fined in the amount of his establishment.’\(^{100}\) There was a degree of change, however sluggish, by the 1840s when Richard Strachey was ‘authorised to obtain on the public service any instruments that can be spared by the officers who have them in charge.’\(^{101}\) He was also allowed to ‘purchase or obtain from England’ any instruments otherwise unborrowable but essential to successfully prosecuting the task and ‘the Lieutenant Governor will authorise the payment for them on the public account, if the expense be moderate,’ but even such qualified largesse remained far from the norm.\(^{102}\)

**The Problem of Scale**

Beyond developing practices for day-to-day repairs, intelligible inscription and the repurposing of inadequate devices, it was quickly apparent to the Bengal infantry surveyors gaining access to the high Himalaya in the 1810s that the instruments offered by London artisans had notable limitations, both conceptual and physical. Central to this was the need for instruments that would read low enough to give altitudes for the highest elevations such instruments had ever been deployed at.\(^{103}\) Indeed, Alexander Gerard wrote of standard barometers – even those marketed as ‘mountain’ barometers – with exasperation as ‘all I have seen are not adapted for the measurement of very high places.’\(^{104}\) He continued that while one ‘went as low as 20 inches’ it would nevertheless ‘be of no use amongst the Himalaya, where I have travelled many hundred miles without having the barometer above 19½ inches, and once so low as 14.675 at the height of 19,450 feet.’\(^{105}\) Gerard thus leverages his authority from experience, elevating himself from a mere data gatherer to a scientific pioneer. As a contributor to the Calcutta-based journal *Gleanings in Science* reveals, scales were an ongoing problem even in

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\(^9\) Hodgson to Lieut. Colonel Young, 12 July 1818, NAI/SOI/DDn. 152, f66-7.

\(^{100}\) William Webb to Colin Mackenzie, 8 October 1818, NAI/SOI/DDn. 150, f71.


\(^{102}\) Thornton, f18-9.


\(^{105}\) Gerard, f136.
1829: 'when I ordered my brass scales from Dollond, I had them divided down to 17 inches, which I imagined, then, would be the limit of their travels upward.' However, 'the mercury sunk 1 1/2 inch below this point' and the observer was forced to try and compensate for this by carving marks below the scale with a penknife in the hope of extending it later. In this instance, the instrument’s unsuitability for the task was literally inscribed into it. There was an ongoing disconnect between instruments designed in Europe (perhaps for the Alps) and those needed for the highest mountains on the globe. That instruments capable of measuring very high places remained hard to come by even in the 1820s is indicative of the sustained imaginative failings of those outside India (and in Gerard’s opinion those in Calcutta without direct experience of the mountains) when it came to the true scale of the Himalaya. This was a problem that could only be rectified with instruments especially conceived for the highest places and, after his experiences on Reo Purgyil, Alexander Gerard ordered barometers to his own specification, ‘the scale which by means of a vernier shews 1/1000 of an inch [and] extends so low that altitudes of 24,000 feet may be measured by it.’ Although surveyors and explorers in the first half of the nineteenth century never reached altitudes anywhere near that high, they were becoming aware of the possibility that human beings and the apparatus of science had much higher yet to go.

Theoretical limitations with barometers were also reflected in the way that the barometric formulas needed to be adjusted for the particular climates and latitudes of the Himalaya, and to produce accurate readings for very high (and at the time the formulas had been devised, unprecedented) altitudes, a process that was ongoing in the first half of the nineteenth century. Raw measurements from barometers always needed to be corrected, especially for temperature, and for other causes of error relating to time of day, latitude, season, and extremes of local weather. One of the most common of ways of doing this was ‘Dr Maskelyne’s method’ which, as Gerard argued, ‘always gives the altitudes of very elevated places too little, because the equation for the latitude is not taken into account.’ Most critically, barometrical readings needed to checked against equivalents taken at the same time of day from instruments kept at lower stations, ‘as without corresponding observations, the results of Barometrical measurement are likely to be erroneous.’ Calcutta and Saharanpur provided base measurements against which other variations in the higher mountains could be compared, such that refinements to these standards might mean recalculating earlier heights from

the raw readings preserved in fieldbooks.\textsuperscript{111} Figures for height were not static, and the surveyors’ original fieldbooks might prove more valuable than their worked-up and published calculations. As James Prinsep wrote in 1833, referring to the curious behaviour of diurnal oscillation at extreme altitudes: ‘the determination of the zero or no oscillation altitude, may probably be obtainable from the journals of Captain Gerard or his brother, Dr. J. G. Gerard.’\textsuperscript{112} Operating in the Himalaya did have some natural advantages, as ‘in these climates … the Barometer is so much more regular in its indications than in Europe,’ although this perhaps made establishing credibility among metropolitan instrument makers who were used to less stable barometrical outcomes even more difficult.\textsuperscript{113}

Woefully inappropriate scales, unsatisfactory formulas, fragile tubes, and adjustment screws that were difficult to operate with frozen fingers and bulky gloves were merely part of a smorgasbord of problems with instruments designed in London or Paris by those with no experience of Himalayan conditions. As Alexander Gerard wrote, ‘it appears to me that in regard to barometers and indeed most instruments, accuracy has generally been sacrificed to portability, and instruments of various kinds which are only suited for some parts of Europe are daily sent to India where they are often useless.’\textsuperscript{114} Similarly, in the first volume of the journal \textit{Gleanings in Science}, edited by James Herbert and to which the Gerards and other Bengal Infantry surveyors were contributors, it was noted that ‘it is extraordinary that in making instruments for the Indian market, the artists of London will not advert to the difference in the habits of the two countries.’\textsuperscript{115} He was alluding, as well as the topographical factors, to the differing labour conditions in India. Himalayan surveyors had the ability to relatively cheaply co-opt local bodies to carry their instruments, and as Hodgson argued, in ‘instruments intended for India solidity should be considered; we want those which will do their work effectually, & and are not anxious that they should be small & easily portable, as we can always here find means of carrying them.’\textsuperscript{116} This emphasis on durability also implies the potential for rough treatment at the hands of ‘careless’ porters. For professional, working surveyors – rather than gentlemen savants – ornamental or aesthetic qualities were of little value, and instruments only needed to be functional, without ‘the bungling and expensive contrivances which are applied to

\begin{footnotesize}
\begin{enumerate}
\item \textsuperscript{111} Hodgson and Herbert, ‘An Account of Trigonometrical and Astronomical Operations’, 319–20.
\item \textsuperscript{113} Herbert, ‘An Account of a Tour’, 414. By the mid-century, the accumulation of measurements meant formulas specific to the Himalaya were more readily available. As Joseph Hooker recorded, before heading into the mountains, he was provided with a ‘very excellent formula is that used at the Surveyor General’s office.’ Joseph Dalton Hooker, ‘Observations Made When Following the Grand Trunk Road across the Hills of Upper Bengal’, \textit{Journal of the Asiatic Society of Bengal} 17, part 2 (1848): 159.
\item \textsuperscript{114} Alexander Gerard, ‘Remarks upon Barometrical Heights’, NAI/SOI/Fdbk. 113, f135.
\item \textsuperscript{115} ‘On the Most Eligible Form for the Construction of a Portable Barometer’, 314.
\item \textsuperscript{116} John Hodgson, ‘Field Book of May 1817’, NAI/SOI/Fdbk. 91, f170.
\end{enumerate}
\end{footnotesize}
instruments’ of science, as fabricated by London artists, in the elaborate and useless finish given to them."

While lauding the local knowledge of displaced locations possessed by the Bengal infantrymen, Hodgson was explicit that this included an understanding ‘not only of the language but of the customs, prejudices and peculiar feelings of the natives.’ The necessity of large parties of hill porters to carry instruments and supplies, and the omnipresence of Asian guides, brought a further dimension to the social performances required to establish the credibility of instrumental practices. Interactions between Himalayan peoples and instruments were usually recorded by the surveyors through standard tropes of curiosity, awe and superstition. These tropes allowed explorers, as Dane Kennedy has argued, to represent themselves as ‘agents of a technologically inspired modernity.’ Alexander Gerard described the Tartars and their opinion of his collection of instruments in this manner: ‘they are very inquisitive and curious, and were constantly asking questions about the reflecting circle, sextants, barometers, and the astronomical telescope; the latter pleased them most, and I had frequently to shew the same objects to thirty or forty different people.’ Meanwhile, Joseph Hooker employed similar rhetoric when he wrote of reascending a pass to ‘to verify my observations,’ suggesting that:

The Tibetan Sepoys did not at all understand our ascending Bhomtso a second time … when I reached the top I found [Archibald] Campbell seated behind a little stone wall which he had raised to keep off the violent wind, and the uncouth warriors in a circle round him, puzzled beyond measure at his admiration of the view. My instruments perplexed them extremely, and in crowding round me, they broke my azimuth compass. They left us to ourselves when the fire I made to boil the thermometers went out, the wind being intensely cold.

Of course, it is difficult to know what the Tibetans truly made of the surveyors’ instruments. The way these interactions are recorded inevitably tell us far more about the European writer than about his Asian assistants, even while their presences are a tacit reminder of the imperial consequences for those being surveyed.

Instrumental activities in the Himalaya in this period, if not specifically to measure altitude, allow us to glimpse a ‘hidden history’ of labour in other ways. These include one which anticipates the now famous story of Nain Singh, Kinthup, and the so-called ‘pundits’ who were sent out in the 1860s to explore parts of the Himalaya politically inaccessible to Europeans. Fifty years earlier, some of the Bengal infantry surveyors attempted to develop similar practices. Surveyor-General of Bengal John Garstin, commenting in 1812 on an account from a munsdi employed by William Webb, wrote that he

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117 ‘On the Most Eligible Form for the Construction of a Portable Barometer’, 318.
118 Hodgson to William Casement, 24 January 1829, NAI/SOI/DDn. 231, f261.
122 For the longue durée history of ‘native explorers’ in India, see Mathur, ‘How Professionals Became Natives’.
could ‘conceive they will all be of great use’ and concluded ‘these native surveyors work hard, for small pay, they can penetrate into parts of the country inaccessible to Europeans and procure valuable information.’

John Hodgson similarly sent out Asian surveyors, in one instance towards Lake Manasarowar which remained enticingly beyond the frontier. Though we can’t recover the surveyor’s name from the silences of the colonial archive, Hodgson notes that he was a Brahmin ‘formerly in the service of Lieut. Webb, who he says taught him something of the use of a Compass, but I found him deficient & gave him some instructions.’ Reflecting on the surveyor’s efforts, Hodgson went on to note that ‘the Bramin says he had & used, a compass as far as Udsein … & that it was there broken, I doubt his having had one & indeed the whole much of his story, but such as it is I send it for want of better.’

Hodgson’s agency here is somewhat undermined, but he is still willing to admit that this information, however compromised, was better than leaving the map blank in such an important quarter. The use of Asian surveyors nevertheless did not entirely overcome the danger of causing diplomatic incidents in the borderlands, and Hodgson considered sending the Brahmin to Kashgar ‘to get some idea of the distance & route to the nearest part of the Russian dominions’ but reconsidered ‘apprehensive that he might attempt to pass himself off as an authorised agent of Government & misbehave accordingly.’ Indeed, it was perhaps this last factor that led to the EIC largely suspending the development of programs using Asian surveyors until the 1860s. This disbanding was ordered in no uncertain terms, and responding to Hodgson’s dispatch from ‘the Bramin,’ Charles Crawford stated that the ‘Government have notified to me that they wish to throw cold water on all natives being taught or employed in making geographical discoveries.’ However abortive, this early attempt is nevertheless significant in light of the turning back to ‘pundits’ in the 1860s when the frontiers remained problematic, and for revealing the inherent hierarchies of labour and knowledge that underlay the mapping of the Himalaya onto the vertical globe.

123 John Garstin to Charles Wright Gardiner, 7 March 1812, NAI/SOI/DDn. 128, f72.
125 John Hodgson to Charles Crawford, 14 November 1813, NAI/SOI/DDn. 130, f99-100. He continued that ‘the man is intelligent and enterprising, writes Hindee, some Persian, & a little execrable English, & poses as a pilgrim & native doctor, with medicines for those who are so unfortunate as to become his patients.’ Further undermining his own agency, Hodgson also noted that he had intended to purchase a quadrant and teach the Brahmin to take ‘altitudes of the sun and stars’ but became unwell, and while incapacitated ‘this man then either honestly misunderstanding me, or being impatient to be gone on his journey, went on it, having himself purchased and found a good compass in one of the shops for 60 Rs.’ See also R.H. Phillimore, Historical Records of the Survey of India (Dehra Dun: Survey of India, 1950), Vol 2, 353-4.
126 John Hodgson to Charles Crawford, 14 November 1813, NAI/SOI/DDn. 130, f101. As he elaborated, ‘knowing too much of the exaggeration & falsity of natives I dare not vouch for the correctness of this route … I have reason to believe that the man did go to Maunsir himself, but suspect that the remainder of the journey back he may have got by information.’
Conclusion

In concluding this chapter, I want to now briefly consider a new sort of instrument – one specifically designed for measuring altitude – that was arriving in India just as the Gerards were struggling up Reo Purgyil; namely, Francis Hyde Wollaston’s ‘thermometrical barometer’ (hypsometer). In tracing its fate in the Himalaya, we see a summation of the challenges – both real and rhetorical – facing the Bengal infantrymen in spaces in which instruments, inscriptions, and bodies were all prone to failures. In this period, taking rough altitude readings using a regular thermometer and tin shaving cup had sometimes been worthwhile in the absence of anything more suitable (as was practiced by the Gerards, Hodgson, Herbert and Webb, and later by Hooker and Thomson). However, the growing necessity of precisely measuring altitude led to the emergence of specific boiling-point apparatuses that purported to increase accuracy and durability, of which the Wollaston was the most prominent example. The device took its temperature reading from the steam, which was more regular than the boiling water itself, and came fitted with a vernier, as can be seen in Fig. 1.3:

Fig. 1.3. Plate detailing Francis Hyde Wollaston’s ‘Thermometrical Barometer,’ as published in the Philosophical Transactions (1817). 129

In choosing the name ‘thermometrical barometer,’ Wollaston was perhaps deliberately making the claim that his device could compete directly with barometers in terms of accuracy, portability, and cost-effectiveness. Indeed, this device represents an attempt to evolve boiling-point thermometers from an instrument of approximation into an instrument that was both accurate and precise. One of the Wollaston’s main selling points was also that it was supposedly less prone to breaking than barometer tubes. An 1823 advertisement for this new thermometer in *The Calcutta Journal of Politics and General Literature* quoted extensively from Hodgson’s misfortunes with broken barometers in promoting its superiority.130 Hodgson himself was initially optimistic when he heard about the thermometrical barometers, noting ‘I think that Dr. Woolaston’s improved thermometer will supersede the mountain barometers altogether. It has every advantage.’131 However, once he had actually had the chance to examine one, he became markedly less convinced, stating rather bluntly that: ‘Woolaston’s thermometrical barometers are of no use, you cannot take them out of their case without breaking, they will not do; besides there are none in Calcutta.’132 This criticism was echoed by James Prinsep who thought that: ‘the error into which Wollaston fell was an attempt at too great sensibility. His instrument is beautiful in a laboratory, where it will serve to shew minute variations in the index error… but for rough work out of doors, accuracy must in some measure be sacrificed to strength and portability.’133 Even in designing an instrument specifically intended to measure mountains in situ, the metropolitan artisan, based in London and at multiple removes from the spaces of the high mountains, could not imagine the world faced by Himalayan surveyors on a daily basis.

This was doubly apparent given that, as with barometers, Wollaston’s boiling-point devices suffered lingering issues with scales, legacies of the way the instrument was initially conceived and tested on Mount Snowdon in Wales. As James Prinsep continued, Wollaston and his assistants: ‘drew up a table of the value of the degrees between 214° and 202° in feet… but, as this range only extends to an altitude of 5405 feet, it is evidently quite insufficient for the traveller in India, who may ascend to 18,000 feet and still see Snowdons towering above his head.’134 Wollaston seemed to be aware of this issue, insisting that the ‘instrument, though adjusted now to my own particular use by the quantity of mercury in the thread, is capable of measuring any greater altitude, even Mt. Blanc or Chimboraço.’135 Writing in 1825, however, Herbert suggested that the thermometrical barometer was still ‘not made

133 Prinsep, ‘Table for Ascertaining the Heights of Mountains’, 197.
134 Prinsep, 197.
of sufficient extent as yet to comprehend within its range the boiling points’ encountered in the Himalaya. He also thought that the method of calibration described by Wollaston was impractical in the high mountains and seemed more suited to ‘the easier journeys through civilized Europe.’ From his Himalayan vantage point, Herbert was frustrated by the way that London savants and instrument makers were still struggling to address the need for instruments that had scales appropriate for mapping the upper reaches of the vertical globe, and that were rugged enough for Himalayan travel. With his direct experience of the Himalaya and position of distance, he had no qualms asserting this. This was itself a social performance, and in critiquing Wollaston, Herbert was simultaneously insisting on his own ability to produce reliable knowledge of the Himalayan frontier.

The problems with fragility and scales were at least partially addressed in later models of the thermometrical barometer, and its eventual eligibility for the Himalaya is borne out by the way that Wollaston’s devices were used extensively by English surgeon and botanist William Griffith (1810-45) and Victor Jacquemont in their Himalayan travels in the late 1820s and 1830s. Griffith also noted in 1842 that several were ‘furnished to the Surveying Officers of the Army of the Indus, as their Barometers ceased to be effective soon after leaving Quettah,’ but as he also explained ‘they contain the readings off of the Thermometer, Barometer invented by Dr. Woollaston … with the substitution of an ordinary Thermometer for his delicate one,’ indicating that fragility and ad hoc reconfigurations were an ongoing concern. However, even if instruments continued to break and be repaired, by this time some of the imaginative disconnect around scales had been alleviated. Although many of the challenges of surveying in the mountains remained unsolved, as later nineteenth-century stories only too clearly show, by the mid-century it was no longer impossible to imagine that the Himalaya held within its fastness the loftiest places on the globe.

This chapter has been a story, above all, about limits: of bodies, of instruments, of senses, and not least, of imperial mastery. As surveying in the Himalaya became increasingly important, both to science and to the constitution of imperial frontiers, the instrumental practices used to measure the highest mountains of the globe came under increased scrutiny. Fragility was an ongoing concern, exacerbated by issues of remoteness that manifested themselves in a lack of replacements and limited

137 Herbert, 412.
138 William Griffith, Journals of Travels in Assam, Burma, Bootan, Affghanistan and the Neighbouring Countries, ed. John McClelland (Calcutta: Bishop’s College Press, 1847), 339; 371; Jacquemont, Voyage Dans l’Inde, Vol 1, 342-3. Griffith had both an old and an improved model of the Wollaston, and used them side-by-side. The use of thermometrical barometers was relatively short lived, and they were soon mostly superseded by aneroid barometers (first developed in the 1840s).
139 William Griffith, ‘Tables of Barometrical and Thermometrical Observations, Made in Afghanistan, Upper Scinde, and Kutch Gundava, during the Years 1839-40’, Journal of the Asiatic Society of Bengal 11, part 1 (1842): 49. Griffith made further remarks about the Wollaston, noting that he had possessed ‘several in India, but never met with one that was in working order. The great weight and thinness of the bulb … renders them very liable to be broken.’
options for repair. The surveyors’ management of ‘states of disrepair’ was achieved with only varying
degrees of success, and sometimes compromises between accuracy and practicality, and between
name-brand and India-made instruments, were necessary in an environment hostile to the human
body and mind, as well as to the apparatuses of science. Surveyors insisted on the idiosyncrasy of the
high mountains and the challenges to instrumental practice they faced within these spaces, in order to
leverage their ability to overcome them for authority. There is undoubtedly much to be gained by
examining ‘the integration of instrumentation with human performance and the establishment through
such performances of trustworthy accounts of remote phenomena.’ However, we need to keep in
mind the extent to which these social performances had multiple audiences, and played out against the
ongoing challenges provided by a disconnect between the realities of instrumental practice as
understood between not just metropole and colony, but between those in the mountains, those in
Calcutta, and those in London. This imaginative discord manifested itself in debates around inadequate
government-issue instruments, scales more suited to the Alps than the Himalaya, and untenable
regulations around the submission of fieldbooks. Fieldbooks, barometers and thermometers
nevertheless played key rhetorical roles and functions in establishing the reliability of knowledge
produced in a hypoxic and sense-scrambling world, and a world which the British still little
understood, but were beginning to fear did not provide the secure frontier its jagged aspect seemed to
convey. Instruments, bodies and inscriptions, and the moments their limits were exceeded, thus
provide a valuable window into the scientific, political and imaginative constitution of the Himalaya.
Through this window, we see surveyors struggling to assert their ability to produce reliable
knowledge in a world in which one might stand at the height of the summit of Mont Blanc and still see
Snowdons towering above.

Returning, one last time, to the Gerards where we left them high on Reo Purgyil, we find that
their claim of reaching a new high point on the vertical globe (and ultimately the credibility of their
instruments and observations) was acknowledged, if perhaps a little grudgingly, by Alexander von
Humboldt, whose altitude record on Chimborazo they had beaten (albeit only slightly). The
Gerards’ attitude to their achievement (shared, however poorly acknowledged, with their guides)
nevertheless reveals something of an ambiguous attitude towards altitudinal supremacy at this time.

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141 Humboldt could never quite himself to unequivocally accept this, noting the Gerards had gotten ‘as high, if
not 117 feet higher, than I ascended the Chimborazo.’ Humboldt, *Views of Nature*, Vol 1, 236. This equivocation
comes through in translation, see Alexander von Humboldt, *Ansichten Der Natur*, 3rd ed. (Stuttgart: J.G. Cotta,
1849), Vol 1, 56; 123; Vol 2, 50. Humboldt’s source was the overtly patriotic James Bell and John Bell, *Critical
Researches in Philology and Geography* (Glasgow: James Brash & Co, 1824), 144. In 1827, Clement Johnson, by his own
somewhat imprecise reckoning, probably reached the same point on Reo Purgyil that the Gerards had. See Clement
Johnson, ‘Journey Through the Himala-Leh Mountains to the Sources of the River Jumna, and Thence to the
Whether the Gerards high point was (as they thought) or was not (as we now know) a new altitude record does not perhaps matter all that much anyway, except in the context of the later nineteenth-century preoccupation with summiting higher and higher peaks, and a valorisation of height which has persisted until the present, remaining most explicitly embodied by Mount Everest. The Gerards were keen to see their barometers read lower than fifteen inches, and undoubtedly later put considerable effort into instrumentally verifying their high point, indicating their willingness to engage in an essentially arbitrary imperial contest. That this record was nevertheless not as important to them than it might have been later in the century is apparent from the understated way Alexander Gerard records this ‘accomplishment’ in a technical memoir on mapmaking. Perhaps most tellingly, nobody appears to have been overly anxious to rush out and beat their ‘record.’ Reaching new heights was one thing, reliably instrumentally verifying them in a challenging and sense-scrambling environment was another, and arguably where for Alexander Gerard the true contest lay.

Beyond these scientific and personal interests, arguments were also more urgently being made for the ‘great practical utility, which may be derived to geography from a knowledge of the true position and elevation, of several snowy peaks in the Himalaya chain.’ This was both for measuring back down to the plains and for securely drawing the mountains within the framework of imperial borderlands. It was for both science and empire that the Bengal infantry surveyors lugged (or rather, employed Asian porters to lug) a panoply of fragile instruments into the Himalaya to accurately record the elevations, shapes, and locations of what were only just coming to be acknowledged were by far the highest mountains on the globe. Even if the scale was sometimes different, Himalayan surveyors were not, of course, alone in grappling with the problems of accurately measuring altitude, and similar issues with instruments were playing out in other mountains on other continents. Throughout the first decades of the nineteenth century, the necessity of mastering the unstable complex of instruments, inscriptions, and bodies to produce credible knowledge was thus attached to an

\[142\] Having lived in the Himalaya for millennia, it is not unlikely that indigenes had at some point been even higher (and the Inca had certainly been higher in the Andes).

\[143\] The claim for reaching 19,411 feet was repeated in a posthumous version published in 1841, though again in an undramatic fashion. Gerard, Account of Koonawur, 176. While the Gerards don’t appear to have actively exploited their ascent, later commentators occasionally did, even if these claims have not survived into the popular consciousness of mountaineering. See for example Bell and Bell, Critical Researches in Philology and Geography, 144. As they wrote, ‘are those men who pierced the rugged defiles, climbed the steep ascents, and scaled the lofty ridges of the Heemalah, and stood on higher ground than was ever trod by a Saussure, a Condamine, or a Humboldt,* to be thus deprived of the legitimate reward of their toils, in order that their laurels may adorn the temples of Frenchmen and Germans?’ Here the footnote explained that ‘*Lieutenant Gerard, in 1812 [sic], ascended the mountain Tarhigang [Reo Purga] … to the height of 19,411 feet, or 118 feet higher than what Humboldt attained in his ascent of Chimborazo.’ Others reported the Gerards’ ascent in merely local terms. For example, Victor Jacquemont noted while at Nako that ‘C’est de ce village que partirent les frères Gérard pour gravir jusqu’à la hauteur de 19,500 p.a. (5,943 m) sur les pentes de Pourkyoul, qui le domine. C’est, je crois, la plus grande hauteur où l’on soit parvenu dans l’Himalaya,’ without indicating that this implied it was also the world height record. Jacquemont, Voyage Dans l’Inde, Vol 2, 335.

increasing recognition – and laborious imposition of – global commensurability onto mountain environments. However, instrumental practice was far from the only thing made unstable by altitude. In the next chapter, we look in more detail at physiology, and examine the way that altitude sickness complicated both expedition sociability and the development of medical topographies of high mountains.
Altitude has strange effects on the body and the mind. The higher up the vertical globe one climbs, the more apparent these effects become, even as the cause remains invisible. In 1822, East India Company surgeon James Gerard was ascending the Shatul Pass (where the notebooks, telescope and porters’ lives had been lost), some 15,500 feet above the level of the sea. He later recorded that:

The smallest attempt to make an effort threw us back. The extreme labour we had in getting up the last 500 feet cannot be described. Anxiety and slight sickness deprived us of using our arms when inclined to break off a chip of rock by the blow of a hammer; respiration was free, but insufficient: our limbs could scarcely support us, and the features collapsed as if precursors of a fever.²

Difficulty breathing, headaches, somnolency, loss of appetite, lethargy and hypoxia all awaited those venturing into the high mountains. Movement itself was difficult, let alone swinging a hammer in the pursuit of scientific knowledge, or raising a pen to record reliable observations about the still largely unmapped northern frontiers of the East India Company’s burgeoning Indian empire. Indeed, James Gerard went on to conclude that he had ‘never experienced so decided a proof of the existence of an agent inimical to the principles of animal life.’³ At the same time, he tried to make sense of the symptoms he suffered, and his account is interwoven with an attempt to scientifically explain the – at the time – very little understood effects of high places on the body:

The cause here is not quite obvious, nor are those extraordinary symptoms of prostration of strength, anxiety, and mental imbecility satisfactorily explained, and while we cannot hesitate to refer the primary and immediate agent to the thinness of the air, or more properly, the diminished pressure, by which the balance of the circulation is destroyed; nevertheless, the effects are so capricious and irregular as to be at variance with the idea of a constant cause.⁴

In his account, Gerard describes a medical topography of high mountains that is in flux. He identifies the rarefaction of the atmosphere as the cause of his suffering, even while clearly struggling with the

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¹ An abridged version of this chapter is forthcoming as Lachlan Fleetwood, ‘Bodies in High Places: Exploration, Altitude Sickness and the Problem of Bodily Comparison in the Himalaya, 1800–50’, *Itinerario* 43, no. 3 (forthcoming 2019).
³ Gerard, 326.
⁴ Gerard, 320–21.
inconsistencies with which symptoms were experienced. In the context of early Himalayan
exploration, however, these inconsistencies are central to the story.

Tensions around the ‘capricious and irregular’ distribution of the symptoms of altitude sickness
were exacerbated by the way that the European travellers who entered the high Himalaya in the first
half of the nineteenth century rarely – that is, if ever – did so alone. As James Gerard continued, ‘all
my people have also been affected in different ways, some with sickness, others with head-ache,’ but
he tellingly clarified that ‘every one is not equally affected.’ Europeans, explorers, surveyors and
travellers were thus forced to compare and contrast their bodily performances against those of their
Bhotiya, Tartar and Lepcha guides and porters. This dependence on Himalayan labour, combined with
the invisible and insidious effects of altitude sickness, served to intensify expeditionary relationships:
between explorers and guides, employers and employees, Europeans and Asians. In this chapter, I
examine the resulting tensions by considering the politics of bodily comparison that developed around
altitude sickness at multiple scales: in the way bodies, European and Asian, experienced altitude
sickness; in the way comparisons between bodies affected cross-cultural interactions within expedition
parties; in the way these experiences and comparisons were represented in written productions; in the
way these comparisons were made globally, especially with the Alps and the Andes; and in the way
these experiences and comparisons were represented in written productions; in the way these actions ultimately helped constitute medical topographies of high mountains in pervasive ways,
as peripheral spaces and aberrant environments in relation to lowland imperial norms.

This chapter nevertheless demonstrates that comparativity operated differently for different
actors, and that there was an inherent politics of access to comparisons, between European explorers
and their Asian guides, as well as between colonial actors in the high mountains, those in the lowlands
of Calcutta, and those in Europe. In thinking about the politics of bodily comparison in the face of an
invisible force, seasickness provides a helpful analogy, and indeed contemporary travellers made
frequent allusions. In both cases the cause was invisible, even if clearly related to a particular
environment. Symptoms were also experienced with high degrees of variability, and with seemingly
little regard for social hierarchies around fitness, age, gender or race. The crucial difference,
however, was that after millennia of seafaring, seasickness was a known and accepted phenomenon,
even if medical understandings of it remained limited. On the other hand, travelling to very high

1 Gerard, 326.
6 For other ‘mountain’ diseases like goitre, and an overview of medical topographies in South Asia more generally,
see Arnold, Science, Technology and Medicine in Colonial India, 75–81.
7 See Tamson Pietsch, ‘Bodies at Sea: Travelling to Australia in the Age of Sail’, Journal of Global History 11, no. 2
(2016): 209–28. A related analogy might also be panorama viewing, which could induce dizziness often described as
akin to seasickness. See Oettermann, The Panorama; Bigg, ‘The Panorama, or La Nature à Coup d’œil’. On bodily
comparison in South Asia more broadly, especially in ‘hospitals, jails and above all the army,’ see David Arnold,
‘Race, Place and Bodily Difference in Early Nineteenth-Century India’, Historical Research 77, no. 196 (2004): 254–73.
altitudes was something largely new (at least for European travellers) at the end of the eighteenth century. In this chapter, I thus consider social relationships in an environment that was unfamiliar and hostile to many of the actors. As in the thesis more broadly, I do so not so much from questions of epistemology and hybrid knowledge, but from an approach grounded in everyday practice, and the cross-cultural relationships that these expeditions relied on to function.

This approach reveals that altitude sickness exaggerated existing tensions within expedition parties because it risked inverting expected hierarchies around race and gender in relation to bodily performance. This chapter traces the way European travellers responded – consciously or unconsciously – by developing tropes that they could use in journals and travel narratives in (sometimes almost plaintive) attempts to reassert their assumed superiority. Throughout, I examine responses to altitude sickness particularly through the concept of self-fashioning; that is, the various ways that travellers not only experienced and sought to scientifically explain, but also represented their bodily experiences, both individually and collectively. I consider explorers’ self-fashioning on two different levels: in terms of everyday performances directed at different members of expedition parties, and in terms of accounts written for audiences beyond the mountains, who might have little or no experience of altitude. In the latter case, I show how explorers exploited the uncertainty around altitude sickness to describe their bodily performances in a variety of self-serving ways, and attempted, if not always successfully or convincingly, to fashion their imperial and scientific selves through tropes like masculine heroism and duty to empire.

In tracing the strategies that European travellers used to try to assert their bodily superiority over their Asian companions, it is important to recognise that the networks of labour that made Himalayan exploration possible were highly heterogenous. Expeditions were mobilised in different ways at different times, occasionally through forced labour (sometimes known as the ‘begar’ system), or more often though patronage networks and recommendations. This meant that porters – and even guides – could sometimes be recruited from the lowlands, complicating any simplistic comparisons between European and Asian bodies (even if this dichotomy often appears in contemporary travel accounts). Indeed, when he was setting up camp near Hatu in 1822, Welsh EIC officer William Lloyd (1782-1857) noted that ‘our servants from the plains, who had never seen snow before, looked at it with that indifference which is so peculiar a mark of the Hindoo character.’ In this, he was far

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from the only traveller to rhetorically use the first encounter of porters with snow to claim cultural superiority. As such moments indicate, expedition parties often included Asian members who were not in any meaningful sense 'local.' This nevertheless makes the moments when travellers did identify the differences between the bodies of uplanders and lowlanders all the more important, and in what follows I trace how these distinctions would eventually become essential to both scientific understandings of altitude and perceptions of imperial possibilities in the Himalaya.

The travel narratives and journals that form the basis of this chapter were written by an eclectic grouping of (with a handful of exceptions) European, and indeed largely British, surveyors, explorers and travellers. The most extensive set of accounts come from East India Company employees, especially Bengal infantryman seconded to surveys in the mountains. Others, particularly towards the mid-century, are provided by a wider range of travellers who visited the mountains to pursue a combination of scientific, imperial, economic and leisure interests (though these interests did not yet include mountaineering). This source base adds a further dimension to politics of comparison by mediating what sorts of comparisons were available, and to whom. Those who wrote were able to constitute high mountain environments and their experiences of them through their narratives and textual productions, an opportunity not usually afforded to the people who carried their loads, shared their tents and campfires, and struggled to breathe alongside them. In this chapter, I nevertheless want to suggest that the inherent uncertainties around altitude were also open to exploitation by guides and porters, even if performed in different ways and for different audiences. Given the limitations of the colonial archive, such suggestions can of course only be tentative, even if reading certain moments against the grain does suggest that guides and porters were sometimes able to navigate the uneven distribution of symptoms to exert agency, in particular by resisting often unpleasant and dangerous labour conditions.

While I use 'altitude sickness' for convenience throughout this chapter, the term itself had yet to enter usage in the Himalaya. 'Mountain sickness' and 'mal des montagnes' were sometimes used, reflecting climatic and environmental associations, but also a lack of codification as a coherent illness.

Early efforts to address the knowledge lacuna around altitude were usually anecdotal, though as the

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11 For this issue in histories of exploration more broadly, see Driver, 'Hidden Histories', 427.
12 While not claiming total comprehensiveness, in this chapter I take an encompassing approach to examining the extant pre-1850 Himalayan travel narratives, unpublished reports, and journals produced by those who visited heights where altitude sickness was a factor (the total number of which is relatively small, perhaps less than forty).
14 Usage nevertheless sometimes reflected novelty, with 'mountain sickness' being both italicised and placed in quotation marks in the translation of a German physician's journal, which referred to "the difficulty of breathing, and the feelings of indisposition caused by the "mountain sickness."" W. Hoffmeister, Travels in Ceylon and Continental India Including Nepal and Other Parts of the Himalayas, to the Borders of Thibet, trans. Anon (Edinburgh: William P. Kennedy, 1848), 351.
century progressed travellers increasingly turned to quantitative methods and self-monitoring (if often in an ad hoc and opportunistic fashion) by taking pulses and counting inspirations (or rate of breathing). In this vein, historians of science have been productively deploying and examining the human (and nonhuman) body as both a site of a scientific practice and as a scientific instrument, and have argued for greater recognition of the embodied nature of scientific knowledge.15 Scholars point, for instance, to the way that ‘a human body whose walking pace and perceptual skills have been trained and disciplined is also functioning as an instrument’ with a key example being the so-called ‘pundits’ (see also Chapter 1).16 Studies of altitude or respiratory physiology represent a much narrower subset within this historiography, and otherwise excellent scholarship has focused almost exclusively on the second half of the nineteenth and the twentieth centuries; that is, the period of systematic and often institutionally-sponsored scientific studies of altitude.17 Scholars like Sarah Tracy and Alex McKay have emphasised that these often had an imperial dimension, concerned with labour and long-term acclimatisation in a colonial labour context.18 Respiratory physiology has also been productive in complicating the distinction between ‘laboratory’ and ‘field’ practices, most notably in the work of Vanessa Heggie.19 This chapter thus complements the existing scholarship, even as it diverges from it, by historicising and contextualising an earlier phase in the development of scientific understandings of altitude physiology.

The politics of bodily comparison also look different before 1850 because the debilitations experienced in high places were often still mysterious and terrifying, and the effect of the rarefaction of the air on bodies was not yet a given. Significantly for self-fashioning, the long-term adaptation of mountain peoples – most explicitly embodied today by mountaineering Sherpa – was also yet to be widely recognised. Beyond the history of altitude physiology, the bodily comparisons this chapter traces are significant because they played out at the beginning of the colonial encounter for many Himalayan peoples with an increasingly expansionist East India Company. At a time when surveyors and administrators were attempting to appropriate the Himalaya into both a regional imperial

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framework and a global scientific order, these expeditionary interactions laid the groundwork for long-term political, economic and labour relationships to empire. More broadly, the early decades of the nineteenth century represent both a key moment in imperial expansion into the Himalaya and in the formation of medical topographies of high places through global comparison.

Indeed, tensions around comparisons in high places were far from unique to the Himalaya. Grappling with the problem of altitude sickness in the early nineteenth century also required drawing on imperial networks to make comparisons with different mountain ranges. While travelling in the Himalaya, explorers were simultaneously imagining other parts of the vertical globe, occasionally drawing from personal experience, but more usually from published descriptions of other late eighteenth and early nineteenth-century ascents. This chapter thus further points to the development of ideas of verticality, and increasing recognition that the high Himalaya, the high Andes and the high Alps might represent medically commensurate environments. There is sometimes a juxtaposition though, and the recognition of the commensurability of mountain environments in South America and Europe could serve to increase, as much as to alleviate, the uncertainty around altitude sickness. Comparisons meant it was clear that high spaces disagreed with bodies everywhere, but curious inconsistencies in the heights in which symptoms appeared in different places sometimes led initially to more confusion rather than coherence. These confusions stemmed from several factors, actual and imagined, including differences between tropical and temperate mountains and the idiosyncrasies of travel in different ranges, as well as issues stemming from incessant self-fashioning, and the unevenness with which information allowing comparisons travelled over imperial and scientific networks. Recognising the intensification of comparisons in high places – on a variety of scales by a variety of actors, both locally and globally – thus allow us to dissect the early phases of the formation of what was an inherently global science, but it also demonstrates that this globality must be traced through both connection and disconnection.

These questions were further intensified by the way that European encounters with altitude sickness were inextricably bound up with the machinations of empire. As we have seen, increasing scientific interest in the high passes and peaks was intertwined with the constitution of the Himalaya as a high mountain frontier. Physiological challenges and possibilities for movement in the high mountains thus had implicit military implications. As William Webb recorded while operating near Tibet: ‘I considered that to pass churlishly along the frontier prying into its passes, and reconnoitring would more likely to excite and to confirm than to allay their jealousy already kindled’ though he anyway had to call a halt because ‘the extreme labor and great difficulty of respiration experienced in

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the last undertaking has occasioned a general sickness in my Camp.’ 21 This concern with upland frontiers echoes recent work on ‘Zomia,’ which is helpful for thinking through the overlap of social and environmental factors in Himalayan exploration. 22 In this context, altitude sickness might also be considered, to use James Scott’s term, a ‘friction of terrain.’ Here Scott’s assertion that ‘the degree of friction represented by a landscape cannot simply be read off the topography. It is, to a considerable degree, socially engineered and manipulated to amplify or minimize that friction’ is useful in thinking about the way cross-cultural labour relations shaped the way altitude sickness was recorded in travel accounts, and the way these, in turn, determined imperial ambitions with regard to the mountains. 23

In this chapter, drawing on ‘Zomia-thinking’ to re-centre the story on upland spaces is helpful in two opposing respects: firstly, in recovering Himalayan people as agentive participants in expeditions; and secondly, in explaining how experiences of altitude sickness contributed to the peripheralisation of the Himalaya – socially, politically and environmentally – in relation to lowland imperial ambitions.

In this chapter, I examine the politics of comparison around altitude sickness in four sections, organised thematically rather than chronologically. In the first section, I examine the extent of the uncertainty around the effects of altitude on human and nonhuman bodies in the early nineteenth century, and contextualise the politics of bodily comparison in relation to lowland colonial anxieties around health, acclimatisation and air. I then turn to a discussion of indigenous understandings of altitude sickness (as arising from the poisonous miasmas of plants or Bīs), and the ways these were developed as a trope in European accounts. Next, I consider the way the comparative performances of European and Asian bodies were recorded in travel narratives, and use these as a lens into the complexities of self-fashioning. Finally, I examine various experimental approaches around quantification and the instrumentalisation of bodies (by measuring pulses and breathing) that were employed to try and parse the seemingly incessant contradictions in the way symptoms were experienced. Throughout, I develop the idea of altitude sickness as a ‘friction of terrain,’ and situate this within the context of contemporary concerns around the constitution of the Himalaya as a high frontier, and the delineation of a globe that increasingly had to be imagined as vertical as well as round.

21 Webb to C.J. Doyle, 7 June 1816, British Library, IOR/F/4/552/13384, f4; f7. Webb’s self-policing was praised by the powers in Calcutta: ‘it has in the judgement of His Lordship in Council become peculiarly necessary to observe the strictest caution in all out proceedings on the Frontier of Chinese Tartary … you should endeavour as much as possible to avoid even the most limited intercourse with the Country and people beyond the Himmaleh.’ J. Adam to William Webb, 14 September 1816, British Library, IOR/F/4/552/13384, f5.
23 Scott, The Art of Not Being Governed, 166.
Encountering High Places

Though almost never recorded in writing, upland populations had long developed theories of altitude sickness. French physiologist Paul Bert, in the historical overview that opens his monumental study, *La pression barométrique: recherches de physiologie expérimentale* (1878), records a preponderance of local terms for mountain sickness, collected from all corners of the globe, including, ‘la veta, la puna, le mareo, le soroche des Sud-Américains, le bis, le tunk, le dum, le mundara, le seran, l’aïs des montagnards de l’Asie Centrale, l’ikak des naturels de Bornéo.’

The earliest written descriptions of altitude sickness are usually accredited to Chinese sources; specifically, tales of the Great and Little Headache mountains recorded in 37-32 BCE, and the monk Faxian’s account of his travels in Kashmir and Afghanistan from the fifth century CE. Here we also see variations of the Bis tracing back to antiquity, with Chinese pilgrims reporting that strong-scented leeks caused the headaches they experienced while traversing the ‘Tsung-Ling’ (or ‘Onion Mountains’) of the Karakoram. Similar ideas also arose in other parts of the vertical globe than the Himalaya, including in the Andes, where the poisoning of the air was sometimes attributed to mineral rather than plant-based emanations, such as from buried antimony, suggesting the widespread utility of miasmatic explanations.

Of European accounts, one of the earliest and most interesting comes from Spanish Jesuit José de Acosta’s *Historia natural y moral de las Indias* published in 1590, which included a description of the infamous high-altitude silver mine at Potosi. Acosta’s account was remarkably prescient in identifying symptoms and speculating that the thinness of the air was the cause, as well as making explicit analogies with seasickness. Corresponding experiments with air pumps and atmospheric pressures saw recognition of the rarity of the air (if not understanding of its implications) in the seventeenth century, and Europeans became increasingly fascinated with mountains across the eighteenth century. It was not, however, until the last decades of the eighteenth century that these two interests began to properly intersect, perhaps no more famously than in the body of Alexander von Humboldt, who recognised the lack of oxygen (which had only been ‘discovered’ as relatively recently as the 1770s) as the cause of the headaches and nausea he experienced on Chimborazo in 1802. During this ascent, he famously fashioned his body as both a witness and an instrument, recording the increasing debilitation

24 Bert, *La pression barométrique*, 341. [‘the veta, the puna, the mareo, the soroche of the South Americans, the bis, the tunk, the dum, the mundara, the seran, the aïs of the mountaineers of Central Asia, the ikak of the natives of Borneo’]


27 Bert, *La pression barométrique*, 35–42. The idea of a poisoned wind also occurred in other contexts, such as the jungle lowlands of the Nepal Terai, and even in the vertical realm below ground. For the latter see Anthony, ‘Mining as the Working World of Alexander von Humboldt’s Plant Geography and Vertical Cartography’.

he suffered, even if he was not immune to conflating symptoms like bloodshot gums and eyes. In parallel with the strange debilitations of the body experienced in high mountains were those encountered during early experiments with hot air balloons. In the case of ballooning, however, the rapidity of ascents – and hence lack of acclimatisation time – meant the particulars differed significantly. While commentators in Europe made explicit connections in the first decades of the nineteenth century, those in the Himalaya did not yet do so, indicative of the unevenness with which comparisons travelled and were applied, and the importance of tracing disconnection as well as connection in the practice of imperial global sciences.

Turning to the Himalaya, explicit descriptions of the symptoms of altitude sickness, let alone attempts to explain them, are surprisingly rare before 1800. Europeans who travelled over Himalayan high passes in the eighteenth century – including several Jesuits and the East India Company sponsored trade missions of George Bogle and Samuel Turner to Tibet – tend not to describe recognisable symptoms of altitude sickness in their travel accounts at all, even though they must have experienced them. While descriptions of suffering do occur, these are usually conflated with the deleterious effects of wind, cold and exhaustion, and altitude was not clearly separated out as a discrete phenomenon. Even as the nineteenth century dawned and Himalayan travellers began more consistently recognising the unique effects of altitude, the high variability with which symptoms were experienced meant that considerable ambiguity remained. French naturalist Victor Jacquemont exemplifies this, even in the 1830s repeatedly claiming not to have experienced the same ill effects high in the Himalaya that he himself had experienced at much lower elevations in the Alps (and he was among the only travellers at this point to have visited both). As he recorded, ‘L’effet, s’il dépend uniquement de la rarefaction atmosphérique, devrait être le même à la même hauteur dans toutes les régions du globe,’ and yet in his opinion this appeared not to be the case. Jacquemont did, however, frequently dismiss the symptoms of headache and nausea he felt at high altitudes as the result of extreme exertion, and cold and hunger affecting his digestive system, rather than the rarefaction of the atmosphere (loss of appetite is, itself, a common symptom of altitude sickness). At a time when the vertical globe was still being mapped out, the idea of an equivalency of altitude symptoms – and


31 Bert, *La pression barométrique*, 141–42; West, *High Life*, 2; 49.


33 Jacquemont, Vol 2, 101. [‘The effect, if it depends solely on the rarefaction of the atmosphere, should be the same at the same height in all regions of the globe’]

34 Jacquemont, Vol 2, 288. This is not to say that Jacquemont was unaware of the rarity of the air, only that he was unconvinced it was the cause of his debility.
that the same effects might be experienced at the same elevations in the Himalaya, Andes and Alps – remained debated. In general, symptoms seemed to be felt lower in the Alps than in the Himalaya, and in temperate rather than tropical mountain ranges.\textsuperscript{35} Travellers later pointed out that the necessity of making long approaches through the foothills meant that Himalayan explorers tended to be better acclimatised, which might explain the discrepancies.\textsuperscript{36} Collectively, examples such as these remind us that experiences of altitude in the Himalaya could not be addressed without also evoking other mountains, even as Jacquemont demonstrates that the exact correlations might be confusing and contested. In the first decades of the nineteenth century however, global comparison of differences (perceived and actual) often only added to the uncertainty around altitude, leading to a peculiarly local politics of bodily comparison.

In this period, understandings of altitude sickness also had to be worked out with reference to climatic theories of race and disease. While eluding simplistic generalisations, the nineteenth century saw a growing emphasis on racial difference (and fixity), coupled with a more explicit European belief in the superiority of their ‘climate, culture and constitutions.’\textsuperscript{17} As Alan Bewell has argued, the confrontation with new diseases in this period, and often differing levels of susceptibility between coloniser and colonised, ‘played a key role in producing difference’ and led to the creation of new racial and cultural myths.\textsuperscript{37} Historians of medicine have, in turn, shown how this engendered insecurity at a time when the subcontinent was coming to be seen as inherently pathological, spurring a growing pessimism about the possibilities for acclimatising European bodies to the ‘tropics.’\textsuperscript{38} Some early travellers in the Himalaya – including James Gerard – were trained and employed as surgeons, and investigations into the medical topographies of the mountains were tangibly linked to these lowland concerns. Comparisons were expressed especially in relation to miasmas, effluvia and poisonous air (and sometimes water), which were all significant contemporary imperial concerns.\textsuperscript{40} Discussions around the debilitating effects of high altitude thus provide a contrast to developing ideas of the ‘hygienic’ properties of mountain air, something that would eventually be extended to the

\textsuperscript{35} See Bert, \textit{La pression barométrique}, 7.
\textsuperscript{38} Alan Bewell, \textit{Romanticism and Colonial Disease} (Baltimore: Johns Hopkins University Press, 1999), 17.
\textsuperscript{39} See especially Mark Harrison, \textit{Climates and Constitutions: Health, Race, Environment and British Imperialism in India, 1600-1850} (Delhi: Oxford University Press, 1999). For the way medical topographies in India were laid out by low-ranking officials and surgeons, often in military contexts, see Wendy Jepson, ‘Of Soil, Situation, and Salubrity: Medical Topography and Medical Officers in Early Nineteenth-Century British India’, \textit{Historical Geography} 32 (2004): 137–55.
cultural characteristics and morals of mountain peoples. The notion of the benefits of ‘pure’ mountain air for health was also a primary impetus for the construction of hill stations such as Shimla, Mussoorie and Darjeeling, especially from the 1820s onwards. Such romantic, sublime and picturesque associations were not lost on the Himalayan travellers that feature in this chapter, but where this story departs from narratives of the hills as refuges from miasmas and tropical disease, is in the difference between the foothills and the high mountains. The lowlands, increasingly seen as diseased and debilitating, might be categorised as environmentally distinct from the hill sanatoria. However, as one continued higher, invigoration turned again to debilitation (albeit for different reasons), creating a ‘friction of terrain’ with implications for colonisation and frontier security. In relation to developing medical topographies of mountains, this indicates the recognition of a difference between moderate altitudes and the upper reaches of the vertical globe. Not all high places were equal, and as much as plants increasingly needed to be placed into the multiple biogeographical zones in which they thrived or withered, so too did bodies.

These concerns went beyond the human, and Himalayan travellers paid frequent attention to the effects of altitude on nonhuman bodies, adding a further dimension to the politics of comparison. These observations were especially applied to the horses and yaks that plied the mountain paths. As Fig. 2.1. reminds us, these were spaces in which human and nonhuman bodies coexisted:

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41 Peter Bishop notes how the ‘the ancient ambivalence towards mountain peaks had shifted from a belief in various demons into a concern about the different qualities of air. At high altitude the “air” cannot provide nourishment: it is almost too pure. At low altitudes air is malevolent.’ Bishop, The Myth of Shangri-La, 46–48. See also Nicolson, Mountain Gloom and Mountain Glory. As one contemporary commentator put it, high places were often considered by ‘vulgar minds as the hallowed abode of superior beings. Moreover, the rarefaction of the air in these altitudes produces an influence upon the human lungs which favours the illusion, some attributing the effect to a poisonous air generated by demons, others to the purity of the element, which is suited only to the constitution of those who can breathe the ether of the gods.’ ‘On the Holiness of High Places’, Asiatic Journal 23 (1828): 317.

42 Dane Kennedy, The Magic Mountains: Hill Stations and the British Raj (Berkeley: University of California Press, 1996); Sharma, ‘A Space That Has Been Laboured On’. As James Herbert put it while assessing Darjeeling as the potential site for a hill station: ‘there is a lightness and a buoyancy in the air, or rather in our spirits, in mountain regions, that to him who has doled away years in the apathetic indolence, inevitably induced by the climate of the plains, and particularly of Calcutta, feels like taking a new lease of life, or rather like passing into a new and superior state of existence.’ J.D. Herbert, ‘Particulars of a Visit to the Siccim Hills, with Some Account of Darjilling, a Place Proposed as the Site of a Sanatorium or Station of Health’, Gleanings in Science 2 (1830): 116.
Attention to the effects of altitude on nonhuman bodies was anecdotal rather than systematic in this period. However, it was clear that nonhumans also suffered, that symptoms were not qualitatively different to those afflicting human bodies, and that they originated from the same cause. For example, while examining the permeability of the frontier in Ladakh, William Moorcroft recorded that difficulty breathing ‘extended to the animals, particularly the horses; but the yaks were not wholly exempt, and we were obliged to halt repeatedly to give the cattle relief.’

Other travellers occasionally considered the relationship between fauna and altitude more broadly, such as Scottish surgeon and botanist Thomas Thomson, who in the 1840s wondered at the many species of birds wheeling above: ‘large ravens were circling about overhead, apparently quite unaffected by the rarity of the atmosphere, as they seemed to fly with just as much ease as at the level of the sea.’ He also thought it ‘very remarkable’ to find fish in mountain streams as high as 15,500 feet ‘inasmuch as it would certainly not have been very surprising that air at that elevation should, from its rarity, be insufficient for the support of life in animals breathing by gills.’ Attempts to delineate altitude sickness as a scientific phenomenon thus required accounting for the bodies of both humans and

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44 Thomson, *Western Himalaya and Tibet*, 435.
45 Thomson, 165.
nonhumans. That both suffered peculiar debilitations at altitude ultimately strengthened the case for considering uplands as medically distinctive environments, even as it added to the ‘friction of terrain’ circumscribing movement and imperial control in high places.

Indigenous Explanations

If high places represented uncertain environments for European explorers at the turn of the nineteenth century, they had, of course, long been coherent spaces to the people who lived there. As Alexander Gerard wrote:

> It is worthy of remark, that the Koonawurees estimate the height of mountains by the difficulty of breathing they experience in ascending them, which, as before noticed, they ascribe to a poisonous plant; but, from all our enquiries, and we made them almost at every village, we could find nobody that had ever seen the plant, and from our own experience we are inclined to attribute the effect to the rarefaction of the atmosphere, since we felt the like sensation at heights where there were no vegetable productions.\(^46\)

As well as implying that Humboldt’s use of his body as a barometer on Chimborazo was far from unprecedented, Gerard refers to the most widespread explanation given by Himalayan people to European travellers for the debilitating effects of high places; namely, that they resulted from the noxious emanations of plants, which produced a poisoned wind. Across the period of this study, the engagement of European and Asian lowlanders with altitude coexisted with longstanding indigenous explanations that attributed the headaches, nausea and hypoxia encountered in the high passes to the poisonous miasmas of plants. This idea was reported by travellers across the full span of high Asia, from Afghanistan to Bhutan, albeit with significant local variations and nuances, and was most commonly referred to as the ‘Bis-ki-huwa,’ or simply the ‘Bis.’ English traveller ‘Mrs’ Hervey, who made extensive trips to Kashmir, Tibet and Tartary at the mid-century, wrote, “Bischk,” or Bikh, is “poison,” and “Hâwa” signifies “wind,” so the expression is literally translated by, “Wind of Poison.”\(^47\)

As Gerard’s account suggests, European observers were, on the whole, dismissive of the idea of a poisoned wind. In one sense, the Bis might be seen as a colonial story, an imperfect facsimile of an idea travellers received from their guides, and moulded into a trope that could be used to dismiss

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\(^47\) [Mrs] Hervey, *The Adventures of a Lady in Tartary, Tibet, China and Kashmir* (London: Hope and Co., 1853), Vol 1, 133. Despite her expansive three volume account, little is known about Hervey (not even with certainty her first name). Part of the difficulty in tracing her is that almost all the Europeans she encountered are reduced to a pseudonymous letter i.e. ‘Captain H---’ or simply ‘O---.’ Often accompanied by her long-suffering personal servant, a Muslim named Ghaussie, and without any European companions, she made extensive trips to Kashmir, Tibet and Tartary between 1850 and 1852 (some to areas never previously visited by Europeans). She eventually returned to England, where her third volume concludes. Hervey, Vol 1, 46; Vol 2, 298. Though styling herself ‘Mrs’ Hervey, her husband is conspicuously absent. While she may have been recently widowed, it seems that see was travelling to escape an unhappy marriage. For more, see Rosemary Raza, *In Their Own Words: British Women Writers and India, 1740-1857* (Oxford: Oxford University Press, 2006), 263; Brigid Keenan, *Travels in Kashmir: A Popular History of Its People, Places and Crafts* (Gurgaon: Hachette India, 2013), 144–56.
superstitious indigenous knowledge, keep the ‘others’ in their place, and serve as a foil for their own physiological inquiries. This section, which considers the Bis only through extant colonial sources, is not intended to reconstruct an indigenous medical topography of the Himalaya. Rather, I am interested in the way the Bis was recorded in travel accounts, and assisted in the imaginative constitution of the mountains as distinctive spaces of exotic, sublime experience. In thinking about the story of the Bis as a European shorthand, I follow Michael Bravo and Sverker Sörlin who argue for paying attention to ‘narrative as a technology of travel’ and that ‘attention to narratives, rather than notions of local knowledge, can reveal the complex linkages between cultures of science, travel, and observation, and the conditions that sustain their circumscribed domains of power.’ However, if tracing the idea of the Bis through European accounts is on the one hand the genealogy of a colonial story, it can also be used to highlight the extent to which Himalayan exploration was dependent on pre-existing networks, and the way that altitude sickness operated as a ‘friction of terrain.’ Indeed, because the uneven distribution of symptoms was open to exploitation, explorers had to account for the Bis if they were to successfully marshal the labour necessary for high mountain travel.

Though sceptical, European travellers sometimes investigated the plants to which the Bis was attributed, perhaps compelled by the way these stories coincided with the growing necessity of understanding biogeography in three dimensions. Indeed, both plants and bodies increasingly needed to be located by attending to verticality and, for a time, it seemed possible that the relationships between bodies and air, and air and plants, might be linked. However, as Gerard alluded, the most significant evidence arranged against the Bis was that the correlation between plant distribution and altitude sickness did not add up. Scottish artist and traveller James Baillie Fraser (1783–1856) recorded while near Gangotri that ‘what proved the fact that all this was the effect of our great elevation, was, that as we lowered our situation, and reached the region of vegetation and wood, all these violent symptoms and pains gradually lessened and vanished.’ While Fraser had been directed towards flowers, Hervey was informed by her guides that a species of moss was to blame: ‘they believe the wind becomes poisonous, by blowing over a certain plant of a moss species, which grows abundantly on all high mountains in Tartary, and is found when all other vegetation ceases.’ As Hervey alludes, mosses had been discovered at heights far exceeding the limits of other forms of flora, and were sometimes thought to still be able to release their noxious emanations while buried by snow,

48 For a brief precis of Tibetan sources on altitude sickness (and their limitations), see McKay, ‘Fit for the Frontier’, 119–22.
51 Fraser, Journal of a Tour, 449.
thereby potentially offering an accounting for symptoms of altitude sickness at elevations where there was no apparent vegetation.

Observations of plant distribution, examination of specimens, and enquiries made among local informants continued to be sought across the first half of the nineteenth century. Of the various species of plants and mosses examined as potential sources of the Bis, one widely discussed suspect was Aconitum Ferox. An extract from the root was presumed to be the source of the notorious Himalayan substance known as Bikh (or, essentially, 'the poison').

Widely available in the bazaars despite attempts to ban it, surgeon and naturalist John Forbes Royle also reported the probably apocryphal idea that it was used in attempts to poison water sources during the Anglo-Gurkha War. A specimen of Aconitum can be seen in Fig. 2.2:

Fig. 2.2. Specimen of Aconitum Ferox gathered from Nepal by an unnamed Asian collector in 1821. This collector had been tasked with acquiring plants from part of the Himalaya from which European botanists remained politically excluded. ‘Aconitum ferox Wall.,’ Royal Botanic Gardens, Kew, Herbarium Specimens, http://specimens.kew.org/herbarium/K000639437.

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53 See David Arnold, Toxic Histories: Poison and Pollution in Modern India (Cambridge: Cambridge University Press, 2016), 57–63. Though reflecting extensively on Bikh, this otherwise excellent account makes no mention of the connection to altitude sickness.

54 Royle, Illustrations, Vol 1, 48.
Scottish surgeon George Govan (1787-1865), who was also the first superintendent of the Saharanpur Botanic Garden from 1817-23, extensively considered the connection between altitude sickness and plants, writing that:

On the very summits of the Choor first appear the Juniper, Alpine Rhododendron, and the lofty Aconite, the well known poisonous effects of which, when taken internally, seem to have given rise to a belief among the natives, that it poisons the air in its vicinity; an opinion for which I never could discover any foundation, unless it may be found in the lofty elevation of the belt, inhabited by this showy plant, where occasionally (certainly not always or uniformly) the disagreeable effects usually ascribed to the rarity of the air are experienced by travellers.55

From his vantage in the Himalaya foothills, Govan went on to suggest that his informants attributed ‘this belief to the circumstance of the plants always occurring at very high elevations,’ having ‘never met with it much below where the barometer stood at 19 inches.’56 The idea that the Bikh was the source of bodily debility was, as Govan acknowledges, not an unreasonable one, even as his investigations established its improbability. The connection between Aconitum and altitude was perhaps strengthened by the way Bikh poisoning, which induced asphyxia, was superficially similar to the symptoms of mountain sickness, though this was investigated not so much experimentally as through the acquisition and comparison of specimens.57

Often implied as being simplistic, credulous and unscientific, representations and understandings of the phenomena of mountain sickness and the Bis among Himalayan peoples were nevertheless more complex and nuanced than many European commentators acknowledged. Indeed, while reading these sources against the grain has its limits, there are occasional moments that suggest that the Bis, as characterised in European travellers’ accounts, failed to adequately encompass the indigenous explanation it came to represent. John Batten, at the time Assistant Commissioner of Kumaon, recorded that:

The natives do not attribute the effects indiscriminately to ‘nirbisi,’ or aconite—and indeed the worst oppression is felt above the reach of all vegetation. ‘Bish ke howa’ (The poisoned air) is the general expression for the cause of the oppression, though it is true that certain plants are often quoted as the root of the evil.58

Batten thus suggests that the Bis was a term that might encompass the phenomena of altitude sickness more broadly, and implies that it did not always rely on plants as an explanation. James Fraser also hints at the complexity inherent in understandings of mountain sickness provided by his guides, both of whom were natives of the mountains; namely, Goving Bhisht ‘a man of high caste and considerable

57 See Wallich, Vol 1, 36.
consequence’ from the district of Rewacen, and Kishen Sing ‘a favourite servant of the late rajah [of Garhwal].' As Fraser wrote: ‘they cannot account for this phenomenon, but believe it to proceed from the powerful perfume of myriads of flowers in the small valleys and on the hill sides; but they do not seem quite satisfied with this solution of the difficulty themselves.’

Fraser’s record of his relationship with Bhisht and Sing, however one-sided, also suggests that guides and porters might have exploited uncertainties around the Bis to resist unpleasant and potentially perilous labour conditions. On one occasion, Fraser suspected his guides were exaggerating in an attempt to dissuade him from proceeding via a difficult route by talking ‘wildly of a serār or wind from the mountains, pregnant with this mysterious poison.’ So as not to lose fourteen days travel time, Fraser wanted to take the risk, having ‘observed how prone these people, particularly Goving Bhisht and Kishen Sing, were to exaggerate difficulties and the length of the road, and to throw obstacles in the way.’ Altitude sickness and the Bis could thus allow guides to exert agency, in this instance in resisting a dangerous journey. Indeed, sometimes Fraser suspected members of his expedition parties might be faking or exaggerating symptoms, on one occasion as a scapegoat for other self-inflicted ills:

We experienced much trouble to-day from our coolies, who were, probably, many of them the same that we saw so much intoxicated, and busily engaged in dancing for the two previous days: they were with difficulty urged on … They told us that they were affected by the Serān, or poison in the air, from the flowers above noticed; and though I believe that their situation may in some degree be referred to drunkenness and excess, and something may be allowed for laziness, still their general behaviour and appearance indicated a good deal further that could not be accounted for.

This is inflected with Fraser’s increasingly antagonistic relationship with his expedition party, but he is not entirely unforgiving, and even while castigating his porters for supposed moral failings, he is willing to concede that altitude is at least partially responsible for their debility. On another occasion though, a porter seemed to collapse ‘to all appearance senseless, and totally heedless of the arguments, both verbal and manual,’ however ‘there was no doubt that he thus feigned illness, for his pulse and breathing were perfectly regular and good; and the people of Comharsein who were with us were perfectly aware of the trick.’ This is an interesting moment, and one that can be read in terms of resistance. Even as European travellers were working out how to navigate the politics of bodily comparison and fashion their own experiences of altitude sickness, moments like this suggest that they also had to contend with the performances of others.

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59 Fraser, Journal of a Tour, 398; 405–6.
60 Fraser, 435.
61 Fraser, 435.
62 Fraser, 435.
63 Fraser, 440.
64 Fraser, 195.
Travel Narratives and the Problem of Comparison

If the high Himalaya were spaces in which the performance of European and Asian bodies were inevitably placed in situations of direct comparison, the question for European travellers became how to record these comparisons in travel accounts and journals. Recent scholarship has demonstrated that mountains can be productive spaces for examining social relationships, and the way that, for example, mountaineering could blur class but codify gender relationships in the Alps. See Reidy, ‘Mountaineering, Masculinity, and the Male Body in Mid-Victorian Britain’. See also Hansen, ‘Partners: Guides and Sherpas in the Alps and Himalayas, 1850s–1950s’. Similarly, as Marie-Noëlle Bourguet, Christian Licoppe, and H. Otto Sibum demonstrate, while on Mont Blanc Swiss naturalist and physicist Horace-Bénédict de Saussure developed a hierarchy within his expedition party based on altitude, pulse and nausea, a hierarchy in which ‘fortunately (and somewhat suspiciously)’ de Saussure outperformed his hired guide. Bourguet, Licoppe, and Sibum, *Instruments, Travel and Science*, 12–13. Within this volume, see also Marie-Noëlle Bourguet, ‘Landscape with numbers.’ Bourguet, Licoppe, and Sibum, 13.

Concern about the potential of high mountain spaces to destabilise hierarchies around bodily performance haunts the accounts of Himalayan travellers, where the additional factor of race – itself a highly unstable category in this period – presented a complication not experienced in the same way in the Alps. Indeed, embodied knowledge production looks different when it has to account for the bodies of ‘others’ in a context of uncertainty. In written accounts, however, unlike in everyday negotiations over loads and routes, explorers had much greater control over the politics of comparison. It is difficult to generalise about tropes of self-fashioning in Himalayan accounts across the first half of the nineteenth century, and there are more exceptions than rules. However, more often than not, travellers seem to explicitly or implicitly suggest that Asians did not necessarily do better at altitude, and in fact usually did worse, than the European explorers they were hired to guide. Though Europeans and Asians are shown to suffer together, considerable rhetorical effort was made in travel narratives to ensure hierarchies around bodily performance were not inverted. Performing superiority was nevertheless complicated by the way that, as historians have demonstrated, the human body could be deployed to bestow authenticity on scientific accounts, and to arrogate ‘field’ observations over those from the ‘armchair’ or the ‘laboratory.’ Indeed, Bruce Hevly has revealed the development of the ‘rhetoric of adventure as an important element in the culture of field science’ and hence the way ‘heroic experience could be a

powerful source of authority.’ In a similar vein, Dorinda Outram has examined the ‘authentication of the explorer’s travels by the trials of his body,’ and here the body’s vulnerability is key, without which ‘the explorer could not manifest in his own person the moral economy which made his reporting acceptable as authentic knowledge.’ In this section, I thus demonstrate that there was a tension between representing the ‘trials of the body’ in travel accounts to establish a privileged position for producing credible knowledge of remote locations, while also avoiding upsetting social hierarchies around race and bodily performance.

This tension is evident in the writing of Alexander Gerard, who in describing his ascent to the high point on Reo Purgyil (as discussed in the previous chapter), spoke of how he and his brother James ‘overtook our people not a mile from our halting place. We had infinite trouble in getting them to go on, and were obliged to keep calling out to them the whole way, at one time threatening, and at another coaxing them.’ However, these assertions were followed by a rather frank admission that: ‘to tell the truth, however, we could not have walked much faster ourselves, for we felt a fulness in the head, and experienced a general debility.’ In these kind of literary sleights-of-hand Gerard manages to imply that European masculinity prevails, even while demonstrating that the brothers themselves suffered and interacted heroically with a challenging environment. Questions around self-fashioning were exacerbated by the way explorers’ authority over their guides and porters was often fragile. While reflecting on the possibilities for movement in the borderlands near the frontier with Tibet, Gerard recorded that: ‘we were so completely exhausted at first, that we rested every hundred yards; & had we not been ashamed before so many people, some of whom we got to accompany us after much entreaty, we should certainly have turned back.’ This line appears in an unpublished report to the East India Company, and in a published version of the same incident, an additional sentence was inserted, to the effect that ‘we observed the thermometer every minute almost, in order to show the people we were doing something.’ Here the brothers attempted to mask bodily weakness with an instrumental performance that amounted to feigned scientific practice, and in moments like this, we are reminded that the European surveyors’ supposed superiority was far from assured in the extreme environment of the high Himalaya. Shame and an inability to risk loss of face motivated them to force their struggling bodies to keep moving upwards. The Gerards needed to convince the guides – whose enthusiasm for the task was already tenuous – that their suffering had a purpose, even if this purpose was not one that would necessarily have made sense to the guides. This also reminds us that travellers’ letters, journal and reports were by no means free of self-fashioning, and were anyway often written

71 Gerard, Account of Koonawur, 291.
73 Lloyd and Gerard, Narrative of a Journey, Vol 2, 32.
with publication in mind; indeed, this example is representative of the way that there is usually little
to distinguish between how bodily comparisons were recorded in unpublished and published materials
in this context.

Though less frequent, accounts do sometimes clearly portray guides outperforming their
European employers, even if this tended to be excused by gestures towards long-term acclimatisation.

Bengal Infantryman James Manson (1791-1862), while attached to a mineralogical survey of the
Himalaya in the 1820s, described that above 17,000 feet:

Without the assistance of two men (Bhoteahs) accustomed to travel at such elevations, and a
jabba (an animal bred between the Tartar yak and common cow), to whose tail I tied myself,
(it being too weak, from want of food for three days, to carry me, as was intended,) I should
never have reached the summit of the pass ... and even with their combined aid I did not
accomplish it without very severe fatigue. This sensation is experienced by the natives,
though in a less degree.\(^74\)

As well as providing an arresting image of his dependency and the suffering of nonhumans, Manson
depicts the ‘accustomed’ bodies of his Bhotiya companions as performing better than his own.

Recognition of the adaptation of mountain people to their high-altitude homes nevertheless appears
unevenly in accounts, and European observers were only intermittently engaged with questions of
long-term acclimatisation (despite the parallels with contemporary insecurities around the adaptation
of the European body to ‘the tropics’).\(^75\) As James Gerard wrote, those: ‘who either breathe a highly-
rarefied air, or are accustomed to ascend their steep sides, suffer much less than those who inhabit a
lower zone and denser atmosphere.’\(^76\) In this instance he was comparing upland and lowland Asian
bodies, but on another occasion when European bodies were part of the equation, he implied that
living in high mountains did not necessarily provide the advantages (genetic and otherwise) that we
now recognise in high-altitude populations, writing that ‘[we] nevertheless outdid the villagers, who
accompanied us, and reside at the height of 12,000 feet.’\(^77\) Whatever the contradiction here, he
ultimately thought this question did not apply in the highest reaches of the mountains, writing of the
people of Kanawar:

I have not learnt whether they are subject to occasional indisposition, such as that I
experienced, however this may be, it is indisputable that, beyond a certain height, the effects

\(^74\) [Manson, James], ‘On the Distress and Exhaustion Consequent to Exertion at Great Elevations’, *Gleanings in Science*
1 (1829): 330. Other observers, such as John Batten, called more attention to the variability within mountain
populations, and while at 17,000 feet he noted that ‘one man accompanied me and he and I went groaning along, at a
snail’s pace,’ and continued that ‘the Niti Bhotias regularly educate for the endurance of this air, (Bish ke hawá,) and
some cannot learn to bear it during their whole life. At Dápa I am told that in the morning and evening people feel it
most, and an universal headache prevails.’ J. H. Batten, ‘Note of a Visit to the Niti Pass of the Grand Himalayan
Chain’, *Journal of the Asiatic Society of Bengal* 7, part 1 (1838): 315.

\(^75\) See Harrison, *Climate and Constitutions*; Arnold, *The Tropics and the Traveling Gaze*.


\(^77\) Gerard, 322–23.
of the rarefied air upon the functions of animal life are permanent, and neither custom nor constitution can bear up against them.\(^{78}\)

Though recognising the possibility of placing bodies and plants into different vertical zones, the role of long-term acclimatisation is here discounted. The implications of these questions were, however, never benign, and laid the groundwork for the imperially motivated systematic studies of high-altitude populations of the later nineteenth century.\(^{79}\)

It is only rarely that we get journals or travel accounts dealing with altitude sickness in this period written by contemporary Asian travellers. Even these tend to be mediated by their production for European audiences, such as that of the Kashmiri (though Delhi-born) Brahmin traveller and later diplomat Mohan Lal (1812-1877). Indeed, his account of his travels with Scottish officer and diplomat Alexander Burnes (1805-1841) and James Gerard to Afghanistan in 1832 was composed in English, and conforms to many European travel writing tropes.\(^{80}\) In this, Lal recounted a tale from ‘Babar’ s Memoirs’ which claimed that:

> The famous pass of Hindu Kush is so high, and the wind so strong, that the birds, being unable to fly, are obliged to creep over the top. They are often caught by the people, who kill and roast them for dinner. This is said by Dr. Gerard to be probably owing to the thinness of the air at that great elevation.\(^{81}\)

Lal here notes the existence of older stories around altitude but, through his association with Gerard, presents himself to a European audience as scientifically informed and dismissive of such myths. The writings of the elite munshi and Islamic traveller Mir Izzet Ullah, although based on reconnaissance conducted in the employ of William Moorcroft, provide an interesting contrast. Ullah kept a journal (in Persian, later translated by Horace Wilson) in which he attributes problems at altitude to impure water, suggesting that in the Karakorum, ‘the water was also so unwholesome, producing short breathing.’\(^{82}\) While describing the route to Yarkand, he also describes a variant of the Bis: ‘here begins the Esh—this is a Turkish [Turki] word, signifying Smell; but, as here used, it implies something the odour of which induces indisposition; for from hence the breathing of horse and man, and especially of the former, becomes affected.’\(^{83}\) These are, however, far from indigenous perspectives, and both Lal and Ullah were, like their European employers, lowlanders for whom altitude sickness was an unpleasant novelty. While these examples demonstrate that Asian travellers might have been able to

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78 Gerard, 322.
79 See McKay, ‘Fit for the Frontier’.
83 Ullah, ’Travels beyond the Himalaya’, 296.
draw on different cultural myths relating to high places, they are thus of only limited use in recovering uplanders’ understandings of altitude.

In examining tensions around self-fashioning, it is also important to consider that the accounts of altitude sickness discussed in this chapter were overwhelmingly written by men, and that in these accounts the bodies they describe (both their own and those of their Asian companions) were never explicitly not male. This is not to say that these were spaces in which men and women did not suffer together, as Fig. 2.3. demonstrates:

Fig. 2.3. ‘Women coolies of Kanawar from above Kanum. Foot of Ranung Pass, May 28, 1853.’ Watercolour by Conway Shipley. From a bound volume titled ‘India, Tibet and Kashmir.’ With kind permission of the Central Asia Library of The Henry S. Hall, Jr. American Alpine Club Library.

Though perhaps more rather than less often homosocial affairs, that women were sometimes present in expedition parties is also confirmed by the written accounts. While negotiating a particularly treacherous and vertigo-inducing path while travelling to Lake Manasarovar in 1812, William Moorcroft noted that several of his bearers lost their nerve, but ‘one woman carried four burthens at different times for her less courageous companions.’ When it comes to Himalayan travel accounts written by women up to the mid-century, Hervey’s *The Adventures of a Lady in Tartary, Thibet, China and Kashmir* (1853) is perhaps unique in explicitly describing symptoms of altitude sickness. Her three-

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84 Moorcroft, ‘A Journey to Lake Mánasaróvara’, 385. Other examples abound, such as from Thomas Hutton, who notes that ‘in Kunawur the women often carry quite as much as the men, and several of them marched along with apparent ease under burdens which the effeminate Simla coolies pronounced to be too heavy.’ Thomas Hutton, ‘Journal of a Trip through Kunawur, Hungrung, and Spiti, Undertaken in the Year 1838 (Part I)’, *Journal of the Asiatic Society of Bengal* 8 (1839): 923.
volume journal of travels reflects a consolidated understanding of the bodily debility one was supposed to experience in high mountains, and while crossing the Hannoo Pass, for example, Hervey gives a visceral description, including a ‘terrible nausea, like to nothing else in its overpowering nature but sea-sickness. In terms of self-fashioning, there is little to suggest she was less anxious about showing weakness than her male counterparts, and while social relationships around gender have proven fruitful in the context of mountaineering in the Alps, these questions can be less satisfactorily examined in the early period of European exploration in the Himalaya. Thinking about contemporary bodily experiences and performances of seasickness in relation to gender suggests some avenues of comparison, but this chapter can ultimately only acknowledge that these were spaces in which both European and Asian women experienced altitude sickness, and that whatever medical topographies were being constructed – both real and imagined – also had to account for the bodies of women.

When it came to assessing the credibility of bodily performance in this period, the role of self-fashioning was not necessarily overlooked, and travellers’ assertions about their personal experiences of the effects of altitude were not always accepted uncritically. On occasion, travellers were suspected of deliberately downplaying the effects. For example, when Joseph Alexander Weller, at the time Junior Assistant Commissioner of Kumaon, offhandedly referred to ‘a bad night's rest’ while on a shooting trip to the Unta Dhura Pass in 1842, his editor John Batten remarked in a footnote that, ‘probably the rarity of the air may have had a greater effect on our traveller than … he seems inclined to admit.’ The unevenness with which symptoms were felt left significant scope for members of expedition parties to try to disguise their symptoms. As James Fraser remarked:

After reaching that place [the Bamsooroo Pass] no one was proof against this influence. It was ludicrous to see those who had laughed at others yielding, some to lassitude, and others to sickness, yet endeavouring to conceal it from the rest. I believe I held out longer than any one; yet after passing this gorge every few paces of ascent seemed an insuperable labour, and even in passing along the most level places my knees trembled under me.

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87 J.A. Weller, ‘Extract from the Journal of Lieut. J. A. Weller … on a Trip to the Bulcha and Oonta Dhoora Passes’, Journal of the Asiatic Society of Bengal 12, part 1 (1843): 101. While sceptical on this occasion, Batten went on note that ‘Lieut. Weller is not singular in his exemption from suffering in rarefied air; as during a six years' residence in the hills, I have found that the European travellers to great heights are affected by, or free from, the painful effects of rarefaction in about equal numbers.’ Batten was not embarrassed to put himself in the former category: ‘I myself am a great sufferer.’ Manson, ’Capt. Manson’s Journal’, 1163. Indeed, as he described his ascent of the Burendo Pass: ‘I very soon felt inconvenience from the rarity of the air, finding it absolutely impossible to walk more than a few yards without stopping. The latter part of the ascent was terribly steep & I thought I should never reach the top. My Jhampá was of no use & I wondered how the men got up at all . . . as I neared the crest, I became weaker & weaker – a sickish feeling came over me & I only walked ten steps at a time leaning on a man.’ John Hallet Batten, ’Journal of a Tour of the Himalaya in 1835,’ British Library, Mss. Eur. B336, f25–7.
88 Fraser, Journal of a Tour, 449.
This fits neatly into the trope of implying the superiority of European bodies while not discounting one’s own suffering, but it also reveals the complexities of overlapping and contested performances within the expedition party, and the way the inconsistency of symptoms made performances an ever-present concern. The incessancy of self-fashioning thus added to the confusion around developing medical topographies, and is a reminder of why we need to pay attention to disconnection and imperfect comparison in the delineation of global sciences in this period.

Himalayan explorers never really resolved the problem of how to record the symptoms of altitude in their own bodies and those of their Asian companions in the first half of the nineteenth century. Generally, travel writing tropes allowed for maintaining hierarchies by asserting that European bodies performed as well or better, with exceptions sometimes excused by acclimatisation. Even if this reflected reality and not self-fashioning, it is possible these discrepancies partially stemmed from a difference in motivation, with wages likely less of an impulse to drag oneself upwards when compared to scientific and exploratory fervour or a duty to empire. As was occasionally acknowledged, performance was also strongly correlated with exertion, and there was a significant difference in susceptibility depending on whether an individual was mounted or not, and the weight of the load they carried. More significantly, these tropes also fail to account for the way that porters and guides might have exploited the ‘capricious and irregular’ distribution of symptoms to resist sometimes brutal labour conditions. Indeed, as the various performances of Fraser’s porters suggest, it is unlikely that European travellers were the only ones exploiting the politics of comparison around altitude for their own ends.

**Quantification and the Instrumentalisation of Bodies**

As evident in the way an exasperated James Fraser resorted to taking the pulse of a porter he suspected of feigning sickness, Himalayan travellers increasingly turned to methods for quantifying bodily performance. In deploying their bodies as instruments to read changes in atmospheric pressure, they followed the example of early travellers in the Alps and the Andes, including de Saussure and Humboldt. Measuring pulses and rates of breathing added a new dimension to the politics of comparison, seeming to offer an opportunity to make sense of the wildly differing symptoms, and of the real and perceived (not to mention performed) differences between members of expedition parties, even if this was only implemented in an ad hoc rather than systematic, statistical fashion in this period. James Manson offers one of the most extensive early attempts to quantitatively account for altitude sickness in the Himalaya, measuring his pulse and counting the frequency of his breathing.

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89 See, for example, Hooker, *Himalayan Journals*, Vol 2, 167.
90 Bert, *La pression barométrique*, 44; 92.
using a ‘watch with a second hand,’ recording, for example: ‘ascended the whole without being obliged to stop to take breath. Pulse never exceeding 140 in a minute, nor the number of inspirations 32.’\[^{94}\] Manson also measured and compared the bodies of his Asian companions: ‘I found on standing still after a little bit of steep ascent, that my pulse beat at the rate of 160 in a minute. A seapoy’s, (a hill man,) who was with me, beat at the rate of 172.’\[^{92}\] His identification of the soldier as a ‘hill man’ rather than a lowlander suggests Manson was paying attention to acclimatisation, and he is also clearly grappling with the correlation between altitude sickness and exertion. In this section, I examine attempts at quantification, and the ways these fed into the development of a Himalayan medical topography that could be compared globally. Taken as a whole, these point to an increasing, though haphazardly acquired, degree of scientific coherence to the high Himalaya across the first half of the nineteenth century.

Scottish naval officer and surveyor John Wood (1812-1871), while in the Pamirs employed on a survey of the Indus river, examined the pulses of all his party, writing that ‘to my surprise found that the pulses of my companions beat yet faster than my own.’\[^{93}\] He also went one step further, including, a table of comparisons, as seen in Fig. 2.4:

![Fig. 2.4. ‘Upon Pamir the pulsations in one minute.’ From John Wood’s Narrative of a Journey to the Source of the River Oxus (1841).](image)

Both Wood’s ‘surprise,’ and perhaps his assertion that his own body was better adapted than his Asian companions reflect self-fashioning, but he did acknowledge that the difference in loads carried meant that these comparisons were not entirely fair, or free of other variables such as fatigue. It is noteworthy that other than race and occupation, the only other variable he includes is general fitness; age and gender, though implicit, are never addressed directly. Wood was nevertheless adamant about the body’s potential for instrumentalisation, continuing that:

> When we afterwards commenced marching towards Wakhan I felt the pulses of the party whenever I registered the boiling point of water. The motion of the blood is in fact a sort of living barometer by which a man acquainted with his own habit of body can, in great altitudes, roughly calculate his height above the sea.\[^{95}\]

\[^{91}\] Manson, ‘Capt. Manson’s Journal’, 1163; 1177.  
\[^{92}\] Manson, 1163.  
\[^{93}\] Wood, Narrative of a Journey, 363.  
\[^{94}\] Wood, 363.  
\[^{95}\] Wood, 363.
Just as the Kinnauras had trained themselves to observe their breathing to determine their rough height above sea level, Wood suggests that the rise and fall of the pulse offered the potential to quantify experiences of altitude, even if he acknowledges that these readings could only ever be approximate.

Assertions of the ability of the body to act as a sort of ‘living barometer’ are not uncommon in travellers’ accounts. Before crossing the Niti Pass, William Moorcroft had questioned his guide, Amer Singh – a local and ‘the son of the Seyana [headman]’ of the frontier village of Niti – and was told that the mountains were ‘not so high as many in Garwal.’ Moorcroft was sceptical of this information, which was of elevated importance for the way it was entangled with the delineation of the frontier, remarking that ‘from the view which I have had of them, it appears to me that they are higher’ and once across he noted that ‘the general difficulty of breathing experienced by us in passing them comes in confirmation of this opinion.’ In moments where readings diverged, those from the boiling-point thermometers and barometers were nevertheless preferred, and bodily sensations became subservient to precision devices of metal and glass. Bengal Infantry surveyor William Webb meanwhile considered other variables that might mean bodily measurements were unreliable. As he wrote in 1819: ‘but even considering my own sensations as affording no competent evidence, on account of the weak state of my health, I cannot for a moment doubt the existence of this effect.’ Webb discounts the readings provided by his own body, even while he is adamant of the value of self-monitoring and of the body’s ability to produce scientific knowledge. Other difficulties in self-monitoring were more mundane, and as Victor Jacquemont noted while above 18,000 feet: ‘J’aurais voulu compter les pulsations de mon pouls, mais j’avais les deux mains entièrement engourdies et insensibles.’ Measuring was not always easily or reliably achieved in an extreme environment, even if attempts at quantification seemed to offer the potential to understand the wildly different symptoms or, on a more basic level, remove doubts around self-fashioning and the downplaying or exaggeration of symptoms in the context of everyday expeditionary practice.

Far from passively entering mountainous spaces, Himalayan travellers actively sought out remedies and strategies to cope with the effects of high altitude, and thereby reduce the ‘friction of terrain.’ James Gerard, for example, recorded that he had been told by ‘an intelligent servant’ who

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97 Moorcroft, 414.
99 Jacquemont, Voyage Dans l’Inde, Vol 2, 288. [‘I wanted to count the beats of my pulse, but both my hands were completely numb and insensitive’] Elsewhere, in succeeding getting a reading, Jacquemont used his pulse to again suggest the rarity of the air was not an issue for him: ‘J’y montai d’un pas rapide par une pente très-douce et y marchai plus d’une heure avec vitesse, sans ressentir aucune lassitude particulière causée par l’élévation, aucuns maux de tête ni d’oreilles, aucune tendance au sommeil, rien enfin de particulier, peut-être qu’une légère anhélation; et, en effet, après quelques minutes de repos, mon pouls battait quatre-vingt-deux pulsations.’ Jacquemont, Vol 2, 297-8.
had accompanied William Moorcroft, ‘of fatal consequences from the want of due precaution. He says that the passage of the lofty range should be made while fasting, and recommends frequent doses of emetic tartar during the journey.’

For his part, Moorcroft recorded various remedies collected from his Bhotiya guides, though he does not indicate whether he actually tried them: ‘the natives recommend a small quantity of coarse sugar to be eaten whilst we are mounting, and speak highly of the power of the kind of spar found near the snow reduced to powder and mixed with water, in diminishing the distressingly quickened action of breathing.’ While James Gerard was accompanying Alexander Burnes on a reconnaissance expedition to Bokhara, he was told by a Mullah named Nujeeb that he and Burnes ‘should eat onions in all the countries we visited; as it is a popular belief that a foreigner becomes sooner acclimated from the use of that vegetable.’ This echoes the idea of the ‘onion mountains’ and the way the Bis was sometimes ascribed to wild leeks, but it also points to the existence of well-developed local understandings of short-term acclimatization. In this sense, it is notable that the onions were prescribed specifically as a remedy for foreigners, implying that Nujeeb perceived a difference between the bodies of locals and those of the European travellers.

As well as seeking out remedies, and monitoring physiological effects by taking pulses and counting inspirations, some Himalayan travellers also sought to theorise the causes behind their debility. James Gerard, for example, discussed the way the change in pressure was key to the underlying problem:

As respiration cannot be performed in a vacuum, we should consider that, at the height of 18,480 feet, the exhaustion is already half made, and … the progressive action becomes here an arithmetical series, reducible to an experiment in natural philosophy, where each succeeding stroke of the piston of an air-pump appears to draw the hand placed on the aperture closer and closer, till the pressure above so much overbalances that below, as to be insupportable to the person without risk of detriment. At 18,480 feet, the barometer, in the mean state of the air, stands at 15 inches, so that here we breathe an atmosphere half the density of that at the level of the sea; how then can we be surprised at the effects?

Gerard compares high altitude spaces with laboratory experiments using a vacuum, evoking well-known demonstrations using air pumps. These reflect both his own attempt to parse his experiences, as well as a method of recording and describing which might be explicable to an audience who had no direct first-hand contact with altitude sickness. He also sets up a parallel between experiences in the field and imagined laboratory experiments that could potentially explain what happened to the body in high places. Even if he did not have the resources to carry out such experiments himself, Gerard

100 Gerard, ‘A Letter from the Late Mr J.G. Gerard’, 323.
102 Alexander Burnes, Travels into Bokhara (London: John Murray, 1834), Vol 1, 105.
nevertheless identifies the trajectory that altitude physiology would take later in the century when Paul Bert and his ilk began experimenting with pressure chambers large enough to encompass a human body.\textsuperscript{104} Further advances in the scientific understandings of altitude would await a new era of both laboratory experiments and systematic studies in the field, and this chapter thus ends where the historiography of altitude physiology to date usually begins.

\textbf{Conclusion}

In the early decades of the nineteenth century, the physiological effects of altitude became both a subject – if anecdotally and haphazardly – of scientific enquiry, and a (sometimes literal) headache for Himalayan exploration. In a context of attempts to delineate and map the East India Company’s newly acquired high frontiers with Tibet, and growing (if largely illusory) concerns with Russian activities in Central Asia, altitude sickness also presented a perplexing natural phenomenon that needed unravelling. Here altitude sickness amounted to both a physiological and social ‘friction of terrain,’ circumscribing the mobilisation of labour and imperial possibilities in the high mountains. (Like other ‘frictions of terrain’ it would eventually be reduced at the behest of lowland states, when ‘distance-demolishing technologies’ such as roads decreased reliance on labour in parts of the mountains, but not until the twentieth century.\textsuperscript{105}) Ultimately, understanding the unequal and asymmetrical politics of comparison around altitude in this period matters, because imperial administrators, naturalists and returning travellers used the accounts this chapter has traced to formulate nascent medical topographies of the high Himalaya. These, in turn, worked to constitute the upper reaches of the mountains in relation to lowland norms, as aberrant environments and economically and politically peripheral spaces. However, ‘Zomia-thinking’ also indicates that these divisions could be exploited by uplanders, and indeed imperial control in the Himalaya remained contested and incomplete, especially when compared with an increasingly expansionist and unforgiving British Empire in the lowlands.

This chapter has focused on some of the ways that the constant and necessary co-presence of Asian bodies shaped the way explorers understood altitude sickness, and developed both tropes of self-fashioning and medical topographies of the high Himalaya. The inevitability of comparison in these spaces, exaggerated by the ‘capricious and irregular’ way symptoms were distributed without due regard for conventional hierarchies around bodily performance, intensified cross-cultural relationships. High mountains are thus especially productive for examining the inherent tensions in the labour regimes that made European exploration possible. This comparativity played out on multiple levels, and in different ways for different actors, at both the scale of the local and of the global.

\textsuperscript{104} Heggie, ‘Experimental Physiology’. Humboldt had also gone to the bottom of the Thames in a diving bell in 1827, where ‘he was forcibly reminded of his ascent of Chimborazo – blood vessels burst in his chest, he coughed blood and his nose bled until the next day.’ Botting, 
\textit{Humboldt and the Cosmos}, 223.

\textsuperscript{105} Scott, \textit{The Art of Not Being Governed}, 166.
Indeed, engagement with the high Himalaya occurred simultaneously in this period with an increasing recognition of the commensurability of mountain environments, and a growing sense of a global verticality. This is nevertheless far from a story of the seamless accumulation of knowledge. While it was increasingly clear that high places disagreed with bodies everywhere, as in the case of Jacquemont, curious inconsistences in the heights at which symptoms appeared could lead initially to more uncertainty.

By the middle of the nineteenth century, some of this uncertainty around altitude sickness had lessened, even while complexities around partial pressures and the inherent variability of symptoms remained unresolved. As more and more accounts were compiled, travellers nevertheless came to expect that they would likely suffer in particular ways when venturing into the high Himalaya. English naturalist, and later director of Kew Gardens, Joseph Hooker dealt with altitude sickness in some detail, and in typifying mid-century Himalayan travellers’ understandings, provides an appropriate place to leave this story. In his lavish tome *Rhododendrons of the Sikkim Himalaya*, he also repeats the story of the Bis, revealing the continuing utility of this trope, as is evident in Fig. 2.5:

![Rhododendron setosum](image)

Fig. 2.5. *Rhododendron setosum*. Hooker recorded that this was “the ‘Tsallu’ of the Sikkim-Bhoteas and Thibetians, who attribute the oppression and headaches attending the crossing of the loftiest passes of Eastern Himalaya, to the strongly resinous odour of this and of the *Rhododendron anthropogon* … the species certainly abounds to within a few miles of the summits of all the passes, and, after hot sunshine, fills the atmosphere with its powerful aroma, too heavy by far to be agreeable; and it is indeed a sad aggravation to the discomforts of toiling in the rarified medium it inhabits.”

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In his *Himalayan Journals* (1854), arguably the most famous of the nineteenth-century Himalayan scientific travel narratives, Hooker includes an appendix titled ‘On the weight of the atmosphere in Sikkim; and its effects on the human frame.’\(^{107}\) In recording pulses and taking into account exertion and time since eating, Hooker provides a snapshot of the monitoring and recording practices around altitude sickness that had developed by the middle of the century. He also dealt with both short and long-term acclimatisation (recognising the former but not the later), and in his account there is a confidence, and a sense of familiarity. Altitude sickness was thus no longer mysterious and terrifying, and Himalayan exploration and the delineation of the frontier could continue apace. However, familiarity was by no means mastery, and the unevenness of the distribution of symptoms continued to provide scope for self-fashioning. Medical topographies remained incomplete and in flux, even as imperial scientific networks increasingly saw high mountains being recognised as commensurate environments with particular implications for human and nonhuman bodies.

Into the second half of the nineteenth century, tropes around performance and self-fashioning in relation to altitude sickness, far from vanishing, merely took different forms. In 1883, William Woodman Graham (c.1859-c.1932) made one of the first climbing trips to the Himalaya ‘more for sport and adventures than for the advancement of scientific knowledge,’ and went on to (possibly) set a new world altitude record for the human body of 24,080 feet on Kabru.\(^{108}\) Of this ascent, he made the extraordinary assertion, quoted here from the published text of an address to a packed session of the Royal Geographical Society, that ‘neither in this nor in any other ascent did we feel any inconvenience in breathing other than the ordinary panting inseparable from any great muscular exertion. Headaches, nausea, bleeding at the nose, temporary loss of sight and hearing, were conspicuous only by their absence.’\(^{109}\) By way of explanation, he argued that:

> Unquestionably man’s range is increasing. Read any old account of an ascent of Mont Blanc; it was expected that the climber should suffer every possible inconvenience from rarefied air, and the harrowing details were duly forthcoming. Now the ascent is mere child’s play, and we hear no more of these agonising horrors.\(^{110}\)

Graham concluded that, ‘personally I believe that, supposing the actual natural difficulties to be overcome, the air, or the want of it, will prove no obstacle to the ascent of the very highest peaks in the world.’\(^{111}\) While he would ultimately be proven right on the last point, his other assertions simply represent a new set of tropes. Indeed, anticipating Graham, Paul Bert noted that by the 1860s and

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\(^{108}\) William Woodman Graham, ‘Travel and Ascents in the Himálaya’, *Proceedings of the Royal Geographical Society* 6, no. 8 (1884): 429. This record is contested, and there remains considerable doubt as to whether Graham was actually climbing on Kabru or a different mountain, see Unsworth, *Hold the Heights*, 232–39.


\(^{110}\) Graham, 435.

\(^{111}\) Graham, 435.
70s, many mountaineers stopped reporting altitude sickness symptoms altogether, because ‘on craint presque le ridicule du mal des montagnes, comme celui du mal de mer.’

Altitude thus continued to be a cipher, and to offer opportunities for travellers to represent their bodily experiences in self-serving ways. While in the early nineteenth century symptoms might have implied heroic challenge, or bodily suffering that could be deployed to establish authority, by the later part of the century they were again sometimes being left unspoken in popular travel accounts (even as systematic scientific studies of respiratory physiology were beginning to be mounted in parallel). This chapter has examined the politics of bodily comparison around altitude in a particularly acute context, that of the cross-cultural and multiethnic, if imperially motivated, early exploration of the Himalaya. In this context, the omnipresence of Asian guides and porters became central not only to how explorers understood and represented altitude sickness, but also to the way they experienced its unsettling and ill-defined effects. Writing about the Arctic, Michael Bravo and Sverker Sörlin argue that recovering the presence of indigenous peoples often has not gone far enough in histories of exploration, and sometimes: ‘even studies of field practices in places and spaces where people are in abundance, can be carried out while completely ignoring the human beings who are present in the landscape.’ In the high spaces of the Himalaya, under the strain of the insidious and invisible effects of altitude sickness, this was never the case in the first half of the nineteenth century. As the many and often questionable tropes that propagated in the exploration narratives of this period demonstrate, the co-presence of bodies, European and Asian, lowlander and uplander, were impossible to ignore. As we will see in the next chapter, these ongoing uncertainties around altitude in the Himalaya had wider repercussions. Indeed, they dictated not only the development of medical topographies, but also understandings of the materiality of the mountains through their geology.

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112 Bert, *La pression barométrique*, 128. [‘they were almost as afraid of being ridiculed for mountain sickness as they were for sea sickness’]. See also Felsch, ‘Mountains of Sublimity, Mountains of Fatigue’, 353–54.

113 Bravo and Sörlin, *Narrating the Arctic*, 5.
Chapter Three

GEOLOGY

In the first decades of the nineteenth century, although nobody had actually seen a volcano in the Himalaya, it was simply assumed that they had not yet looked hard enough. Even as more and more travellers visited the mountains and failed to locate active volcanoes, naturalists were far from confident that they would not eventually be discovered. As the first Deputy Commissioner of Kumaon, George Traill (1792–1847), remarked in 1832: ‘no volcano is positively known to exist, but there are grounds for suspecting that the Nanda Devī peak contains something of the kind.’ He continued that ‘the Bhotias and natives of the neighbouring districts bear unanimous testimony to the occasional appearance of smoke on its summit: this is attributed by them to the actual residence of a deity’ and in particular, his chula or kitchen. Continuing to draw on the Bhotiyas’ information, Traill noted that doubts about Nanda Devi’s nature were ultimately a moot point, because ascending the mountain to resolve them was out of the question: ‘a religious Mela is held every twelfth year, at the highest accessible point, which is, however, about a mile from the summit: further progress is rendered impossible by a wall of perpendicular ice.’ As he concluded, ‘the dangers and difficulties incurred by the pilgrims are represented as most appalling… [and] under these circumstances, it is scarcely possible that the question of a crater can ever be decided by actual inspection.’

Accounting for the existence or nonexistence of Himalayan volcanoes was thus bedevilled by a lack of observations in situ. Complaints about access became an ongoing refrain, and this chapter examines how

2 Traill, 18.
3 Traill, 18.
4 Traill, 18.
5 Peaks like Nanda Devi and Kanchenjunga continued to be speculated as volcanic throughout the first half of the nineteenth century. See for example James Herbert, Report on Darjeeling, a Place in the Sikkim Mountains Proposed as a Sanatorium or Station of Health, British Library, IOR F/4/1250/50477, f9; ‘Volcano in the Himalaya’, Gleanings in Science 1 (1829): 338–39; Walter Sherwill, ‘Notes upon Some Atmospherical Phenomena Observed at Darjiling in the Himalayah Mountains, during the Summer of 1852’, Journal of the Royal Asiatic Society of Bengal 23 (1854): 57. These claims were also repeated in Europe, see for example ‘Account of a Volcano in the Himalayah Mountains. Communicated to Dr Brewster by a Correspondent in India’, Edinburgh Journal of Science 4, no. 2 (1826): 209–11; ‘Account of Hot Springs and Volcanic Appearances in the Himalaya Mountains’, Edinburgh Journal of Science 7, no. 2 (1827): 55–56. The phenomenon of spindrift (snow blown from summits by high altitude winds), which at a distance resembled smoke, was a key source of confusion. As William Lloyd noted while at the Burendo Pass: ‘occasionally thin curling vapours issued from some of the peaks, which, I am confident, many persons at a distance might mistake for deadened volcanoes.’ Lloyd and Gerard, Narrative of a Journey, Vol 1, 242.
overlapping frontiers – topographical and cultural as well as political – circumscribed geological practice in the high mountains.

Early forays into Himalayan geology occurred at the same time the mountains were finally being acknowledged as, by some margin, the highest in the world. These revisions to the vertical globe also occurred in tandem with momentous changes in understandings of the earth. Indeed, the reconfiguration of scales to imagine the Himalaya was matched and exceeded only by the need to imagine a new vastness for geological time and for processes that could transform the earth’s surface. As Martin Rudwick, geology’s most prolific interlocutor for this period, puts it: ‘the shift from “mineralogy” to “geology,” as the most usual term for what would now be called the earth sciences, encapsulates the dramatic changes in the culture of inorganic natural history that occurred between the late-eighteenth and the mid-nineteenth centuries.’ While surveyors were sometimes still seeking non-existent volcanoes, the study of the earth was emerging as a modern discipline. This chapter thus spans the time before and after which the term ‘geology’ can be used without anachronism, and echoes the ambiguities this transformation entailed.

In what follows, I consider the place and practices of East India Company employees and travellers on the fringes – both geographically and socially – of rapidly evolving debates in geology. As much as it demonstrates the unevenness with which geological information emerged out of the mountains, this chapter is also about the unevenness with which up-to-date information was available to the surveyors and naturalists tasked with going into the mountains to map the geology of the largely unknown high places. In particular, I consider the lack of geological training afforded to those seconded to surveys in the mountains, and the haphazard availability of relevant texts and other resources. I show that these limits were compounded by material problems around acquiring and transporting specimens, reflecting both the extreme topography and the politics of operating at and beyond nascent political frontiers. Just as significantly, I demonstrate that these imperial and geographical frontiers were further complicated by operating in, to use Fa-ti Fan’s formulation, ‘cultural borderlands.’ As Fan explains this concept (developed to explain everyday botanical practice in China), it serves as ‘a point of entry for explorations into the day-to-day practices of scientific

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7 I use the term ‘geology’ throughout this chapter for convenience, in a broad sense that refers to a range of knowledge-making practices pursued by East India employees and travellers in dealing with questions about the earth. Rudwick notes although ‘geology’ originated in the 1770s as synonymous with geotheory, it cannot be used without anachronism until the early nineteenth century, where it took on the quite different connotation of rigorous empirical observation of earth (and by this time actually eschewed the discredited pretensions of speculative geotheory). See Martin Rudwick, Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution (Chicago: University of Chicago Press, 2005), 347–448; 468–69. See also Martin Rudwick, Worlds Before Adam: The Reconstruction of Geohistory in the Age of Reform (Chicago: University of Chicago Press, 2008), 2–3.
imperialism’ where the ‘pattern of power relations was complex, dynamic, and localized. It involved constant negotiations among different parties, and the outcome was not uniformly in favor of the [European] naturalists’ (though as he notes, care must be taken not to ‘downplay the reality of power differentials’). Indeed, in preferring this framing over the classic idea of ‘contact zones,’ Fan argues that ‘it draws attention to the cultural aspect (including material culture) of encounters, and, second, it maintains a sense of border and intermediacy.’ In this chapter, the concept of ‘cultural borderlands’ is especially useful for understanding the way that geological specimens (for example the so-called ‘lightning bones’) could be acquired via pre-existing networks of trade in ritual objects. However, I demonstrate that attempts to circumvent frontier restrictions was only ever a partial solution. Indeed, the dislocated objects these networks returned were often difficult to place accurately on the vertical globe, meaning that the problematic lack of in situ observations was ongoing.

In examining everyday activity in ‘cultural borderlands,’ I also highlight surveyors’ dependency on guides to locate key collections (for example the Spiti fossils), and to explain changes in topography over time (such as by drawing on multi-generational oral traditions to understand the movement of glaciers). The colonial archives place some intractable constraints on illuminating these episodes, but the presences of Himalayan peoples haunt this chapter at every turn. While we will meet certain key individuals – including Pati Ram, Nagu Burha and Ram Singh – a key aim is simply to render visible the sheer scale of contributions silenced in the geological accounts of the savants published in Europe in this period. If nothing else, it becomes clear that the fossils extracted from the Himalaya, and eventually placed in the hands of savants like William Buckland, would not have gotten there when they did without the active participation, and sometimes active resistance, of Himalayan peoples. Indeed, as well as expertise, this chapter emphasises the enormous quantities of labour required to mount expeditions into the high mountains, and to transport often heavy and bulky samples out for closer inspection in the comfort of the lowlands. In a shift from the preceding chapters which focused on discursive strategies and imaginative disconnect, this chapter thus foregrounds the physical stuff of the mountains – the rocks and the ice, the soil and shells – in order to better understand the processes involved in making the Himalaya into a high mountain ‘type.’ In highlighting the overwhelming laboriousness of making the Himalaya globally commensurable, the materiality of specimens emerges as a key limiter in a context of extreme topography and fragile labour relations.

In tracing the materials used to overwrite Asian cosmologies with those of European geology (itself a cosmology in flux), this chapter thus expands the argument for the way the mountains were

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8 Fan, ‘Science in Cultural Borderlands’, 221; 224.
9 Fan, 215.
10 On the importance of verticality to geology and territory, see Braun, ‘Producing Vertical Territory’. For the general tardiness in developing three-dimensional representations in other geological contexts, see Rudwick, Bursting the Limits of Time, 83.
made and remade in this period through comparison.\textsuperscript{11} The first appointee to the Geological Survey of the Himalaya, James Herbert, acknowledged of his survey that: ‘there are no new rocks likely to occur for as Mr Humboldt has observed these are the same in every quarter of the globe.’\textsuperscript{12} However, as he elaborated, if ‘tertiary strata have hitherto been found in countries of moderate elevation: it is not unlikely … that the examination of them at such enormous elevations’ would be interesting.\textsuperscript{13} Key points of direct contrast with other mountain ranges included minerals, fossils, strata and glaciers. As with barometrical scales and the symptoms of altitude sickness, these comparisons nevertheless sometimes led to more rather than less uncertainty. Indeed, the question of volcanoes was compounded by misleading inferences arising from the Andes. As we have seen in previous chapters, Himalayan travellers drew widely on the work of Alexander von Humboldt, whose prominent theories of mountain formation and ascent of the volcano Chimborazo in 1802 loomed large in their imaginative repertoires.\textsuperscript{14} The very definitely volcanic nature of the Andes thus made it harder to believe that a mountain range as stupendous as the Himalaya might have none. However, as James Herbert recorded, there is:

> Considerable difference of physical aspect between these mountains and the Andes, the chain with which it has been most usual to compare them … the numerous volcanoes, extinct or igneous of the Andes … belong to a totally different order of things from that which prevails in the Himalaya.\textsuperscript{15}

Given these ‘usual’ comparisons, accepting that the order of things might be different in the Himalaya took time, and the limits of knowledge could continue to extend to questions as large as the existence or nonexistence of volcanoes. This chapter thus presents further evidence for why we need to pay attention to both disconnection and connection in the writing of global histories of science, especially by examining unhelpful moments of comparison.

While geological investigations had bearings on questions of scientific and cosmological importance, they also had inextricable economic dimensions.\textsuperscript{16} The search for substances like coal to

\textsuperscript{11} Andrew Grout considers comparison in relation to geology more broadly, noting that theories: ‘based on essentially European experience was not always countenanced by geologists in India, who often sought to assert their identity by stressing the instances in which Indian geology differed demonstrably from that elsewhere.’ Grout, ‘Geology and India, 1770-1851’, 135. I agree that EIC employees in India played up differences to elevate their own contributions, but with a different emphasis to Grout, suggest that this was less about claiming something specifically Indian, as it was about stressing the unexpected challenges fitting India into a global picture.

\textsuperscript{12} James Herbert to Charles Lushington, 30 November 1826, British Library, IOR/F/4/957/27123(24), f29.

\textsuperscript{13} J.D. Herbert, ‘On the Organic Remains Found in the Himalaya’, Gleanings in Science 3 (1831): 266.

\textsuperscript{14} For his part, Humboldt suggested that while the Himalaya might be higher, they were deficient compared to the Andes as they were ‘wanting in the imposing phenomena of volcanoes.’ Alexander von Humboldt, Cosmos: A Sketch of a Physical Description of the Universe, trans. E.C. Otté (London: Henry G. Bohn, 1848), Vol 1, 8-9.


\textsuperscript{16} As David Arnold suggests for India more broadly: ‘if, initially, geology reflected the individual enthusiasm of soldiers and surgeons rather than any official policy of mineral extraction, by the 1830s the Company was becoming more aware of geology’s economic utility and newfound scientific standing.’ Arnold, Science, Technology and Medicine in Colonial India, 45.
power steamships and later railways, and for valuable minerals like gold and silver, served as key motivators, even if these searches were only haphazardly executed, and remained largely unfulfilled in the first half of the nineteenth century.\textsuperscript{17} Potential economic returns were sometimes exaggerated by those pursuing geology for more abstract reasons, to justify the time and expense their geologising incurred. For example, James Gerard rather fancifully claimed that: ‘the soil of Cabool teems with mineral riches, and it is far from improbable that we shall yet see “Hindoo Khoosh” rivalling in precious ores the mountains of Peru.’\textsuperscript{18} Here he evoked the Andes – and in particular Potosí and its extraordinary deposits of silver – painting an optimistic vision that the Himalaya might soon offer similar riches. Such exuberant claims of the mineral potential of the mountains were not uncommon, and as EIC Surgeon R.H. Irvine wrote: ‘with the exception of the absence of volcanoes, the Himalaya range, as far as known, consists in the main body of the very same mineral matter’ as the Andes.\textsuperscript{19} Thus ‘reasoning \textit{à priori}, we may conclude that only want of proper exploration, has prevented the discovery of metalliferous veins.’\textsuperscript{20} As we will see, however, such \textit{a priori} reasoning had a tendency to come unstuck in the Himalaya.

The hunt for valuable minerals could also serve to heighten existing political tensions. William Moorcroft, for example, recorded while sneaking beyond the frontier to Lake Manasarovar in 1812 (see Chapters 1 and 2) that the ground was scattered with rocks bearing minerals, including, possibly ‘some veins of silver in strata of quartz.’ However, he lamented that ‘I had no instruments to break stones with, nor did I see any small fragments which I could with convenience place in my girdle. I was obliged therefore rather to leave this point unsettled, than to expose myself to the suspicion of coming into the country in search of precious metals.’\textsuperscript{21} Geological practice in the Himalaya, as instrumental measurement, was thus continually circumscribed by the limits of imperial mastery.

\textsuperscript{17} Grout, ‘Geology and India, 1770-1851’, 13; 29–30. Though not in large quantities, coal was identified in the Himalayan foothills in this period. James Herbert, for example, noted that a ‘vein or seam, I am told by Dr. Govan, was originally discovered, when the British army were encamped under Náhan, at the opening of the Gorkha war.’ J.D. Herbert, ‘Notice on the Occurrence of Coal, within the Indo Gangetic Tract of Mountains’, \textit{Asiatic Researches} 16 (1828): 404.


\textsuperscript{20} Irvine, 139. Andrew Grout argues that: ‘the experience of South America appeared to provide a model to be followed, for it was there that Humboldt had opened the great mineral resources of the Andes mountain chain to the world’s view, and it was argued by many that if treasures were abundant in those mountains then why not in the Himalayas also?’ Grout, ‘Geology and India, 1770-1851’, 47.

\textsuperscript{21} Moorcroft, ‘A Journey to Lake Mánasaróvara’, 389.
around the high frontiers. Indeed, as James Herbert complained in his 'Report upon the Mineralogical Survey,' the Himalaya and especially the plateau of Tibet ‘considered in its various relations to Asia, I might even say to the Old World … is undoubtedly the most interesting spot on the surface of the globe’ and, as such, was in need of urgent mapping. However, ‘unfortunately for science, this task is not likely to be soon effected. The jealousy of the Chinese government, to which the greater part of it belongs, opposing insurmountable obstacles to the progress of investigation and discovery.’

In focusing on the high Himalaya, it is worth noting at the outset that this chapter does not deal, except in passing, with the most famous of the Himalayan (or sub-Himalayan) contributions to geology and palaeontology in this period; namely, the extraordinary fossils excavated from the Siwalik hills in the 1830s. These fossils, which came to the attention of European naturalists during attempts to dig the Doab canal, made the names of Scottish surgeon and naturalist Hugh Falconer and English engineer Proby Thomas Cautley, and garnered them the Wollaston Medal from the Geological Society of London in 1837. Their ‘discoveries’ matter to this story, as David Arnold explains, because previously there had been an ‘inhibiting feeling … that India’s geology had less to offer of scientific interest than its botany or zoology’ but the Siwaliks ‘earned for Indian geology by mid-century international interest.’ Scholars have, with good reason, paid particular attention to the way Hugh Falconer drew on Hindu cosmology in interpreting the fossils, most famously by using information from the Puranas to try and date the extinction of the enormous Colossochelys Atlas tortoise. Savithri Preetha Nair has argued that ‘Falconer’s ability to “translate” the sacredness that the natives attributed to fossils into his own scientific concerns was best reflected in his zoological nomenclature.’ Indeed, while the appellation ‘Atlas’ was intended to invoke the Hindu concept of a turtle that carried the world, it was also, as Pratik Chakrabarti and Joydeep Sen have argued, a rhetorical opportunity to get to this idea via the Greek myth of the demigod who held the world on his back. Chakrabarti and Sen

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22 Herbert, ‘Report upon the Mineralogical Survey of the Himalayan Mountains’, xiii.
25 Pratik Chakrabarti and Joydeep Sen, ""The World Rests on the Back of a Tortoise": Science and Mythology in Indian History", *Modern Asian Studies* 50, no. 3 (2016): 809–10; 833–34. Chakrabarti and Sen note that ‘Falconer’s peers in Britain were not particularly receptive to his analytical and narrative strategy of mixing Indian mythology with geological evidence.’ The discovery of primate fossils in the Siwaliks in 1836 has also received considerable attention. These had connotations for the extreme antiquity of human beings in India, although these were not widely discussed until decades later. See Chakrabarti and Sen, 824; Rudwick, *Worlds Before Adam*, 417–20.
26 Savithri Preetha Nair, ""Eyes and No Eyes": Siwalik Fossil Collecting and the Crafting of Indian Palaeontology (1830-1847)", *Science in Context* 18, no. 3 (2005): 380.
go on to conclude that ‘in the context of the making of geology in colonial India, mythology was not simply a device for the popularization of fossils; rather, it served as a methodological tool for interpreting fossils.’

These engagements with cosmology extended beyond the Siwaliks, but we still know little of the practice of geology in the mountains in this period. Rasoul Sorkhabi provides a useful chronology of specifically Himalayan geology, even if his study is largely synoptic. Geology in India as a whole nevertheless remains understudied, especially when compared to other sciences like botany and astronomy. The most extensive contributions remain those of Andrew Grout, whose important work this chapter builds on. It begins with a key group of high-altitude fossils reputed as talismans and collected and sold by Bhotiyas under the name ‘lightning bones,’ which reveal tensions between specimens that were both scientifically and cosmologically significant, and the ongoing problem of attaining in situ observations. This is followed by a close examination of a series of fossils from Spiti, focusing on the limited resources – both material and intellectual – of those tasked with retrieving them. The chapter then turns to a broader assessment of how these material remains fit into discussions about the upheavement of the Himalaya, while continuing to emphasise the sometimes-limited vocabulary available to those operating in the decentred spaces of the mountains. Expanding from fossils, the final section of the chapter examines glaciers, especially debates over their existence in the Himalaya (in a reverse of the debate over volcanoes) and experiments to establish that they represented the same phenomenon as had been observed in the Alps. These forays into glaciology also demonstrate naturalists’ reliance on multi-generational oral traditions, which highlight both the way imperial mastery was limited in ‘cultural borderlands’ and the multifaceted roles of Himalayan peoples in geological practice. Together, these episodes serve to demonstrate the compounding limits to engaging with the materiality of the mountains, and ultimately, the sheer laboriousness of making the Himalaya globally commensurable in the first half of the nineteenth century.

28 Chakrabarti and Sen, 839. Chakrabarti is also currently completing a book titled Inscriptions of Nature: Geology and the Naturalization of Antiquity.
31 It had long been understood that fossils were the remains of organic beings, and by the early nineteenth century it was increasingly apparent, if not uncontroversial, that that many of these beings were now extinct. Similarly, the marine nature of fossils found in hills and mountains far from the sea had also long been accepted, if not adequately explained. See Rudwick, Bursting the Limits of Time, 63–71.
‘Lightning Bones,’ ammonites and the problem of in situ observation

Among the most widely discussed early geological collections extracted from the Himalaya were a group of fossils often referred to as the bijli ki har. Usually translated as ‘lightning’ or ‘thunder’ bones, the bijli ki har were reputed to have their origins in lightning strikes (an explanation that probably arose because they were exposed by heavy rains and thunderstorms which washed away covering soil). They represented some of the first fossils recovered from the high Himalaya, initially collected by Bengal infantryman William Webb. They were then passed on to Henry Colebrooke in Calcutta, who sent them on to Europe. It was by this means that they eventually found their way into the hands of William Buckland, who referenced them in his major geological work *Reliquiae Diluviana* (1823), suggesting that they provided additional evidence of a deluge that had covered the entire earth, including the Himalaya. Interest in these organic remains was thus magnified by the way they figured in discussions of the upheavalment of the mountains. However, the bijli ki har (examples of which can be seen in Fig. 3.1) had been important to South Asian religion long before they mattered to European science. They thus provide, as we will see in this section, an excellent case study for the plurality of roles of Himalayan people in geological practice.

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13 ‘Asiatic Society of Calcutta - Physical Class, 8 June 1832’, *Asiatic Journal (New Series)* 7 (1832): 118.
14 William Buckland, *Reliquiae Diluvianae, Or Observations On The Organic Remains Contained In Caves, Fissures, And Diluvial Gravel, And On Other Geological Phenomena, Attesting The Action Of An Universal Deluge* (London: John Murray, 1823), 221–23. Buckland noted the bones had reached him ‘by Captain W. S. Webb, who procured them from the Chinese Tartars of Daba, who assured him that they were found in the north face of the snowy ridge of Kylas, in lat. 32°, at a spot to be not less than 16,000 feet high: they are only obtained from the masses that fall with the avalanches from the regions of perpetual snow, and are therefore said by the natives to have fallen from the clouds, and to be the bones of genii.’
The fossils at the top section are those ‘obtained by Messrs Webb and Traill from the elevated land on the N.E. of the line of Snowy Peaks,’ respectively: ‘1. Skull of a fossil Antelope. 2. Lower Jaw of a fossil Deer. 3. Fossil Tooth of a Rhinoceros.’ As Royle explained: ‘the Fossils represented in the upper part of Plate 3 … have also been long known in India by the name of bijli ke har, or Lightning Bones.’

While information about the bijli ke har was scarce, one fact was agreed: they were only obtained from high altitudes. George Traill, who made a collection while serving as Deputy Commissioner of Kumaon, confirmed this:

Fossil bones and organic remains exist in the most elevated parts of the Ghats. The former, here called ‘Bijli Hār’ lightning bones, are chiefly found at the crest of the Niti pass: the latter, called ‘Chakar Patar’ from its resemblance to a wheel, is procured in a ravine on the northern face of the Mana pass. In both instances, the elevation may be assumed at seventeen thousand feet above the sea.

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36 Royle, Illustrations, Vol 2, Plate 3.
37 Royle, Vol 1, xxix.
Here Traill also indicates a second set of fossils from the mountains with importance in South Asian tradition; namely, ammonites or ‘Chakar Patar (Futteer).’ John Batten found some of these on the Niti Pass, recording in his journal: ‘ascended the opposite banks [of the Siánkí river], keeping to the northwest for two miles till I came to what was called the fossil ground, (Chakra patharke makán).’^39 Here he found ‘ammonites lying about in hundreds.’ However, he was suffering badly from altitude sickness and as a consequence had to admit: ‘I was too ill to stay long picking up ammonites, and, moreover, I can always command a good supply from the Bhotias.’^40 In looking to Asian collectors to overcome his own physiological failings, Batten thus acknowledged that the fossils were quite easily procurable lower down. Indeed, they were widely available for purchase at bazaars in the Himalayan foothills, as Hugh Falconer recorded:

They are brought to Almorah by the Bhoteah merchants, and sold as talismans or charms under the name of ‘Bijli ki har’ lightning bones; ammonites, from the crests of the neighbouring snowy passes, called ‘Chakar futteer’ and venerated all over Hindostan as the sacred Salagram, are generally found mixed up with them.^41

In obtaining both ‘lightning bones’ and ammonites, East India Company employees were thus tapping into pre-existing networks that already circulated these fossils from the mountains to the lowlands.

These networks existed because the fossils had particular and longstanding uses in Hindu religious practice, as James Herbert reported:

The first notice of organic remains from the Himmalaya mountains was I believe derived from the fact of the Gunduk river bringing down, with the stones in its bed, specimens of Ammonites, the Saligrami of the Hindus. As nothing was known at the time of the geology of the mountains, the fact attracted little notice, and indeed was only known perhaps to those who interested themselves in the history and nature of Hindu observances.^42

Both Falconer and Herbert thus indicate that saligramas were employed in Hindu ritual (where they served as emblems of Vishnu, with their spiral shape thought to resemble his chakra wheel). These ammonites were usually gathered along the Gandaki River, especially near the village of Salagrama from which they took their name. As scholars have noted, ‘the ammonites are named after the village, which in turn took its name from the abundant sala trees (Vatica robusta).’^43 While both saligramas and bijli ki har were used in devotional practice, the ‘lightning bones’ additionally had a role in medicine. As James Herbert continued: ‘they were valued, not only as charms, but as medicines; belonging in the latter case to the class of absorbents. As they consist chiefly of carbonate of lime, it appears that

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^39 Batten, ‘Note of a Visit to the Niti Pass’, 315.
^40 Batten, 315.
^43 See van der Geer, Dermitzakis, and de Vos, ‘Fossil Folklore from India’, 72–74.
they were not unfitted for this office.'\textsuperscript{44} Herbert thus indicates that not only did they have a medical application, but that they would be efficacious by the standards of European medicine. John Batten later confirmed this use, seemingly rather shocked at what he saw as the careless destruction of potentially valuable geological specimens, writing that the bones were: ‘used as medicine! I am told, in a pounded state.’\textsuperscript{45}

Batten then went on to acknowledge the limitations of these specimens for the advancement of geology, partly because they tended to be in bad shape (even before they were ground up for medicine): ‘I have rarely been able to obtain teeth or other characteristic specimens.’\textsuperscript{46} Hugh Falconer noted similarly that ‘judging from the quantities which find their way to Almorah, the fossils are by no means scarce,’ but ‘they are rarely seen entire, consisting generally of fragments.’\textsuperscript{47} This mattered, because it made the all-important identification of which animals the bones belonged to difficult.

James Herbert later had the opportunity to examine the specimens collected by Traill and passed on to Colebrooke, and gave a detailed analysis of the state they were in: ‘they consisted of bones of sizes [sic], including crania or fragments of crania of different animals … all these bones were completely mineralised, being converted into carbonate of lime.’\textsuperscript{48} Royle meanwhile presented an analysis of the mineral composition of these bones, which was published in the \textit{Journal of the Asiatic Society of Bengal}, as seen in Fig. 3.2:

![Fig. 3.2. Notes on the mineral composition of the \textit{Bijli ki har} by John Forbes Royle.\textsuperscript{49}]

Along with the bones' poor state of preservation was another and even more serious problem for geology: they had not been observed \textit{in situ}, and there remained considerable doubts about where they had come from. As James Herbert wrote, ‘hitherto, they have been collected only by natives,

\textsuperscript{44} Herbert, ‘On the Organic Remains Found in the Himmalaya’, 269.
\textsuperscript{45} Manson, ‘Capt. Manson’s Journal’, 1167.
\textsuperscript{46} Manson, 1167.
\textsuperscript{47} Falconer, \textit{Palaeontological Memoirs}, Vol 1, 177.
\textsuperscript{48} Herbert, ‘On the Organic Remains Found in the Himmalaya’, 270.
\textsuperscript{49} ‘Proceedings of the Asiatic Society, Physical Class, 8 February 1832’, \textit{Journal of the Asiatic Society of Bengal} 1 (1832): 77.
whose reports,—never very precise as to particulars the value of which they do not appreciate,—can scarcely be allowed to settle a point of this interest.\[^{50}\] He recorded elsewhere that:

> From the same people from whom these bones were obtained, great numbers of *Ammonites* and of *Belemnites* were obtained … concerning the locality of these or of the *Belemnites*, I never could get any clear information beyond the fact of their being found North of the range before-mentioned, which, as it is the boundary of the Honorable Company’s territory, was likewise that of my investigations.\[^{51}\]

Here, again, the frontier circumscribed the availability of knowledge, something collectors could never really mitigate, because where fossils were ‘brought from beyond our frontier by natives … neither the distance or the elevation are precisely known.’\[^{52}\] Indeed, even if these frontiers were considerably more porous for Tartars than it was for European surveyors, the problem of verifiable locality data persisted. James Manson, for example, investigated bones he found for sale in the bazaars, and raised some doubt that they were even from the Himalaya:

> The bones which are brought by the Bhoteahs for sale at the fair held at Bageswur, it appears they purchase at Gurtope, and consequently they are not found amongst the Himalaya, which had formerly given an interest to these productions, but which must now, if the above account prove true, cease altogether.\[^{53}\]

Manson was likely being overcautious, but such doubts remained a key issue, and as Falconer noted in 1839, ‘no competent European observer has as yet seen them in situ.’\[^{54}\]

At the mid-century, Richard Strachey indicated that the problematic lack of direct observations was still unresolved. He also speculated that in some cases fossils might have been acquired from roadside and mountaintop shrines or cairns (much like the *shughars* we saw Alexander Gerard conflating with Tartar border guards). Strachey noted that these were constructed by ‘the superstitious of so many nations, including the Hindus and Tibetans of the Himalayan regions’ and:

> Accumulations of all sorts of oddities are often found in these piles, among which horns and skulls of wild animals, fossil shells, bits of crystal, or eccentric-looking stones invite the sacrilegious attacks of European travellers, and many of my specimens of ammonites are spoils of this description.\[^{55}\]

\[^{50}\] Herbert, ‘Report upon the Mineralogical Survey of the Himalayan Mountains’, cxlix.


\[^{52}\] Herbert, ‘Report upon the Mineralogical Survey of the Himalayan Mountains’, cxlix.

\[^{53}\] Manson, ‘Capt. Manson’s Journal’, 1167.

\[^{54}\] The date of 1839 is that suggested by Falconer’s editor, Charles Murchison (although the essay itself was not published until 1868). Falconer, *Palaeontological Memoirs*, Vol 1, 174. Falconer collated the information from previous travellers and concluded: ‘their occurrence still wants the important testimony of direct observation; but the other evidence to the point is so good as to leave no room for reasonable doubt on the subject. This evidence is as follows: 1. The concurrent statements of good observers, such as Webb, Traill, and Batten, supported by specimens, that fossil bones are found in the northern faces of the Niti and Mana Passes, and the Steppe of the Hoondès. 2. The direct testimony of the Bhoteah merchants who bring the fossil bones to Almorah; they state that they are found in ravines in the plain below the Snowy Passes. 3. The universality of the belief at Almorah, where the *Bijli ki hār* are brought, that they come from the plains of Tibet, and from nowhere else. 4. The absence of any grounds tending to discredit the evidence in favour of the fact.’ Falconer, Vol 1, 174-5.

\[^{55}\] Strachey, ‘Narrative of a Journey’, 262–63. Thomas Hutton also collected natural historical specimens this way, though using greater discretion than Strachey: ‘on these piles very fine specimens of horns of different animals are
Material specimens revered in one tradition were thus purloined to serve another, though Strachey suggested that the 'Bhotiyas have no scruple in assisting in such proceedings' and 'they generally appear to care but little, unless impelled by considerations of temporal expediency, for the superstitious practices of their Tibetan or Hindu neighbours.' Strachey went on to note that the nature of these fossils, found 'at an elevation of from 14,000 to 16,000 feet above the sea,' pointed to some central questions in geology. However, because 'we were altogether ignorant of the precise locality whence they came' no 'conclusions could be formed as to their geological import.' As he continued, 'the Niti Pass, from which it was said that the bones had been brought, was not the place where they were found, but one of the routes only by which they came across the great Himalayan chain from unknown regions beyond.' These doubts about the bijli ki har and shaligrams thus demonstrate the crucial role of pre-existing Himalayan networks in the acquisition of material specimens, but also a debilitating lack of trust in critical associated information about locality and altitude. This lack of in situ observations nevertheless mattered, because of 'the very important inferences connected with these remains in regard to the elevation of the Himalayas.' Before examining these debates around upheavement though, we first need to examine a second key set of fossils, and the successive and vexed attempts by surveyors and naturalists to extract them from Spiti.

The Spiti Fossils

At the same time that 'lightning bones' were being chased in bazaars, an important and related series of fossils were being acquired by James Gerard, at the 'remarkable' elevation of 17,000 feet, proving that 'the waters of the ocean had, at some former period, covered these mountains.' For his part, Gerard waived responsibility for identification, citing his limited geological training:

If the observation of shells and mountain strata of organic remains at such an altitude be worthy of attention to the geologist, I am happy in having enjoyed the opportunity of verifying the fact—leaving to more experienced hands the recognition of the species and the age of the fossils, the classification of the strata in which they are imbedded, and the theory of their being raised to their present elevation.

56 Strachey, ‘Narrative of a Journey’, 263.
58 There continued to be occasional mentions of Bijli ki har in the second half of the nineteenth century, including by the so-called ‘Pundits’ who explored the Himalaya in the 1860s. See for example T. G. Montgomerie, ‘Report of a Route-Survey Made by Pundit, from Nepal to Lhasa, and Thence Through the Upper Valley of the Brahmaputra to Its Source’, Journal of the Royal Geographical Society of London 38 (1868): 151–52.
59 Falconer, Palaeontological Memoirs, Vol 1, 5.
60 Biographical Sketch of the Late James Gilbert Gerard’, Asiatic Journal (Third Series) 4 (1844): 68.
Even if Gerard is here leery of philosophising – and given his broader oeuvre, he is perhaps being disingenuous – it is clear that he was conscious that these fossils had a bearing on important geological questions. This is further evident in his report on the expedition to Spiti, where he wrote that ‘the accounts of the Lamas confirm the report of calcareous deposits … wherein shells and various organic remains, with petrified bones, are found’ and that ‘there is every probability that the whole country lying at the back of the Himálaya … abound with fossil relics, the living prototypes of which have disappeared from the earth.’ In this instance, he indicates an acceptance of the still controversial idea of the extinction of species, and a distinct awareness of the place his fossils might have in wider debates.

Moments like this also inadvertently point to how, at every step of the way in acquiring these fossils – from locating, to transporting, to interpreting – James Gerard relied on the knowledge of Himalayan peoples. His Tartar guides told him of the existence of – and helped him locate – the fossil beds, and his discussions with them led him to speculate that there would be more organic remains found on the Tibetan plateau (even if these remained politically inaccessible). Indeed, Tartars seconded by the Qing made it a complex business firstly to get in, and secondly to get specimens out. As Gerard wrote of his experiences at 17,000 feet in Spiti:

Illness, and the languor produced by such an attenuated atmosphere, prevented my taking every advantage of my visit to this interesting region, and my journey was terminated by the limits of the British territory. Just before crossing the boundary of Ladák into Basáhir, I was gratified by the discovery of a bed of marine fossil shells resembling oysters… but the suspicions of the Chinese prevented my bringing away many specimens.

In this instance, as in so many others, the material and physiological difficulties of working in these spaces were thus compounded by the cultural and political.

On one occasion Gerard did manage to obtain a shell from beyond the frontier, traded from a border guard after a night of heavy drinking. Gerard recorded that the unnamed officer ‘had heard of my searching for fossils and curiosities, and presented me with a petrifaction from Lake Mansarawur; it seems a species of Medusa.’ Whatever the potential geological implications of organic remains from the extraordinarily elevated Tibetan plateau, Gerard noted the limited usefulness of obtaining specimens this way, echoing the problems with the bijli ki har:

The very few shells which have thus come to light, are chiefly interesting as insulated specimens of the varied resources of the country; being from their unknown situs and position deprived of their value to the geologist, though still identifying the continuity of character, and pointing out an intimate analogy with the fossil geology of opposite regions of the globe.

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63 Gerard, 276.
Even if problematic, Gerard thus indicates the necessity of comparing the fossils of the high Himalaya globally. Such a comparative outlook was also evident in his evoking of the romantic implications of his discoveries. As he later wrote, while in Afghanistan with his health irretrievably deteriorating:

I am quite sick of my situation & would exchange it if I could (at a single leap) alight like the Condor, upon the highest summit of the Himalaya & find myself amongst antediluvian reliquiae, or the fossil bones of those monsters of antiquity, the mammoth & mastodon. I should even be contented with a deposit of oysters or muscles.66

Here he thus combines allusions to the sublime with knowledge of key fossil discoveries in other parts of the world, especially by evoking Humboldt’s Andes with the mention of the condor.

James Gerard’s report on Spiti and ‘a box containing 164 paper parcels of fossils’ were later forwarded to the Asiatic Society by his brother Patrick, where they were discussed at a meeting of the ‘Physical Class’ in 1832.67 East India Company Chaplain Robert Everest (younger brother to surveyor George for whom the world’s highest mountain would later be named) had the opportunity of examining, sketching and publishing a brief notice in the *Asiatic Researches* (1833), where several of the Spiti shells were figured. Some of these can be seen in Fig. 3.3:

Fig. 3.3. ‘Himalayan Fossil Shells.’ This image showcases a selection of Gerard’s Spiti fossils, as depicted by Robert Everest, including several ammonites and belemnites.68 At the time ammonites, seemingly of marine origin, were highly sought after and discussed in geological circles because they appeared to have no living analogue in the present, clearly suggesting the existence of a former and now extinct world.69 (Some of these Spiti fossils can also be seen in Royle’s collection as depicted in Fig. 3.1 above.70)

Everest’s figures were also published in the India-based journal *Gleanings in Science*, where it was noted that ‘these organic relics are generally in so mutilated a state that few of the characteristic types are discernible, and the difficulty of naming them is increased by the want of works of reference on fossil conchology.’ As was further explained:

> It is hoped by circulating the figures in the GLEANINGS to elicit further opinions on the subject from those who make conchology their peculiar study. Those also who reside among the hills may, by seeing what species the cabinet of the Society possesses, be better able to select fresh varieties, and complete in time this interesting series of Himalayan fossils.

In this instance, the editors thus specifically argue for circulating information about the fossils back into the mountains, in the hope of filling in ongoing gaps in knowledge.

The travails involved in identifying these fossils also points to the ongoing limits of resources. In an 1835 report, John McClelland (1805–1875) outlined the advantages and disadvantages of pursuing geology in India in general, and the mountains in particular. In presenting ‘the result of a temporary residence in Kumaon, while on the regular tour of duty with my regiment in that province,’ he highlighted the unevenness with which journals and new findings circulated:

> India, however, is not a country in which new publications are advertised in every village; and such are the disadvantages of private individuals in remote districts, that they often remain ignorant of the existence of the most important works, until some peculiar circumstance or accident presents them to notice. I mention this, as an apology for not having availed myself of some interesting papers that have recently appeared in India on Geological subjects, and which I had no opportunity of seeing, till my return to Calcutta.

In a period when geological theories were rapidly appearing and disappearing in savant circles in Europe, the availability of up-to-date information mattered. Moments like this are a reminder of why we need to treat places like Kumaon differently to ‘centres in the periphery’ like Calcutta. Indeed, while advocating for a new Geological Society in Calcutta (and sub-branches in other parts of the country) to complement the more general work of the Asiatic Society, McClelland argued that: ‘it is painful to reflect on the number of years the immense empire of Hindustan has been in our possession; and that to this day we should remain as ignorant of its physical structure as we are of that of China, or the interior of Africa.’ In chiding the Company, he remarked that advances were chiefly provided by interested amateurs combining duties, and ‘in the few instances in which British governments have patronized the travels of scientific men, the motives have been rather the extension of commerce than the promotion of science.’ As David Arnold has argued, ‘far from embodying the
rule of science in the service of empire, the Company’s involvement in science often appeared more like a fitful flirtation.\(^{76}\)

Returning to the specific case of the Spiti fossils, James Gerard’s physiological and political difficulties mandated the need for return visits. The first of these was carried out by French naturalist Victor Jacquemont, who visited to examine the fossils beds in 1830. While much geological practice in the Himalaya in this period continued to be itinerant and opportunistically, carried out by army officers and surgeons like James Gerard, those with better training (and renumerated explicitly for their scientific efforts) did occasionally get opportunities to enter the high Himalaya, and here Jacquemont is an example. Indeed, he visited under the auspices of the French Jardin des plantes between 1829 and 1832, and made enormous collections, both botanical and geological. He quickly found that his researches too, were circumscribed by the frontier, even if while in Tartary he sometimes had ‘good luck’ in finding ‘Chinese vigilance at fault.’\(^{77}\) For his part, Jacquemont was sceptical about the quality of the geological knowledge being produced by the EIC employees who preceded him. As he wrote: ‘these wilds have been travelled over by a good many English, and I have reason to believe that their Flora is sufficiently well known’ but in the case of the materials of the earth ‘they had all learned geology from books and in India, and I have no faith in their decisions.’\(^{78}\)

As well as James Gerard, Jacquemont was likely thinking of James Herbert, who was appointed by the EIC government in Calcutta to the ‘Geological Survey of the Himalaya’ in 1823.\(^{79}\) While geology remained largely itinerant in the first half of the nineteenth century, Herbert’s survey represented an exception, and the one significant attempt at a systematic accounting. This survey nevertheless pushed Herbert to – and beyond – his capacities as a geologist. Even as his efforts ‘rendered a most essential service to the cause of geological science, in giving to the world a connected Geological Map of this part of our great mountain barrier,’ his observations had critical

\(^{76}\) Arnold, *Science, Technology and Medicine in Colonial India*, 25.

\(^{77}\) Jacquemont, *Letters from India*, Vol 1, xxvi.

\(^{78}\) Jacquemont, Vol 1, 127.

\(^{79}\) See ‘Papers regarding the Bengal Survey Department, 1823,’ British Library, IOR/F/4/750/20517. The survey itself was abolished for financial reasons in 1829, reflective of the unfulfilled and perhaps exaggerated anticipation of the mineral wealth of the mountains. Frederick Dangerfield and Alexander Laidlaw had been appointed in similar roles previously, but for reasons of competence and health, failed to produce results. See Grout, *Geology and India, 1770–1851*, 172–77. When Herbert’s findings eventually appeared posthumously, as the ‘Report of the Mineralogical Survey of the Himalaya Mountains lying between the Rivers Sutlej and Kali’ (1842), they were distributed gratis as a special issue of the *Journal of the Asiatic Society of Bengal* (a detailed geological map was also published in 1844). Herbert, ‘Report upon the Mineralogical Survey of the Himalayan Mountains’, ‘Geological Map of Captain Herbert’s Himalaya Survey’, *Journal of the Asiatic Society of Bengal* 13, part 1 (1844): 170. A short section was published in 1833 as J.D. Herbert, ‘On the Mineral Productions of That Part of the Himalaya Mountains, Lying between the Satlaj and the Kali, (Gagra) Rivers’, *Asiatic Researches* 18 (1833): 227–58. Several manuscript versions of this report also exist in the British library: Add. MS. 14381; Miss. Eur. E96; and IOR/F/4/957/27123(24). In this chapter, I quote from the prefatory matter in IOR/F/4/957, and from the published version for the body of the report, specifying in each case.
Indeed, Hugh Falconer noted after Herbert’s death that he had ‘investigated with great zeal,’ but:

Unfortunately, Captain Herbert was a self-taught and book geologist, and he was called upon to describe the geology of an unknown field—a subject new to him, at the very time when he was acquiring his first knowledge of geological science. The consequence is, that his labours have been less valuable than they otherwise would have been from his talents and general scientific acquirements with longer study.

While in one sense a rhetorical strategy—pointing out the limitations of a predecessor to elevate one’s own contribution to science—such descriptions accurately reflected the challenges of seconding surveyors to scientific projects. For his part, Herbert was far from unaware of the limitations of his geological knowledge. As he wrote in the introduction to his report: ‘Geology, as a science, has not yet attracted in India that attention which its importance merits, and it would be futile in me to deny that, till selected for this duty, I had but a slender acquaintance with the subject.’ As he explained however, ‘while exploring the local phenomena of this tract I have been in reality studying the principles of the science; an advantage in so far as I may hope to have escaped the trammels of system.’ Herbert thus tries to spin his ignorance as a positive, claiming that his lack of prior knowledge would prevent him from prejudice towards particular interpretations, and thereby improving him as an impartial observer.

Presenting himself as the exception to the rule, Jacquemont remained unconvinced by his predecessors. Enjoying the luxury of travelling solely for scientific purposes, he saw himself more in the mould of travelling naturalist *a la* Humboldt, and pressed his credentials as such. However, he too encountered challenges with the availability of up-to-date information in remote locations, and as he continued:

My professional friends are urgent that I should send them from time to time a scientific paper which they might publish as a certificate of my existence . . . [but] if I wished to write some pages with care, pages which I should not regret at any future time having written, I immediately feel the want of books, which are not at hand. I had rather pass for dead than for dying, which might be concluded from feeble and neglected works. I cannot flatter myself that I shall bring home from my journey materials enough to live upon India for a score and a half of years, as M. de Humboldt has done on his concerning America.

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82 David Arnold notes that ‘the surgeons, engineers and army officers who first wrote about geology often lamented their own lack of expertise. They saw themselves as amateurs, essentially confined to “collecting and recording with precision”’, this was (to their minds) a worthy enough task but its main function was to provide the raw data that more expert minds in Europe might evaluate and incorporate into wider systems of scientific knowledge.’ Arnold, *Science, Technology and Medicine in Colonial India*, 27–28. While Arnold’s assessment is broadly correct, I would add that this makes the moments in this chapter that EIC employees envisaged themselves making greater contributions and engaging in theorising even more interesting.
83 Herbert, ‘Report upon the Mineralogical Survey of the Himalayan Mountains’, ii.
In this last, he was tragically correct, and his contribution to science was blunted by the state of his papers and collections at the time of his death in Bombay at the age of 31 (as a result of complications arising from Cholera). Like Herbert, Jacquemont’s premature death both limited and delayed the impact of his collections.\footnote{Similarly, the majority of James Gerard’s discoveries were not studied and compared to Jacquemont’s, Hutton’s and Strachey’s collections until 1863. By this time, they were in very poor condition: mixed up, lacking labels and stashed indiscriminately in a cupboard. See Henry F. Blanford, ‘On Dr. Gerard’s Collection of Fossils from the Spiti Valley, in the Asiatic Society’s Museum’, Journal of the Asiatic Society of Bengal 32 (1863): 124–38. See also J.W. Salter and H.F. Blanford, Palaeontology of Niti in the Northern Himalaya: Being Descriptions and Figures of the Palaeozoic and Secondary Fossils Collected by Colonel Richard Strachey (Calcutta: O. T. Cutter, 1865), 110. See also Baud, Forêt, and Gorshenina, La Haute-Asie telle qu’ils l’ont vue, 36.}

Indeed, Thomas Hutton remarked in 1837 that, even including Jacquemont, little follow up work had been done on Gerard’s discoveries in Spiti, positioning himself to be the one to do it. He argued that the Siwaliks had drawn the attention of metropolitan savants to the Himalaya more generally, and ‘at a time when the attention of the Scientific bodies of Europe, is turned to the valuable discoveries of our fossilists in the Sub-Himalayan ranges,’ this might be used to advantage for promoting ‘farther and more complete research’ on Spiti.\footnote{Thomas Hutton, ‘Read the Following Letter from Lieut. Thomas Hutton, 37th N.I. Dated Simla, 27th August, 1837’, Journal of the Asiatic Society of Bengal 6, part 2 (1837): 897–98.} Hutton’s reasoning was also couched in language playing up the fear of being scooped by foreign travellers, with particular reference to Jacquemont:

Subsequent to Dr. GERARD’s discovery,—and wholly dependent on that gentleman for his information,—M. JACQUEMONT I believe visited the valley of the Spiti,—but whether he succeeded in penetrating to the fossil locality, or was deterred by the rigours of the climate, is unknown. Shall we, however, allow the riches of our dominions to be brought to light and reaped by Foreign Societies? They send out travellers to glean in the cause of science, through every clime, while we alone, the richest nation of them all, sit idly by and watch their progress.\footnote{Hutton, 898.}

This was a relatively rare instance of explicitly national chauvinism around scientific practice in the Himalaya in this period, and indeed Hutton’s rhetoric was not necessarily representative.\footnote{Andrew Grout argues that ‘criticism of foreigners’ revolved around both economic concerns and the fear ‘that Britain was falling behind in international science.’ Grout, ‘Geology and India, 1770–1851’, 125–31. These incidents of chauvinism nevertheless seem rarer than Grout suggests, at least in the Himalaya (and are even less present in botany for example).} In the account of an earlier journey to the Burendo Pass, Hutton nevertheless also gone out of his way to cast aspersions on Jacquemont’s intentions, suggesting that to:

Some valuable discovery, made near the Gangtung Pass on the road from Dabling to Bekhur on the confines of Chinese Tartary, the hints dropped on his return, by the enterprising traveller M. JACQUEMONT, no doubt referred; why else, should he have evinced so much anxiety to prevent any European from visiting that quarter, until he should be able to make known his discovery to the French government and return under their auspices to avail himself of it?\footnote{Hutton, ‘Journal of a Trip to Burenda Pass in 1836’, 924.}
Hutton went on to speculate that gold being ‘the discovery hinted at, is neither impossible nor improbable. It is certain that none but the precious metals would have been worth the notice of the French government,’ though it is perhaps telling that there is little indication that the Chinese thought similarly about the supposed potential for precious metals.\textsuperscript{90}

In a footnote to Hutton’s article, the editor (probably James Prinsep) added the following commentary on Hutton’s attempt to keep any discoveries within the purview of British interests:

*“If an Englishman go thither, never mind;—but if a German or a French naturalist visit it,—give your guide a hint to walk him over the precipice”—was the expression, in badinage, of the enthusiastic traveller; certainly betokening that he had some curious discovery (probably of fossils) of which he would secure the first honors; and affording an amusing estimate of national curiosity.—Still is it not confirmed by the fact that no Englishman has since sifted the nature of JACQUEMONT’s interest in that spot? — Ed.\textsuperscript{91}

Whether or not the Asiatic Society took Hutton’s rhetoric seriously, his request to revisit Spiti to follow up on the discoveries of Gerard and Jacquemont was ultimately successful, and they voted 1000 Rupees towards his efforts, ‘on the conditions suggested by himself’ that the fossils he collected ‘be deposited in the Society’s Museum.’\textsuperscript{92} Hutton set out in 1838, but quickly had political troubles of his own to contend with: ‘I experienced the greatest difficulty in reaching the fossil ground owing to the want of supplies and the unwillingness of the Kiladar at Dunkur to allow me to proceed’ as ‘he had received instructions from Ludak to oppose my advance.’\textsuperscript{93} Hutton made violent threats and did eventually cajole his way to the fossil beds, but only managed to acquire a small and disappointing collection, ‘certainly not worth one quarter of the trouble they have occasioned.’\textsuperscript{94} Hutton thus found his agency limited in the ‘cultural borderlands’ of the high mountains, struggling to negotiate longstanding networks of labour and expertise. It is to these networks we now turn.

**Pre-existing networks, or, the many roles of Pati Ram**

Thomas Hutton, like James Gerard and Victor Jacquemont before him, relied heavily on Himalayan informants to locate his fossils. In fact, he even worked with the very same man as his predecessors: a Bhotiya trader from Sungnam known as ‘Puttee Ram,’ whose services had been indispensable to both

\textsuperscript{90} Hutton, 925.
\textsuperscript{91} Hutton, 924–25.
\textsuperscript{92} Hutton, ‘Read the Following Letter from Lieut. Thomas Hutton’, 898.
\textsuperscript{94} Hutton, ‘Extract of a Letter from Thomas Hutton, Soongum, 5 July 1838’, 668.
Gerard and Jacquemont during their time in Spiti.95 (As well as to Hutton, Jacquemont and James Gerard, Pati Ram also provided support to James Baillie Fraser in 1815, and Alexander Gerard in 1818 and again in 1821).96 The way Pati Ram cuts across and connects these fossil hunting expeditions, and his multiple roles as an informant, broker and guide are thus worth reflecting on at some length. Because Pati Ram had previously worked with multiple travellers, Thomas Hutton knew of his value well before he set out for the mountains (through both personal recommendations and references in published travelogues). Having arrived in Sungnam, a village which represented a key staging post for forays into the high mountains, Hutton recorded that:

Shortly afterwards the vuzee himself paid me a visit, and proved to be no less a person than the frank and honest Puttee Ram, the friend of Dr. Gerard, and the source from whence he derived much of his information regarding the higher portions of the hills towards Ladak and Chinese Tartary.97

This meeting occurred in 1838, and Hutton continued to record that Pati Ram was ‘now grey and bent with age’ but:

Entered at once into a history of his acquaintance with Dr. Gerard and Mr. Fraser, and talked with pride over the dangers he had encountered with the former in their rambles through Spiti and its neighbourhood. He asked me if I had ever heard his name before, and the old man's eyes actually sparkled with delight, when pointing to an account of one of Gerard’s trips, I told him his name was printed there.98

While this presents an arresting image of accounts circulating back into the mountains, such glimpses of Pati Ram through Hutton’s telling are undoubtedly highly romanticised. That his services were indispensable is unequivocal; what he really thought of his involvement in these Himalayan expeditions remains elusive. Pati Ram nevertheless emerges as one of the most visible brokers in the colonial archives of early Himalayan exploration, by virtue of both his relatively high status and because he assisted at least five separate explorers over six or more expeditions. Reconstructing Pati

95 ‘Puttee Ram’ was a title (in this context a ‘puttee’ also referred to a division of land), and he was also referred to as ‘the Puttee Ram.’ According to Alexander Gerard, he was an ‘intelligent Koonawuree’ and was ‘better known by Lahoureepung, the name of his house.’ Hutton spells Puttee with a double ‘t,’ Gerard with only one. Gerard, Account of Koonawur, 77. Jacquemont refers to him as ‘Pattiranme.’ See Jacquemont, Voyage Dans l’Inde, Vol 2, 265. Jacquemont described him thus: ‘un des habitants du village a étendu jusqu’à Delhi, Lahor et Cachemir ses petites opérations commerciales: il s'appelle Pattiranme. Il vint me voir avec le visir quand j’arrivai, car il devait partir le lendemain pour la Tartarie chinoise. Il a en Ranawer une plus grande renommée que M. Laffitte à Paris.’ For brief mentions, see Jahoda, Socio-Economic Organisation in a Border Area of Tibetan Culture, 93; 101; 108.

96 Fraser used the information he gleaned to produce a ‘Route given by Puttee Ram from Serān, in Bischur, to Gara, along the Course of the Sutlej.’ See Fraser, Journal of a Tour, 289–90; 299; 301–11. For Alexander Gerard’s interactions, see Lloyd and Gerard, Narrative of a Journey, Vol 2, 214; 216; 219; 225; 227–30; 233; 246; Gerard, Account of Koonawur, 77; 109; 111–14; 120; 137; 140; 149–50.


98 Hutton, ‘Journal of a Trip through Kunawur’, 1839, 935. Hutton suggested that Pati Ram ‘has not only been a great traveller through the upper hills, but has also visited Kurnal, Delhi, Hansi, and Hardwar.’
Ram’s multiple roles in expeditionary practice thus helps us think about Himalayan dependency differently, and in terms that invert traditional accounts of exploration, by placing him at the centre of a multi-generational network of travellers.

Recounting his own trip to the fossil beds of Spiti, Thomas Hutton described in detail the services that Pati Ram provided to the expedition:

From him I obtained a man who understood the Tartar language, to accompany me through Spiti, and he assured me I should experience no difficulties, as there was now a road across some parts of the mountains where, as in the days when Gerard first visited those parts, there was none at all.99

As well as providing access to interpreters and guides, Pati Ram thus also offered information about changes in travel conditions, helpfully showing that James Gerard’s travelogue – a key source of information for Hutton – was now outdated. Pati Ram also warned Hutton he was likely to be disappointed when it came to the collection of specimens:

He said that Spiti produced but few; chiefly ammonites (Salick ram) which were found near Dunkur, but that the best place to procure them was on the Gungtang pass, near Bekhur, but the Chinese were so jealous of strangers looking at their country, that if I went there I should not be allowed to bring any thing away. Besides this, the pass was at the present season impassable, and from the lateness and quantity of the snow which had fallen, it could not be open before the middle of August.100

In this instance, we see how Pati Ram provided information about the quality of the geologising, as well as seasonal information about the state of the route, and an update on the politics of the frontier (earlier he had supplied diplomatic assistance and letters of introduction to Alexander Gerard).101 In locating and recovering the Spiti fossils, Gerard, Jacquemont and Hutton thus relied on Pati Ram not only for his knowledge of Himalayan geography, but also for the networks he could help mobilise on their behalf.

While unavoidable, this reliance on local labour regimes nevertheless often resulted in tensions. In particular, difficulties recurred around transporting heavy geological specimens out of the

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99 Hutton, 935.
100 Hutton, 935–36.
101 Pati Ram’s services to the expeditions of Alexander Gerard were matched in importance only by their sheer variety. As well as answering ‘some questions relative to the physical geography of the interior,’ he provided diplomatic assistance, even if this was of limited use in accessing Tibet, and made some ‘intercessions for my friendly reception at the frontier.’ Lloyd and Gerard, Narrative of a Journey, Vol 2, 214; 216. Pati Ram also advised extensively on expeditionary practice, for example helping Gerard with winter attire as well as the problem of acquiring enough food for porters in the sparsely populated highlands: ‘it frequently happened that when a sufficient quantity of grain was collected, the scanty population could not furnish porters for the conveyance of half of it; I was, therefore, sometimes under the necessity of leaving several very useful articles behind. Before my journey to Speetee, I mentioned this circumstance to Putee Ram, (so often alluded to,) … Puttee Ram replied with his usual frankness, “This is my business;” and he left me. I did not under stand him, but, to my surprise, he soon afterwards returned with a large flock of sheep, and said, “I'll make you a real Tartar: you have grain for ten or twelve days, and now you have no use for porters; load the sheep with the grain, finish it first, and then kill and eat the sheep: this is the way we travel on the uninhabitable tracts; we never think of grain as long as we have plenty of sheep.”’ Gerard, Account of Koomawar, 149–50.
mountains. As Alexander Gerard complained, echoing concerns with transporting surveying instruments: ‘the carriage of the minerals upon men’s backs (most of them for 650 miles through the hills) also involved a great deal of expense, and limited my travels although my inclination for exploring the Himalaya was greatly increased [sic] much still remains to be done in the vast & interesting field of almost untrodden ground.’ These problems could go far beyond expense, however, and as Gerard recorded in his fieldbook while travelling in Kanawar: ‘the specimens picked up are numbered 86, but a great many were lost by the people throwing them away on their return to Camp.’ On another occasion, he similarly had to admit that ‘the minerals picked up on the way from Shulpeea were as far as I remember similar to those numbered 1&2, & there was some gneiss but the whole of them were thrown away by the guides.’ A bit of context explains, perhaps, why the guides were disinclined to haul Gerard’s lumps of rock out of the mountains: ‘travelling was rendered laborious from our sinking 1½ or 2 feet, the fissures were just beginning to appear [in the snow].’ Indeed, Gerard continued that: ‘we thought it prudent to order a speedy retreat, especially as the guides were greatly alarmed & strongly remonstrated against our proceeding farther as the snow would sink the whole way & we would certainly fall into some deep chasm.’ Given the very real possibility of vanishing into a crevasse, the heavy and seemingly arbitrary rock samples may not have seemed especially important to the guides. As in the previous chapter, such moments could thus be read as acts of resistance to sometimes deeply unpleasant labour conditions. Returning to Thomas Hutton, we find that he, too, had problems exerting his supposed authority as expedition leader, complaining about the disappearance of a set of horns he had obtained, and noting that ‘this theft however, was the least of the evil, for the rascally Tartar, thinking his load too heavy, had thrown away a number of valuable rock specimens also.’ In moments like this, the overlap of social and environmental factors compounded the difficulties of transporting specimens out of the mountains.

Such episodes also raise the question, however difficult to answer, of what the Bhotiyas, Kinnauras and Tartars thought of the laborious process of collecting rock specimens and hauling them

103 Alexander Gerard, ‘Remarks Regarding the Geological Specimens, Collected in 1821 by J.G. Gerard and A. Gerard,’ British Library, Mss. Eur. D137, f42. In the manuscript this remark is annotated in pencil with brackets and an ‘X,’ marking it for deletion.
104 Gerard, ‘Remarks Regarding the Geological Specimens,’ f48. This remark is also annotated in pencil with brackets and an ‘X.’
105 Gerard, ‘Remarks Regarding the Geological Specimens,’ f42-3. Gerard also noted the technological adaptation of Himalayan peoples, recording that ‘the guides sunk but seldom for they had shoes for the purpose of crossing snow beds, which were at least 5 or 6 inches in breadth; they told me that early in the morning before the sun had any power, it would bear the weight of a loaded person during the greater part of this month, although in May & June when the pass was most frequented it did not sink at any time of the day.’ Gerard, ‘Remarks Regarding the Geological Specimens,’ f41.
106 Gerard, ‘Remarks Regarding the Geological Specimens,’ f43.
to the lowlands. Edward Madden explicitly speculated on what his guides might have thought he was doing, stating that they were:

Very curious to know what the ‘Sahib-log’ did with the sacks and boxes of stones which they carry down to the plains with them! They must surely contain gold, silver, precious jewels, or very probably the Philosopher’s stone, in the reality of which they implicitly believe, may be amongst them!108

Here though, his report conveys little of or nothing of his guides’ actual perspectives, and is instead couched in a superstitious anecdote which Madden uses to assert his epistemological superiority. Other moments suggest more complex interactions, however, and Thomas Thomson had to report that of the specimens he had gathered while deputed to the ultimately farcical Tibetan Boundary Commission, most reached Calcutta safely in his possession but some, ‘despatched by what was considered an exceedingly safe opportunity; from Hanle to Simla’ though they ‘never reached the latter place they are supposed to have been plundered, on account of the ammonites (considered sacred by Hindoos) which they contained.’109 Here Thomson blamed the loss not on apathy, but rather on deliberate theft (given Richard Strachey’s plundering of shrines at around the same time, this comes across as rather ironic). Such episodes inadvertently reveal explorers’ sometimes fragile authority over their expeditions. Moreover, they further highlight the issues that could arise in ‘cultural borderlands’ over fossils which amounted to both scientific specimens and religious objects. Indeed, these remains formed the material foundations of overlapping – though as we will see in the next section, not always irreconcilable – cosmologies for explaining the origins of the mountains, and this meant tensions were inevitable.

Organic Remains and the Upheavement of the Mountains

Debates around the original locations of fossils, as well as illustrating the laboriousness of scientific practice, provide a window into contemporary discussions about mountain formation and how the

109 Thomas Thomson, ‘Notes on the Geological Structure of Western Tibet,’ British Library, IOR/F/4/2461/136806, f7. This boundary commission was intended to clear up lingering uncertainty as to where part of the frontier – between Gulab Singh’s Kashmir, recently established as a vassal state, and Tibet – actually was, even though the assumed border had served well enough for centuries. However, it ended up being a unilateral endeavour, wholly unsuccessful in its stated aims: ‘the stubborn jealousy of the Chinese refused to recognise our officers in the character of boundary commissioners and no deputation on their part was sent to meet them on our mutual border.’ Administrators in Calcutta were therefore forced to concede that the status quo was perhaps adequate and that the research had shown ‘that there is nothing which requires adjustment and that we may safely leave matters as they are under their present indefinite form without fear of aggression on either side,’ which was somewhat wryly noted, ‘was also the opinion of the Chinese, before the mission started.’ Lord Dalhousie to the Honorable Court of Directors, 31 July 1851, British Library, IOR/F/4/2461/136806, f3. The high frontier had long functioned without any need for scientific and instrumental fixing, and the way the British backed down reveals the ongoing limits of their mastery in the higher reaches of the mountains. See also Woodman, Himalayan Frontiers; Parshotam Mehra, An ‘Agreed’ Frontier: Ladakh and India’s Northernmost Borders, 1846-1947 (Delhi: Oxford University Press, 1992); Gardner, ‘Moving Watersheds’.
Himalaya fit into this unfolding global picture. Specimens of marine fossils like those from Spiti were important, while the bijli ki har were of arguably even greater interest, being of large animals. As Hugh Falconer explained, there must have been:

A great upheavement of the Himalayahs, extending to many thousand feet, and equal to the elevation of a tract which formerly bore a tropical fauna, up to a height which now causes a climate of nearly arctic severity. Remains of rhinoceros, antelope, hyena, horse, large ruminants, &c., [are] found at 16,000 feet above the sea.\footnote{Falconer, Palaeontological Memoirs, Vol 1, 28.}

As Falconer continued, the discovery of these remains at such altitudes was notable given the lack of vegetation and ‘polar’ climate, and ‘involves important considerations regarding the physical changes which must have taken place in this part of the Himalayahs since the Rhinoceros remains [see Fig. 3.1 above] were entombed in the stratum where they are now met with.’\footnote{Falconer, Vol 1, 173.} In other words, these animals could not survive in the present climate of the elevations their remains were found at, and this required explanation. The bijli ki har thus had to be accounted for in order to make the Himalaya into a coherent high mountain ‘type’ that could be compared globally, but their place in the overall picture was perplexing.

Underlying these debates were cosmologically charged questions over whether high-altitude fossils were explained by a deluge – whether merely ‘geological’ or literally ‘biblical’ – which had lifted the fossils to their present location, or whether these sites were in fact upraised former ocean beds. Either would explain the deposit of large mammals or marine remains around the world, even in the highest mountains like the Himalaya. Around the time of Herbert’s and Gerard’s geologising, a diluvial explanation was widely considered likely, even if the connection of this with a very recent biblical flood – most prominently by William Buckland in Reliquiae Diluvianæ (1823) – was no longer considered plausible by most.\footnote{Rudwick, Bursting the Limits of Time, 104–5; 115–19; 130–31; 600–602; 620–22; 637–38; Rudwick, Worlds Before Adam, 5, 14; 59–61; 80–87; 190–92; 193–98; 206–7; 346; 424–27; 435–36. Rudwick convincingly shows that the supposed schism between ‘geology and Genesis’ is often exaggerated, and that most geologists in this period practiced their science without undue conflict with either their peers or their own worldviews. See also Laudan, From Mineralogy to Geology, 38.} Others, including notably Georges Cuvier, took a more encompassing approach, pointing to multicultural stories of floods as evidence of a global event. This was echoed by Hugh Falconer who pointed to Hindu traditions of a deluge, such as the Noah-figure Manu recorded in the Puranas, while Joseph Hooker noted that his Lepcha guides from Sikkim also had ‘a traditionary deluge.’\footnote{Joseph Hooker to Francis Palgrave, 17 March 1849, Kew Archives, JDH/1/10, f139-140.} Indeed, whether through contemplation of material evidence or multicultural cosmologies, most thought by this time that any diluvial event – or ‘geological’ deluge –
must have occurred much earlier than that allowed in purely Biblical turns. In the Himalaya, European geology and Asian cosmology could thus sometimes both point to the same conclusion.

The Himalaya nevertheless offered a frequently bemusing comparative context, and those operating there seized on opportunities to highlight contradictory claims by savants in Europe. This is evident, for example, in James Gerard’s assessment of William Buckland’s relation between his famous Kirkdale Cave and fossils like the bijli ki har, as evidence for a recent, Biblical and universal deluge. As Buckland had put it in Reliquiae Diluvianae (1823):

The occurrence of these bones at such an enormous elevation in the regions of eternal snow, and consequently in a spot now unfrequented by such animals as the horse and deer, can, I think, be explained only by supposing them to be of antediluvian origin, and that the carcasses of the animals were drifted to their present place, and lodged in sand, by the diluvial waters.

However, as James Gerard argued, using his Himalayan vantage point to refute one of the most eminent savants in Europe:

Dr. Buckland, theorising from the system of European physics, drawing inferences from the phenomena of the Andes, and conclusions from the empirical formula; of schools, actually appealed to the lofty Himalaya for verification of the agent of those fossil remains which he found in the debris of the Kirkdale caves, because some petrified bones were alleged to have come from the back of Kylas (this word means the skies or heaven), at an estimated altitude of 16,000 feet, consequently, says Dr. Buckland, from the regions of eternal congelation, unvisited and unaccessible by man or animals, there fore the deposits of the flood. Had the Professor known nothing, or known more, he would have arrived at a more rational finale.

Among other errors, Gerard suggests that it was global comparisons with the Andes that has led the metropolitan savant astray, and does little to pull his punches. Indeed, Gerard continued in a similarly sarcastic vein that: ‘nobody, except very clever people, doubts the deluvian event; but if such futile and preposterous means are used to verify the fact, our credence may indeed be staggered. Dr. Buckland should keep to his caves and the mud, for the Himalaya are beyond the pale of his object.’

114 Chakrabarti and Sen, “‘The World Rests on the Back of a Tortoise’”, 10–15. Indeed, the short timescale of the earth implied by a literal reading of Genesis had by this time been, for the most part quietly, put aside. See Rudwick, Bursting the Limits of Time, 130.

115 Buckland, Reliquiae Diluvianae, 223.

116 [Gerard, James Gilbert], ‘The Himalaya Country’, 111. As Gerard put it elsewhere: ‘Professor Buckland... has ventured to appeal to the Himalayan granite peaks for corroboration of his systematic delusions, because some fossil bones, considered by Captain Webb to be human, were brought to him from the back of Kylas at an elevation of 16,000 feet (which according to Dr B) is a region buried in eternal snow and inaccessible to man and could only have been deposited there by the deluge, but these bones turned out to belong to the deer which frequent the highest spots like these.’ James Gerard to William Fraser, 21 January 1829, cited in P. J. Marczell, Alexander Csoma de Kőrös (Kolkata: Asiatic Society Monograph Series, 2007), Vol 2, p184. For the source of the original confusion, see Webb, ‘Extract of a Letter from Captain William Spencer Webb, 29th March, 1819’, 68.

By the 1830s, most Himalayan travellers and metropolitan geologists (and, it must be said, Buckland himself by 1836) had moved well beyond any correlation with the Biblical flood. However, some ‘Mosaic’ or ‘scriptural’ writers in India, as in Europe, continued to associate the Himalayan fossils with Genesis. Notable is Thomas Hutton, whose important collections of material fossils often had to be detached from controversial theorising. He argued, for example, that the mountains had been upheaved violently at the end of the deluge to their present height and that:

The fall of man is the true period to which the loss of the fossil marine Mollusca of the Spiti and Subathoo fields is to be referred … the increasing depravity of the human race, once more called down the vengeance of an offended God, and brought about the second and last grand revolution which the earth has experienced, namely, the Mosaic deluge.

Hutton’s views were nevertheless not widely shared, as his editor’s rather damning preface makes clear in having the ‘great pleasure in giving publicity to this paper, for the views contained in which the author is alone answerable.’ In instances like this, we see that divorcing important material specimens from superstitious accompanying explanations was not a process only applied to Asian cosmology.

That the Himalaya had been upheaved at some point in the past was thus no longer in any real doubt by the 1830s. However, the timescale on which this unfolded remained contested. Increasingly, it appeared to have occurred (relatively) recently in geological time. As Hugh Falconer continued:

‘there are unquestionable proofs on the southern side of the chain that important elevations have taken place within a very late period, geologically speaking’ and the equivalence of the fossils with existing species ‘would show the upheavement, beyond all question, to date, geologically speaking, since the commencement of the present order of things.’ Victor Jacquemont was largely in agreement: ‘my observations on the skirts of the Himalaya, along the plains of Hindostan, are quite confirmatory of my friend M. Elie de Beaumont’s views respecting the late period at which that mighty range sprung from the earth.’ Here he was applying the widely discussed theory extended by de Beaumont on the origins of mountain ranges, which argued that they came about through successive periods of violent crustal upheavement (revolutions), which he referred to as ‘epochs of elevation,’ separated by longer

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118 Buckland acknowledged the weight of evidence and repudiated any connection in his Bridgewater Treatise of 1836. See Rudwick, Worlds Before Adam, 427; 435–36.


120 Hutton, ‘Geological Report on the Valley of the Spiti’, 198. As the editor explained more fully, the paper was offered ‘in the belief that hardly any novel theory could be broached, which would be unproductive of good results, (if not by its intrinsic merits, at any rate by the consequence of the discussion it might excite).’

121 Falconer, Palaeontological Memoirs, Vol 1, 181.

122 Jacquemont, Letters from India, Vol 1, xxvi.
intervening periods of accumulation. Jacquemont nevertheless suggested, if in somewhat bombastic fashion, that this view was contentious in India. As he wrote to de Beaumont in 1830:

If M. Pentland has found in Peru some mountains higher than those of the Himalaya, I would not advise him to come to India; and as it is generally admitted that this mighty range, before which the Andes sink into inferiority, is the eldest-born of the creation… for your beautiful work on the relative age of the elevation of mountains… will in India be considered a personal insult by the geologists of Calcutta, their wives, their children, and their children’s dolls. At Bombay I shall take care not to say I am a friend of yours… to touch the antiquity of the Himalaya is no less a sacrilege in India.

Here Jacquemont, tongue-rather-firmly-in-check, points to ongoing rivalry in global comparison (while also rhetorically provincialising Calcutta as a site of science). Such ridicule was nevertheless both indicative of and complicated by the way that the elevational superiority of particular mountain peaks and ranges, much as universal theories of their upheavement, were prone to dramatic revision in this period.

Just as the timescale for upheavement was debated, so too was the mechanism, and by the 1840s this reflected the broader geological debate often simplified as ‘catastrophism vs uniformitarianism.’ This amounted to the question of whether changes in the earth’s surface (such as the elevation of mountain ranges) was the result of sudden violent revolutions, perhaps involving megaearthquakes or megatsunamis unexperienced in human history, or whether ‘actual’ or observed causes were adequate to explain gradual changes over a long timeframe. Either explanation had to account for mountains as stupendously elevated as the Himalaya. At the mid-century, Richard Strachey was hedging his bets: ‘in the present state of our knowledge but little evidence could be adduced as to the degree of rapidity with which all these changes have taken place,’ but went on to echo de Beaumont: ‘I shall only express my own opinion, that though the great regularity of structure and comparative uniformity of upheavement seem to show that the general movement has been quite gradual, yet that there have certainly been well marked epochs of special activity.’ Writing around the same time, Thomas Thomson drew on his experience with the boundary commission and was more willing to take a stand, coming down on the side of Charles Lyell’s eventually ascendant ‘uniformitarian’ argument: ‘the conclusion has been forced upon me that these mountains have emerged extremely gradually from an ocean.’

Even at the mid-century, fuller answers to these questions thus continued to be circumscribed by frontiers, both social and geographical.

127 Thomson, *Western Himalaya and Tibet*, 27.
Glaciers, global comparison and Himalayan oral traditions

In 1847, Richard Strachey prefaced an account of ‘two most decided Glaciers, which I have just visited’ with the perhaps exaggerated claim that a description might be interesting given ‘the existence of Glaciers* in the Himalayas . . . [is] apparently still considered a matter of doubt by the Natural Philosophers of Europe.’ As he continued:

In all parts of the mountains covered by perpetual snow glaciers abound, and some of them are of great magnitude. The fact that until within the last few years their existence in the Himalaya was doubted, shows, in a manner that needs no comment, what sort of examination this country, perhaps the most remarkable in the world, has received during more than thirty years of British rule.

Here the uncertainties around glaciers were effectively a reverse of those around volcanoes. As well as making a political point about the limited resources available in displaced locations, Strachey also tried to offer a scientific explanation. Indeed, he pointed to confusion around the line of perpetual snow (see also Chapter 5) and suggested complications arose ‘from the circumstances of our older surveyors not having a distinct idea of what glaciers were, in consequence of which they invariably talk of them as great snow-beds.’ In particular, Strachey singled out William Webb and John Hodgson, noting: ‘neither of them knew what a glacier was. Capt. Webb, as we have seen, talks of the Gori emerging from the snow, when we know that in reality it rises from a glacier. Capt. Hodgson falls into a similar error in his description of the source of the Ganges.’ Strachey went on to cast doubt on the observations of the Gerard brothers, ultimately suggesting that credit should go to botanist Edward Madden for ‘having first removed all doubts on the subject.’ Indicative of how rapidly understandings of the mountains shifted across this period, by the mid-century that there had ever been doubt was met with incredulity in some quarters. As Joseph Hooker wrote to Charles Darwin in 1848: ‘Why glaciers were denied to the Himal. I cannot conceive, nor any one else, there are plenty.

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131 Strachey, ‘On the Snow Line in the Himalaya’, 297. Elsewhere Thomas Thomson noted that ‘In the Map No. 65 of the Survey of the Western Himalaya, by Captains Hodgson and Herbert, the glacier of Gangutri is marked “Great snow-bed or glacier;” but whether this indication of a knowledge of the true nature of the mass is due to the surveyors or to the maker of the map in England, I have no means at present of ascertaining.’ Thomson, *Western Himalaya and Tibet*, 476. Thomas Hutton thought Strachey was being disingenuous in his assessment of his predecessors, and particularly criticised him for not having visited many of the places he was writing about. See Thomas Hutton, ‘Remarks on the Snow Line in the Himalaya’, *Journal of the Asiatic Society of Bengal* 18, part 2 (1849): 954–55.
133 Hooker to Charles Darwin, 13 October 1848, Kew Archives, JDH/1/10/112-114.
Even once dispatched, these existential doubts were followed by questions over whether glaciers in the Himalaya presented exactly the same phenomenon as that which had recently been observed in Europe, especially in the Alps. Edward Madden, as Richard Strachey was at pains to point out, not only ‘prominently directed attention to the fact of the existence of glaciers in these mountains’ he also noted they were ‘in all points identical with those of the Alps.’*1134 Madden had travelled and botanised extensively in the Himalaya, and on his return from India was able to visit the Alps personally.135 Victor Jacquemont, meanwhile, was one of the very few Himalayan travellers in this period to make personal observations the other way around; that is, he had seen the glaciers of the Alps first, before venturing into the Himalaya. In comparing, he remarked that Himalayan glaciers were found higher and not always where he expected based on his experiences in Europe. Describing the region around Jumnotri, he noted that: ‘L’épaisseur de ces neiges est de plus de 12 m en certains lieux. J’ignore si l’été les fond entièrement. Dans les Alpes, à une élévation bien moindre, elles formeraient un glacier.’1136

A decade or so later, Thomas Thomson expanded on these investigations into the universality of glaciers, noting that ‘the general appearance of an Indian glacier seems in every respect to accord with those of Switzerland and of other parts of the temperate zone.’1137 Thomson also suggested that if confusions had arisen, then this was excusable because glaciers and their appearance and motion were only relatively recently understood anywhere, let alone in the remote peripheries of India.138 While acknowledging a fundamental equivalency, he nevertheless went on to indicate there were some differences in situation when compared globally:

In every part of the Himalaya, and of Western Tibet, wherever the mountains attain a sufficient elevation to be covered with perpetual snow, glaciers are to be found . . . it may be laid down as a general law, that every glacier has its origin in perpetual snow. The converse of this proposition does not seem to be so universal. We have the high authority of Humboldt for the fact, that no glaciers occur in the Andes of tropical America, from the equator to 19° north latitude.139

In concluding, Thomson also suggested that the latitude of the Himalaya meant that expectations skewed thinking on the discovery of glaciers: ‘it has also, singularly enough, long been the custom to

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1135 Madden, ‘Notes of an Excursion to the Pindree Glacier’, 257–58.
1136 Jacquemont, Voyage Dans l’Inde, Vol 2, 88. [‘The thickness of the snow is more than 12 metres in some places. I do not know if it melts entirely in summer. In the Alps, at a much lower elevation, it would form a glacier.’]
1137 Thomson, Western Himalaya and Tibet, 475.
138 Thomson, 475.
139 Thomson, 474.
look upon the Himalaya as a tropical range of mountains, in which it was, as a matter of course, regarded as impossible that glaciers could exist.\textsuperscript{140}

While demonstrating ‘that these phenomena exist in the Himalaya, under forms apparently identical with those observed in the Alps,’ Richard Strachey noted the caveat that ‘as these are the first Glaciers that I have ever seen, it is right to add, that I am only acquainted with those of the Alps, through the medium of Professor Forbes’s accounts, and that as I lay no claim to originality.’\textsuperscript{141} In these displaced locations, global comparisons often occurred through a limited lens – or at least surveyors insisted as much to excuse failings. Strachey also blamed the topography and politics for circumscribing his observations: ‘to guard against mistakes I would also mention, that these Glaciers were selected for examination only on account of their accessibility, and that consequently no inferences should be drawn from them, of the general extent of Glaciers in the Himalaya.’\textsuperscript{142} In making comparisons between European and Himalayan glaciers, he laid out his findings in the form of charts, such as that seen in Fig. 3.4:

![Comparison of glaciers of the Alps and in the Himalaya. From the proofs of Richard Strachey’s unpublished ‘Physical geography of the Himalaya’ (c.1851). He noted that ‘the annexed woodcut … will convey an idea of the size of the Gori and Vishnuganga glaciers, of which we have rough plans, as compared to some of the best known glaciers of the Alps.’\textsuperscript{143} Courtesy of The Society of Authors as agents of the Strachey Trust.]

\textsuperscript{140}Thomson, 475–76.
\textsuperscript{141}Strachey, ‘A Description of the Glaciers’, 795. Hooker concurred that his ‘notes, made previous to reading Professor Forbes’s travels in the Alps, sufficiently show that perpetual snow, whether as ice or glacier, obeys the same laws in India as in Europe.’ Hooker, \textit{Himalayan Journals}, Vol 2, 134.
\textsuperscript{142}Strachey, ‘A Description of the Glaciers’, 795.
In elaborating on these images, Strachey wrote that ‘the glaciers of the valley of Chamonix are not by any means the largest in Switzerland’ but ‘the valley of Chamonix is so well known, that the comparison with its glaciers will probably be more appreciated.’\textsuperscript{144} Such compromises reflected a need to make his comparisons intelligible to as wide an audience as possible, and why well-known mountains like Mont Blanc or Snowdon were so often used as a touchstones.

As well as observing and comparing glaciers, Strachey also conducted the most extensive experiments in this period to measure their motion in the Himalaya, as seen in Fig. 3.5:

![Fig. 3.5: ‘Glacier of the Pindar [Pindari], 12,000 Feet.’](image)

Richard Strachey is here depicted as an intrepid observer, surveying the glacier with a theodolite. However, his camp and assistants are also visible, inadvertently revealing some of the labour requirements of the expedition. Courtesy of The Society of Authors as agents of the Strachey Trust.

Strachey described his efforts extensively, noting that he returned to the glacier in 1848 ‘chiefly with the intention of making an accurate measurement of its motion.’\textsuperscript{146} He described these operations in detail in a ‘Note on the Motion of the Glacier’:

A stake was driven into the moraine, at its highest point, close to the rock on the line between the two crosses, and a Theodolite was set up over it. Five other marks were also made on the glacier, at intervals along the same line, by fixing stakes in holes driven in the ice with a jumper … on the following day the Theodolite was again set up on the same place as before, and being properly adjusted… the distance between the centre of the stick and

\textsuperscript{144} Strachey, 411.
\textsuperscript{146} Richard Strachey, ‘Note on the Motion of the Glacier of the Pindar in Kumaon’, \textit{Journal of the Asiatic Society of Bengal} 17, part 2 (1848): 203.
that of the fixed mark was then measured, which evidently showed the downward progress of the ice at that point of the glacier since the marks was made the day before.\(^{147}\)

The sketches and calculations Strachey made can also be seen in his notebook (Fig. 3.6):

![Fig. 3.6. A page from Richard Strachey’s notebook, showing a sketch of Pindari Glacier and calculations relating to its motion.](-)

Strachey went on to summarise his measurements by showing that while Himalayan glaciers were relatively slow moving, ‘these rates do not differ in an important degree from those commonly observed in the summer months on glaciers in the Alps, which lie between 9 and 27 inches in 24 hours.’\(^{149}\)

As is tacitly apparent in Strachey’s descriptions and depictions of his measuring process, these observations were heavily dependent on local labour. But these relationships also went beyond mere muscle, to include the provision of critical knowledge. Whatever the uncertainties among European surveyors and administrators, Himalayan people had long understood the nature of glaciers. Indeed, Richard Strachey’s brother Henry noted that:

> Glaciers are well known to the Tibetans under the name of Kangri, i.e. Iceberg, which is also loosely used to denote any high mountain covered with perpetual snow or nevée … [but] their true character is sufficiently attested by the Tibetan inhabitants, who (incurious as they

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\(^{147}\) Strachey, 203.


\(^{149}\) Strachey, ‘Narrative of a Journey’, 156.
generally are in such matters) have observed their progressive motion and éboulement, as evidenced by fragments of ice falling to the foot of the mountain.\textsuperscript{150}

As Henry Strachey continued, this was not only true for the Tibetans, and: ‘these glaciers are well known to the Bhotias, under the term Gal.'\textsuperscript{151} Himalayan peoples were thus crucial for locating glaciers, much as they had been for fossils. For example, on visiting the Pindari Glacier in 1846, Edward Madden wrote that ‘we were accompanied here from Khathee by Ram Singh, the accredited guide to the glacier.'\textsuperscript{152} But guides like Singh provided not only knowledge of routes and safe travel practices, they also gave access to Himalayan oral traditions which were used to map changes in glaciers over time. Information about changing routes of trade and pilgrimage through the mountains made it clear that glaciers were not static, even in the short term. This knowledge could also be used to consider change over multiple generations. As Edward Madden recorded elsewhere: ‘the Bhotials of Milum affirm that their glacier has receded from the village two or three miles to its present site, and Ramsingh assured me that the same is true, in a less degree, at Pinduree.'\textsuperscript{153} In a similar case, Joseph Alexander Weller, at the time Junior Assistant Commissioner of Kumaon, relied on his guides Nagu and Dhun Singh while investigating the Gori Glacier on a shooting expedition. He recorded that ‘Nagoo Boorha tells me, that his father (who lived to 98 years) remembered the source of the Goreen nearly opposite Milum, and Nagoo himself has seen the recession of the snow-bed some 3 or 400 yards in the course of 40 years.'\textsuperscript{154}

To European naturalists, much as to Ram Singh or Nagu Burha, it was readily apparent that the extent of the glaciers of the Himalaya had changed considerably, even if the cause remained debated. As Richard Strachey wrote, ‘in Kumaon the shepherds … have no idea of any actual motion in the whole bulk of the glacier, though they everywhere suppose the ends of them to be gradually receding.'\textsuperscript{155} He considered this information to be of uneven quality and ‘very vague':

\begin{quote}
But in the case of the glacier of the Gori, the termination of which is within a mile of the village of Milum, these stories of the gradual decrease of the glaciers become more trustworthy, and the people point out certain places to which the ice was known to have extended in their fathers’ time, and there is every reason to think their statements correct.\textsuperscript{156}
\end{quote}

Strachey went on to place these concerns in global context, comparing evidence from the Himalaya with theories from the Alps, which suggested that ‘here too there has been a period of cold, a glacial

\textsuperscript{150} Strachey, ‘Physical Geography of Western Tibet’, 52.


\textsuperscript{152} Madden, ‘Notes of an Excursion to the Pindree Glacier’, 249. He descried Singh as ‘an athletic mountaineer of Soopee, with the limbs of Hercules and the head of Socrates, but scarcely his honesty: this last quality having been perhaps sullied by a three years’ abode at Almorah; we found him however, with some disposition to make the best of them, very useful in our subsequent difficulties, and ultimately parted well pleased with each other.’

\textsuperscript{153} Madden, 258.

\textsuperscript{154} Cited in Manson, ‘Capt. Manson’s Journal’, 1166.


\textsuperscript{156} Strachey, f245.
epoch, similar to that now generally admitted to have occurred over the area of Europe,’ even while acknowledging that a fuller determination of this was beyond his resources.\textsuperscript{157}

**Conclusion**

This chapter has examined the way political frontiers, topographical barriers and ‘cultural borderlands’ circumscribed the everyday practice of Himalayan geology in the first half of the nineteenth century. It has demonstrated that political boundaries limited access to important fossils, and required turning to existing networks to obtain key specimens (especially from Tibet). However, it has also shown that acquiring bijli ki har and shaligrams in this fashion, and forcing them to answer to European science rather than Asian religion, was a fraught process. In particular, it has illustrated how these networks exacerbated the existing problem of a lack of in situ observations, whether as a result of recalcitrance on political frontiers or the topographically unreachable and ice-entombed summits of mountains. Indeed, without being securely locatable on the vertical globe, specimens acquired via bazaars and brokers had only limited ability to answer what were increasingly pressing questions about universal deluges and the upheavement of mountain ranges. In tracing existing networks that circulated ritual objects from the uplands to the lowlands, this chapter has demonstrated that operating in ‘cultural borderlands’ meant Asian cosmology could inflect scientific practice in this period, as theories rose and fell in geology with dizzying regularity. Such rapid changes in understandings of the earth were not always easy to assimilate and engage with in remote locations, which were slow to receive up-to-date journals and books. That said, limited training and resources did not stop contradictions – especially those that emerged through global comparison – from being seized on and exploited by surveyors in the mountains (whether for authority, or in demands for additional resources).

Ultimately, this chapter has demonstrated that compounding limits to geological practice meant that volcanoes could be speculated into existence, and that the enormous masses of moving ice that constituted glaciers could be doubted. More broadly, it has contributed to the overall claims of the thesis by emphasising the material dimension of the mountains, and the extraordinarily laborious nature of scientific practice in this period. Making glaciers knowable, and fossils move, so that they could be compared globally required engagement with pre-existing networks (of both muscular power and multigenerational expertise), and this dependency only exacerbated existing challenges to imperial mastery. In considering the way agency could be subverted and resisted in ‘cultural borderlands,’ this chapter thus demonstrates that as much as the history of Himalayan geology cannot be told without the names Richard Strachey, Thomas Hutton, and Victor Jacquemont, it also cannot be written while omitting the names Pati Ram, Nagu Burha and Ram Singh. As we will see in the next

\textsuperscript{157} Strachey, f244.
and penultimate chapter, similar questions of labour and expertise run through the story of the founding of the botanical gardens at Saharanpur and Mussoorie, and understandings of their ambiguous positions on the vertical globe between highlands and lowlands.
In the descriptions she revised to accompany George Francis White’s *Views in India* (1838), English travel writer Emma Roberts (c.1794–1840) wrote that: ‘the city of Saharanpore is of very ancient date, but possesses few or no remains of interest … with the exception of the botanical garden, which forms, indeed, its principal attraction.’1 Roberts went on to note that before being appropriated by the East India Company as a scientific establishment in 1817, the Saharanpur garden had a precolonial history, and ‘common report states, that this useful and ornamental work owes its existence to the family of Zahita Khan, a former chief,’ though she hastened to add that ‘it must have undergone great changes since its early formation [which] … render it truly English in its aspect.’2 Roberts also remarked that ‘though not so great a pet of the government as the Calcutta establishment, the garden at Saharanpore is kept in excellent order, the most being made of the comparatively small sum allowed for its maintenance,’ in this last hinting at the limited resources available to those operating in displaced locations.3 When it came to engaging with the Himalayan mountains in the early decades of the nineteenth century, the limitations of the East India Company’s flagship garden at Calcutta, with its tropical climate and vast distance from the Himalaya, were nevertheless readily apparent. If the EIC – or rather, an eclectic cast of its servants – were to exploit the botanical opportunities offered by expanding frontiers in the mountains, then they quickly realised they would need a ‘northern’ garden to do so.4 In this period, Saharanpur thus became the interface – if unevenly and at times haphazardly – between the hugely diverse and potentially highly valuable botany of the Himalaya and the rest of the globe.

Long in the shadow of the Calcutta Botanic Garden in both contemporary and modern scholarship, the garden at Saharanpur played a central role in the early scientific and imaginative

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1 White, *Views in India*, 20. Emma Roberts, one of the most prolific travel writers in nineteenth century India, rewrote and greatly expanded the original text which White had composed to accompany his images. She did so based on ‘descriptions drawn from the notes of several tourists, and her own experience of Indian life.’ See ‘Lieutenant White’s Views in India, Edited by Emma Roberts’, *The Spectator*, 16 December 1837. These additions were so extensive that throughout this chapter I refer to Roberts as the author rather than White.
2 White, *Views in India*, 20.
3 White, 20.
appropriation of the Himalaya. However, while eminently suitable for growing a different set of plants to the Calcutta garden, at only a thousand feet of elevation Saharanpur was never sufficiently temperate nor ‘mountainous’ enough in its own right to extract all the botanical riches the Himalaya seemed to offer. As Roberts continued, ‘Saharunpore may be called the threshold of the hill districts’ but ‘the plants are generally cultivated in the first instance at Mussooree, a station in the hills, and the experiments made at Saharanpore.’ 5 Established in 1826 at an elevation of 6500 feet, the ‘experimental nursery in the hills’ at Mussoorie had a symbiotic relationship with Saharanpur. Each garden compensated for the other’s seasonal variations in temperature, allowing them to encompass the flora of the mountains, and indeed much of the globe. The development of these two gardens, envisioned in terms of vertical biogeography, is the subject of this chapter. In what follows, I demonstrate that their complementary positions on the vertical globe were essential to understanding the mountains through their botany. However, I also show that the location of these gardens on the vertical globe was ambiguous, and that they represented liminal spaces between the uplands and lowlands, sometimes awkwardly combining characteristics of both.

As we have seen in previous chapters, growing recognition of the commensurability of mountain environments saw the necessity of reframing scientific phenomena in three dimensions, and this was never truer than in the case of plants. Mountains and botany were increasingly interconnected, both conceptually and practically. For example, John Forbes Royle, who became the second superintendent of Saharanpur in 1823, argued that:

As mountains situated in hot countries embrace every variety of climate, they are capable of producing the plants of both temperate and polar regions. To succeed in the cultivation, therefore, of the plants of any particular country, it is first requisite to determine the height to which it is necessary to ascend a mountain, to obtain a similar climate. 6

The recognition that the Himalaya were, by some margin, the highest mountains in the world gave them elevated importance in understanding the geographical distribution of plants in the vertical realm. This chapter and the next tell this story. The current chapter addresses practices around the acclimatisation of botanical specimens, the role of Asian gardeners and collectors, and the institutional challenges in operating from ‘mountain’ gardens with limited resources, displaced from both Calcutta and London. By focusing on institutions rather than itinerant expeditions, this chapter broadens and adds another dimension to the key themes of the thesis; that is, the necessity of further decentring the spaces of scientific practice, paying closer attention to everyday relationships between Europeans and Asians in scientific knowledge-making, and tracing the way the Himalaya were co-constituted with the

5 White, Views in India, 21.
vertical globe, especially through comparison with the Alps and the Andes. The next and final chapter then deals with questions of vertical biogeography and the imagining and tracing of elevational limits. Together, these two chapters thus tell the story of the making of the mountains through botanical appropriation and an often-laborious process of global comparison.

If the mountains remained largely ‘blank space’ for European science at the turn of the nineteenth century, the excitement around their botanical potential was becoming palpable. As Scottish surgeon, and the first superintendent of the Saharanpur Garden, George Govan wrote, it was in ‘vain to attempt describing the enthusiasm and delight experienced by the admirers of nature on first entering these districts with the invading army’ during the Anglo-Gurkha War beginning in 1814. Indeed, botanical knowledge and military expansion were integrated, as the EIC’s acquisition of Kumaon and Garhwal meant naturalists gained more reliable access to a much higher altitudinal cross-section of the Himalaya. Even where the mountain frontiers remained closed to Europeans — such as in the newly diminished but still staunchly independent kingdom of Nepal — Asian plant collectors were deployed to bring back plants and seeds of all kinds. However, as we saw in the previous chapter, specimens obtained in this way brought about particular challenges for knowledge production, having not been observed in situ, and are why this chapter follows a diverse cast of European and Asian botanical actors. Indeed, while following the first three East India Company superintendents at the Saharanpur Garden — George Govan, John Forbes Royle and Hugh Falconer — I simultaneously demonstrate that scientific practice at Saharanpur and Mussoorie was always, to a greater or lesser extent, a cross-cultural, negotiated affair. As we saw in Emma Roberts’s description, Saharanpur had a precolonial history, and more important even than the carryover of infrastructure, the legacy of this older garden was embodied in the transfer of personnel; most notably, Hari Singh, who was employed as head gardener by both iterations. The hill nursery at Mussoorie, meanwhile, however much it was intended to advance European scientific and imperial ends, was often left entirely in the hands of Asian gardeners. Reflecting the sheer scale of these contributions in both labour and expertise, I focus in this chapter on the eclectic and heterogenous networks of — usually silenced and unnamed — plant collectors, bazaar druggists, gardeners and artists who were fundamental to the operation of European botanical sciences in and of the Himalaya. As in previous chapters, by focusing on practical engagements between Europeans and Asians in remote locations as much as questions of epistemology and ontology, I aim to demonstrate the role of everyday sociability in the scientific and imaginative constitution of the mountains.

After a presentation that John Forbes Royle gave to the Asiatic Society in Calcutta in 1832, a member of the audience shared the ‘pleasure and surprize of finding in the Botanic Garden, at

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7 Govan, ‘On the Natural History and Physical Geography’, 19.
Saháranpúr, the English daisy, looking up from the plain of India to the lofty snows of the Himalaya.\(^8\)

Of course, British interest in the mountains, botanical and otherwise, was never this whimsical, naïve or innocent. The foundational purpose of Saharanpur, as with the numerous colonial gardens that dotted the globe by the early nineteenth century, was both implicitly and explicitly imperial, and its maintenance was couched in the language of utility, ‘improvement’ and empire.\(^9\) This included the avoidance of famine (a legacy of widespread recent disasters in Bengal), but also the production of medicines and materials like fibres and timber (the latter often explicitly intended for naval ends), as well as staples and luxury foodstuffs, and even ornamental garden plants, which had an increasingly valuable market in both India and Europe.\(^10\) Perhaps no plant was more famously experimented with than *camellia*, or the tea plant, with which Royle, as well as Saharanpur’s third and fourth superintendents – Hugh Falconer and fellow Scotsman William Jameson (1815–1882) – were all enthusiastically involved. Indeed, Saharanpur was pivotal to the introduction and ultimate success of Chinese tea in India, though this now well-known story (if the role of Saharanpur perhaps less so) is not my focus in this chapter.\(^11\) As well as commerce, the rhetoric of military utility was prevalent in justifying expenditures on the garden. Royle, for example, sometimes emphasised that Saharanpur had imperial and strategic dimensions, downplaying his own more abstract interest in scientific botany. As he argued, the garden was ‘admirably adapted for enabling an observer to obtain a knowledge of the Flora of the plains of Northern India, as well as of the Himalayan Mountains,’ all ‘within thirty miles of the commencement of the successive ranges which form that great barrier between the dominions of the British and the territories of the Chinese.’\(^12\) The result was that sometimes irreconcilable

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\(^8\) “Proceedings of Societies - Asiatic Society, Wednesday, 7 March 1832,” *Journal of the Asiatic Society of Bengal* 1 (1832): 117.


\(^10\) For famines in Bengal see Vinita Damodaran, ‘The East India Company, Famine and Ecological Conditions in Eighteenth-Century Bengal’, in *The East India Company and the Natural World*, ed. Vinita Damodaran, Anna Winterbottom, and Alan Lester (Basingstoke: Palgrave Macmillan, 2015), 80–101. The list of potentially valuable and useful species that the Saharanpur superintendents mooted or trialled was wide and encompassing. In terms of Himalayan species, medicinal plants like rhubarb and ginseng were prominent, as were materials like cedar and hemp, and spices like saffron. Attempted introductions via global interchange included medicines, most notably (if initially unsuccessfully) cinchona, as well as food staples like rice, maize, and potatoes, and other valuable cash crops like cotton, sugar, tobacco and coffee. For these and more, see Royle, *Illustrations*; John Forbes Royle, *Essay on the Productive Resources of India* (London: W.H. Allen & Co., 1840).


\(^12\) Royle, *Illustrations*, Vol 1, 1. In a report on Saharanpur and the botany of the Himalaya, John Lindley remarked that: ‘of course there is an abundance of plants of no beauty nor of any known use, all which should be omitted as
tensions which could emerge between prioritising the acquisition and acclimatisation of commercially, scientifically, medically and ornamentally interesting plants, all of which nevertheless shaped emerging perceptions of the distinction between uplands and lowlands.

The historiography of colonial botanic gardens, and especially their entangled and sometimes insidious relationships to empire, has borne much fruit in recent years. It is not my intention in this chapter to recapitulate the now well-trodden historical ground around ‘colonial’ science and the development of Indian botany or, except where necessary, to detail the circulation of specimens to Europe.13 Examining the role of Saharanpur and Mussoorie in the constitution of the Himalayan mountains and the vertical globe is nevertheless only possible by building on the excellent previous scholarship on colonial gardens, in particular Calcutta.14 Both the city of Calcutta and its botanic garden have been read as ‘centres of calculation’ in a Latourian mould, as well as ‘contact zones’.15 Given its prominence in global botany, it is perhaps unsurprising that a majority of scholarly attention on Indian gardens has been directed towards Calcutta. However, this also highlights the historiographical and archival draw of ‘centres in the periphery,’ which while successfully making important reorientations away from the metropole, have also had the unfortunate side effect of obscuring other important sites and spaces of scientific practice in India. Eugenia Herbert touches on this issue, noting that ‘with the exception of Saharanpur, a former Mughal garden, these [gardens] were colonial creations in the capitals of the three presidencies’ and argues that ‘Calcutta remained to Indian gardens what Kew was to the empire as a whole.’16 While arguably true, this is nevertheless only part of the story. By privileging ‘centres in the periphery’ in our histories, we ultimately risk replicating diffusionist, metropole-centric histories of ‘colonial’ science.
In thinking about Saharanpur and Mussoorie, a useful counter-approach emerges from the work of Sujit Sivasundaram who, in his study of the Peradeniya garden in Sri Lanka, argues that ‘it looks different if we have Peradeniya in central focus rather than Kew. The fragility of Kew’s reach is more apparent … by looking at the island and from the island, it is possible to take locality seriously in the history of science on the global stage.’ Following from this, if we take the mountains from the mountains, things also look different, especially when we examine Saharanpur as removed from both Calcutta and Kew, and Mussoorie at another remove again. Writing in 1825, John Forbes Royle remarked that Saharanpur had been envisioned ‘as a collateral branch of the institution at Calcutta,’ though it remained in many ways independent. Of course, the garden operated as something of a scientific centre in its own right. This was not limited to botany, and Saharanpur became, if briefly, a staging ground for operations in the high mountains, and a clearing house for geological, zoological and palaeontological specimens (not least the extraordinary fossils from the nearby Siwalik Hills), as well as a station for long-term meteorological observations, and a key node in the early trigonometrical survey operations into the mountains. Studying Saharanpur nevertheless offers the opportunity to further decentre the spaces of scientific practice by considering the resources available to those at another level of displacement from London than Calcutta (and Mussoorie as displaced even further). As we move from London to Calcutta, Calcutta to Saharanpur, and Saharanpur to Mussoorie – closer to the mountains and higher up the vertical globe – scientific practice begins to look different (or at least, those operating there insisted that it looked different). In examining these differences – often expressed in terms of limited resources, time and distance – it is thus important to consider not only circulatory successes, but also the many ways that these networks could fail and become confused. Across the period of this study, we will see that the Saharanpur superintendents sometimes – intentionally or otherwise – exaggerated the botanical possibilities of the plants they extracted from the Himalaya, and overestimated their ability to circulate them. Emphasising Saharanpur’s disconnect from Calcutta, let alone London, I argue that for remote institutions like Saharanpur and Mussoorie –

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17 Sivasundaram, ‘Islanded: Natural History in the British Colonization of Ceylon’, 143. Elsewhere, he discusses the growing of ‘European’ fruits at Peradeniya and shows how ‘this program of experimentation bears out emerging British senses of the scientific difference between the highlands and the lowlands, in accord with the increasing popularity of biogeography.’ He goes on to demonstrate that the colonial actors categorised Peradeniya as ‘intermediate’ and ‘in this way the highlands were themselves fragmented into zones.’ Sivasundaram, Islanded: Britain, Sri Lanka, and the Bounds of an Indian Ocean Colony, 182. This process, only writ on a much grander scale, also played out in the Himalaya.

18 Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f150. Initially, as established under Govan the garden was independent of Calcutta (although Govan was expected to co-operate with Nathaniel Wallich). However, following Govan, it took on officially subordinate status, even if this did not always translate into practice. See H. Montgomery Hyde, ‘Dr. George Govan and the Saharanpur Botanical Gardens’, Journal of the Royal Central Asian Society 49, no. 1 (1962): 52.

as much as for expeditions in the high mountains – we need to pay particular attention to the moments when things did not travel, and practices broke down.

Historical scholarship on the Saharanpur and Mussoorie gardens is substantially more limited than it is for the EIC’s garden at Calcutta. H. Montgomery Hyde’s early 1960s biographical article on George Govan, which also details Saharanpur’s founding, remains the most substantial piece of scholarship for the early days of the garden. David Arnold, as part of his broader work on landscape and tropicalisation in India, is nevertheless right to argue that ‘Saharanpur, a thousand miles to the northwest [of Calcutta], had an equally important role in the development of India’s botany and in the increasing delineation of its tropical, as opposed to temperate, climatic zones and flora’ even if he does not go on to make a sustained examination of the garden. Historiographical lacuna notwithstanding, this chapter is not intended as a comprehensive history of Saharanpur and Mussoorie. Instead, what follows is the story of the ‘northern’ gardens roles in the making of the Himalaya in European scientific and imperial imaginations. We begin with the geography of Saharanpur and the modification of the existing garden for the purposes of scientific botany. We then turn to consider debates around the need for a higher garden and the foundation of the Mussoorie hill nursery. This is followed by a discussion of the centrality of two Asian gardeners – Hari Singh and Murdan Ali – to the functioning of the gardens, and an examination of the role of collectors in the botanical delineation of the mountains. The final section then draws these threads together to consider the problems of distance and limited resources in the making of global science. Before Saharanpur could facilitate the emergence of Himalayan botany as global botany, however, it first had to be appropriated from a Mughal garden into an institution of European science, and it is to this process we now turn.

The Geography of Saharanpur and the Appropriation of a Mughal Garden

Writing in 1832, John Forbes Royle acknowledged that: ‘it is singular, and at the same time most fortunate, that nearly at the most northern limit of the British territories, and in one of the most eligible situations for the purpose, a public garden should have been established by the native Governments which preceded the British.’ His predecessor, George Govan, also explained the eligibility of Saharanpur’s geography in some detail: ‘the proximity of the situation to the base of one

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21 Hyde, 'Dr. George Govan and the Saharanpur Botanical Gardens’.
of the noblest mountain ranges in the world, and of which the natural history is among the desiderata of men of science,’ made it the ideal location ‘to attempt the naturalisation either from the Himalaya into Europe or vice versa.’ As this indicates, Saharanpur was always intended to facilitate not only the acclimatisation and extraction of Himalayan plants, but also the naturalisation of those of Europe and the rest of the globe into India and the mountains. As Royle noted, this was allowed by the climate of Saharanpur ‘which is described as being tropical at one season, and partially European at another, and as having, in consequence, an equally varied cultivation.’ He went on to elaborate that Saharanpur’s latitude ‘embraces in its course a greater variety of interesting country than perhaps any other’ because:

The above parallel, or that of 30°, leaving India, passes through Persia, Arabia, and Egypt, and over the southern boundaries of Libya, Barbary and Morocco, across the Atlantic, through New Orleans, between Old and New Mexico, and passing the Pacific Ocean, crosses the very centre of China and Tibet.

Royle later showed that these theoretical comparisons and equivalencies translated into practice, and ‘taking the Saharanpore garden as an example, we have collected in one place, and naturalized in the open air, the various fruit-trees of very different countries, as of India and China, Cauful, Europe, and America.’ While no doubt reflecting some of the exaggerated rhetoric of a superintendent defending his contributions and expenditures, it is nevertheless apparent that, a thousand miles to the northwest of Calcutta, the garden at Saharanpur was excellently situated to become the necessary ‘northern garden’ in the EIC’s nexus of colonial botanical institutions.

This existing Mughal garden – sometimes referred to as the ‘Farhat Baksh [delight giver]’ – had originally been instituted in 1779 by the orders of the Rohilla chief Zabita Khan. Its founding decree included the revenue of seven villages for the garden’s upkeep, which continued after the garden fell to the Marathas in 1788. This was reduced to two villages in 1801, an arrangement that carried through into the garden’s East India Company period. In this section, I trace the sometimes exaggerated, never entirely complete transition of Saharanpur from a Mughal Garden to an East India

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24 Govan to James Hare, 17 April 1816, British Library, IOR/F/4/587/14218, f41; Govan to Charles Lushington, 20 January 1821, British Library, IOR/F/4/660/18324, f73. Govan’s ambitions were nevertheless both literally and figuratively higher, and he noted that in the Himalaya, beginning with the ‘luxuriant vegetation of the Tropics, a gradual ascent leads us through the vegetable productions of almost all latitudes, till at the utmost elevation we reach the melancholy region of stunted pines … lichens and the perpetual snow of the polar latitudes.’ Govan to James Hare, 17 April 1816, British Library, IOR/F/4/587/14218, f50.


29 N.B. Edmonstone and G Dowdeswell to the Court of Directors, 28 October 1817, British Library, IOR/F/4/587/14218, f1-2. See also Hyde, ‘Dr. George Govan and the Saharanpur Botanical Gardens’, 48; Grove, *Green Imperialism*, 412. This name is the same as that given to the more famous ‘Farhat Baksh’ in Lucknow.
Company scientific establishment. In particular, I examine the physical transformations of the spaces of the garden (the transfer of personnel is taken up later), showing that these changes were often as insisted as much as they were real. The co-opting of older, precolonial gardens into the service of empire was far from unprecedented, and in his study of Peradeniya in Sri Lanka, Sujit Sivasundaram argues that establishing a colonial garden over an existing garden (albeit one far more degraded than the still active Saharanpur) enabled ‘the claim that there were symmetries in how nature was used by Britons and Kandyans’ in that ‘both sides sought to exert their control over territory by establishing a network of gardens.’

While referenced frequently in colonial sources (including both administrative records and widely-read travel narratives) the generic way in which Saharanpur was described as a ‘Mughal Garden’ nevertheless elides the heterogeneity of earlier Persianate institutions. The East India Company was happy, at times, to emphasis Saharanpur’s previous history, even while denigrating its earlier management. They nevertheless performed their overwriting of the previous ‘pleasure garden’ with the principles of scientific botany in different ways for different audiences – whether residents of the district, colonial visitors, or consumers in Europe – emphasising at various times utility and improvement, continuity and change, ornament and science.

Although nominally in British hands since 1803, it was not until 1817 that, after visiting the garden and acceding to the suggestions of George Govan and others, the Marquis of Hastings decided ‘that which was intended only for the gratification of an Asiatic sensualist, should contribute to the advancement of science’ and decreed it be formally established as a botanical garden.

Despite recognising the benefits of adapting an existing garden, the EIC employees who were placed in charge of Saharanpur were eager to emphasise what they saw as the poor condition of the institution, and thereby elevate their contributions to improving and remaking it. Indeed, there was an insistence on ‘the Garden having gone into a state of rapid decay whilst under the immediate charge of the Natives.’ This, as was argued by the Magistrate of Saharanpur in 1814, was also central to the justification for the expense of re-establishing and maintaining the garden, which would be of great benefit to the ‘native subjects in this part of the country, who fondly cherishing the recollection of what it once resembled … will, in as much as they now regret the state it lies in, gratefully admire the liberality that shall cause it once more to rise in all and more than former grandeur.’

Govan’s and Royle’s reports indicate that in transforming the garden, they focused especially on removing what they saw as an ‘indiscriminate mixture of saleable produce’ and ‘superfluous and common plants’

\*‘Extract from a Report from the Magistrate of Saharunpore to the Governor General,’ 31 December 1814, British Library, IOR/P/9/8, I22r-v.
which were ‘incompatible with the improvement and Botanical objects of the garden.’ Indeed, this emphasis on science allowed them to insist on what distinguished their program for the garden from that of the previous regimes. Many of the erasures were nevertheless more rhetorical than they were real. Indeed, the continued existence of highly visible vestiges of the older garden are evident in a plan of Saharanpur that Royle prepared in 1831, as seen in Fig. 4.1:

Fig. 4.1. Map of the Saharanpur produced under Royle’s direction in 1831. This map was produced in the context of Governor-General Bentinck’s visit the same year, and concern that the garden would be abolished as part of a general reduction in EIC spending on economic botany. This context perhaps resulted in an exaggerated order, making the garden appear grander and more scientific than it actually was. This map was later published by Royle as the frontispiece to his *Illustrations of the Botany and Other Branches of the Natural History of the Himalayan Mountains* (1839). As a key early work in Himalayan botany, this placement emphasised the centrality of Saharanpur to the botanical imagining of the mountains.

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14 James Hare to C.M. Ricketts, 21 April 1816, British Library, IOR/F/4/387/14218, f30; Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f152. Royle suggested these practices had recurred during the two-year gap between Govan’s superintendence and his own (while the latter was on sick leave). As Royle put it in 1825: ‘the entire management appeared indeed to have been left to the discretion of the Chowdry or head Gardener who being more anxious to increase his own emoluments than to improve the state of the garden, had crowded fruit trees of the most common kinds.’ Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f151-2. While not mentioned by name, he must have been referring to Hari Singh.


16 Grove, *Green Imperialism*, 414; Drayton, *Nature’s Government*, 131. In a letter to John Lindley dated 11 January 1832, Royle bemoaned, ‘the arrival of the Governor-General with the one intention of abandoning the Saharanpore garden. I was obliged therefore to lay aside everything for a while to make out reports, plans, & catalogues of the Gardens so as to exhibit its objects both in a scientific and useful point of view to save it from destruction.’ Cited in Drayton, 131.
The changes made since Saharanpur’s days as a ‘pleasure garden’ also included clearing, levelling, and replanting, as well as the addition of a conservatory and seed house, new roads, ponds and irrigation, and new growing beds where Royle recorded that ‘in one, plants were arranged [by Govan] according to the Linnaean system of classification … though now it would be preferable to change it for the natural method.’ Royle’s other main addition was a ‘physic’ garden, ordered in 1825 by the East India Company expressly for the purpose of supplying the dispensary with medicines difficult or expensive to obtain otherwise. In summing up, Royle wrote that ‘a good deal of new ground has been enclosed, and many alterations made in laying out the grounds. In these the English style of gardening has been as much as possible adhered to.’ The qualification inherent in this statement suggests these transformations were incomplete, even if the superintendents insisted that they were doing the best they could with the resources available. Indeed, in layering these additions on top of the older establishment, the garden never became a wholly European space, in either design or aspect. As the map indicates, a ‘Chabutra’ (tower) remained at the centre of the garden, and a much older ‘Hindu Temple’ continued to be a key node, visible from many parts of the garden. Hugh Falconer commented on the former, noting that ‘an old native Chabootra occupies nearly the centre’ and from this several ‘broad roads lead off in serpentine curves, intersecting the garden in all directions.’ Whatever the reorganisation of the garden beds at ground level along the lines of scientific botany, this tower thus remained the garden’s focal point and a prominent landmark for visitors, as it does to this day.

Mussoorie and the Need for a Higher Garden

For all its advantages over the Calcutta Botanic Garden when it came to the appropriation of Himalayan flora and the naturalisation of European and North American plants, Saharanpur was only ever a partial solution. Indeed, it was never high enough on the vertical globe to encompass the entirety of the botanical offerings of the Himalaya in its own right. The debates about the need for

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17 Royle, ‘Account of the Honourable Company’s Botanic Garden at Saharanpur’, 47. See also Burkill, Chapters on the History of Botany in India, 33.
18 Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f157-8. Wallich in turn suggested ‘the entire exclusion of such as might be more cheaply and easily procured either in the Bazars or by sending people out in search of them.’ See Nathaniel Wallich to J. Adam, 8 October 1825, British Library, IOR/F/4/955/27123(2), f78-9.
20 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f57r. David Arnold argues that ‘with its “suttee monuments” and temple, its Linnaean garden, tea plants and mulberry seedlings, Saharanpur might itself serve as a symbol of the cultural eclecticism of Company science in early nineteenth-century India. But, with time, it became evident that the representation of a large part of India as tropical, and the infiltration of a negative tropicality into a wide range of scientific and governmental discourses, constituted a significant departure from earlier Orientalist scholarship.’ David Arnold, ‘India’s Place in the Tropical World, 1770-1930’, The Journal of Imperial and Commonwealth History 26, no. 1 (1998): 10.
higher garden are thus revealing of the haphazardness of the early imaginative and scientific constitution of the Himalaya, and the haziness around emerging distinctions between uplands and lowlands. George Govan was aware of the limitations of Saharanpur as early as 1820:

Of those [plants] brought from elevations of 8000 and 12000 feet above the level of the sea scarce one plant in 100 can be preserved during the first hot season and rains, although subsequently they become more hardy ... success may in future be expected ... in collecting them in a depot in the hills during the rains and hot weather, to dispatch them to Saharanpore only during the cold season.  

Though a higher garden even than Saharanpur was quickly recognised as essential, Mussoorie was not the only potential location, and Govan had initially settled on Nahan. However, it was only slightly higher in elevation than Saharanpur, and did not offer enough of a climate differential to be a long-term solution. Royle suggested Mussoorie as an alternative, noting that it was located at approximately 30.5° of latitude and ‘attains an elevation of about 5,500 feet,’ going on to explain that ‘as Decandolle states that 500 feet of elevation are deemed equal to one degree of latitude, it will be necessary to add 11 degrees to the latitude of the place and we have 41½ as the latitude to the climate of which that of this place should correspond.’ As Royle continued, ‘it may therefore be safely inferred from the above facts that the climate is analogous to that of the temperate parts of Europe.’

In choosing Mussoorie, Royle also explicitly placed the nursery in a global context, and indicated the climatic preferences of the species he was hoping to accommodate:

The latitude being nearly that of Shiraz and Cairo, and of the southern boundaries of Barbary and Morocco, the solar rays must of course be powerful. But as its elevation is also considerable, the causes which produce a reduction of temperature as we ascend in the atmosphere reduce its temperature to that of the southern parts of Europe.  

Here Royle was grappling with the questions of latitude and altitude, even while evoking global comparisons to indicate his ambitions for the garden. The ‘hill nursery’ at Mussoorie was thus intended to complement, and even compensate, for the weaknesses of Saharanpur (which was, in its turn, compensating for Calcutta). Royle demonstrated this relationship explicitly, as can be seen in Fig. 4.2:

41 George Govan to [Anon], 8 July 1820, British Library, IOR/F/4/660/18324, f52-3.
42 Royle to [Nathaniel Wallich], 7 April 1826, British Library, IOR/F/4/955/27123(2), f115-6. Royle also noted that Nahan, ‘though eligible in point of climate and from facility of irrigation, it had the disadvantage of having a large river like the Jumna intervening between it and the Superintendence at Saharumpore. This impeded the ready communication which is so necessary, from the impossibility of insuring the exertions of natives when removed from inspection and control.’ Royle, Essay on the Productive Resources of India, 209–10.
43 Royle to [Nathaniel Wallich], 7 April 1826, British Library, IOR/F/4/955/27123(2), f118. As we will see in the next chapter, such neat calculations based on latitude and altitude were never so simple in reality.
Royle reflected that, ‘by taking advantage of the different months adapted for cultivation in the hills and in the plains, a complete year of moderate climate may be obtained for the germination of the seeds, and for the growth of the plants of the temperate climates of every part of the globe,’ and summed up that ‘many plants have actually been thus introduced and preserved, which if confined to either would, while young, have been destroyed by the hot winds of the plains, or killed at Masuri by the frosts of winter.’ While undoubtedly a clever solution, this is nevertheless also a reminder of the ambiguous position of these two gardens on the vertical globe, sometimes awkwardly straddling the uplands and lowlands.

Suitability of climate and appropriate elevation were important, but the ‘hill nursery’ would never have succeeded without attention to distance and accessibility. Mussoorie, around 50 miles to the north, was: ‘well adapted for the purpose and has the advantage of being at an available distance from Saharanpore.’ The geographical relationship between Saharanpur, Mussoorie and the higher mountains can be seen in Fig. 4.3:

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46 Royle, 46.
47 Royle to [Nathaniel Wallich], 7 April 1826, British Library, IOR/F/4/955/27123(2), f115.
Fig. 4.3. ‘Sketch of the Doon and Possessions of the Goorkales North of the Seharunpur District,’ by John Anthony Hodgson (1814). This map was produced in the context of the Anglo-Gurkha War, and just prior to the re-founding of the Mughal garden at Saharanpur as an EIC institution. The locations of the Saharanpur and Mussoorie gardens (indicated by blue-coloured dots) are split by 50 miles, 5000 feet of elevation and the valley of the Dehra. George Govan’s temporary hill nursery at Nahan is indicated by the red-coloured dot. The cartoonish depiction of the hills representing the high Himalaya is indicative of the limits of the European knowledge of the mountains in the first decades of the nineteenth century.

The establishment of the hill nursery at Mussoorie also paralleled the town’s inauguration as a colonial ‘hill station,’ and it would go on to be one of the most popular of these, alongside Shimla and Darjeeling. Indeed, by the mid-1830s Emma Roberts noted that although Mussoorie was still a fledgling town, it was ‘daily increasing in size.’ Here she was editing a description to accompany one of the plates that made up George Francis White’s Views in India, which in turn depicted the hill station in highly romanticised fashion, as seen in Fig. 4.4:

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50 White, Views in India, 34.
While Royle considered that Mussoorie admirably fulfilled the purpose he had chosen it for, the ‘hill nursery’ was nevertheless temporarily defunded in 1831, as part of a widespread albeit passing scepticism on the Company’s part around the extent of expenditures on economic botany.\(^\text{52}\) Writing to the government in Bengal, East India Company administrator Henry Thoby Prinsep (1792–1878) suggested that ‘the establishment at Mussoorie Teeba’ has ‘not been successful as a garden.’\(^\text{53}\) As part of a reduction in costs which also affected Saharanpur (including the Superintendent’s salary), Prinsep recommended that ‘the subordinate garden at Mussoorie may be dispensed with altogether – and if the prosecution of Physical Botany be considered essential, the establishment for the purpose can be provided out of the 200 Rs per mensem allowed for the Saharunpore Garden.’\(^\text{54}\) Falconer argued that these reductions went too far, especially given Mussoorie’s essential role in acclimatising valuable mountain species to send to Europe and vice versa. He put the case as follows: ‘a subordinate garden in the Himalayah mountains is a desideratum of vital importance to the Saharunpoo Garden for the

\(^{51}\) White, 35.


\(^{53}\) H.T. Prinsep to G.A. Bushby, 30 March 1831, British Library, IOR/F/4/1828/75444, f43v.

\(^{54}\) H.T. Prinsep to G.A. Bushby, 30 March 1831, British Library, IOR/F/4/1828/75444, f45r.
reception of the fruit trees and productions of Europe.’ As he further explained, ‘the experimental nursery which Mr. Royle established at Mussoorie was abolished in 1831, but the ground is still available, and it possesses the great advantage of being in a measure stocked with valuable fruit trees and other plants and of being within a short distance of Saharanpoor.’ He then went on to ‘strongly recommend’ its reestablishment, which duly occurred under the patronage of Lord Auckland. Falconer’s arguments resonated, and after this temporary shuttering, the ‘hill nursery’ was never in danger of being closed again before the end of the nineteenth century. The debates about expenditures nevertheless reflect inherent tensions between the gardens’ scientific, ornamental and economic purposes, which were often at odds with the superintendents’ interests in the botanical delineation of the mountains.

**Hari Singh and Murdan Ali at Saharanpur**

Returning now to Saharanpur, it is notable that even more than the spatial organisation or the architecture, the most significant continuity between the Mughal and Company periods was the number of Asians employed by the garden in both guises (most prominently the head gardener Hari Singh). Such carryovers, and the appropriation of existing orders was essential to the establishment of Company rule more generally, as demonstrated by Christopher Bayly. In recent decades, scholars have also been especially interested in the roles of Asians in the development and practice of botany in India, whether as botanists, assistants, painters, gardeners and collectors or, in modern scholarly parlance, informants, intermediaries and go-betweens. Botany, perhaps more than other sciences, has left an archive that allows us, if unsatisfactorily and imperfectly, to trace these intermediaries and glimpse their roles and contributions to the making of knowledge about the mountains, if rarely to recover their idiosyncrasies and personalities. When considering Saharanpur’s role in constituting the botany and biogeography of the Himalaya, it is worth emphasising what Falconer noted in his report of 1839: ‘the Superintendent of the Botanical Garden is the only European connected with the Establishment.’ The day to day operation of the garden, and the everyday practices required for it to function – including but far exceeding mere labour – were conducted almost entirely by Asian employees. In his report, Falconer went on to detail the organisation of the garden’s personnel,

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55 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f69r.
56 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f69r. As he continued, it should ‘be reestablished with the following establishment… [a Persian writer, a head gardener, 4 gardeners, and 6 labourers].’
57 Bayly, *Empire & Information.*
58 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f64r.
59 In common with other British colonial institutions at this time, the garden also had access to convict labour and ‘the unpaid establishment of convicts consists of 30 convicts allowed daily from the Saharanpoor jail.’ Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f57v.
listing the names of those in senior roles and their salaries, as well as indicating the dates they were first employed. This can be seen in Fig. 4.5:

Among the most intriguing names on Falconer’s roll is that of Hari Singh, who succeeded his father ‘Moze Ram’ (who had been charged with the Mughal establishment) as head gardener, indicating a family occupation. Singh was retained in the same role when George Govan became superintendent in 1817, and the longevity of his career is notable. As well as spanning the Mughal/Maratha/Company periods, Singh maintained his position under the first four superintendents of Saharanpur, and was apparently still paying rent on a house attached to the garden in 1851. The archival record for Singh is nevertheless sparse, with his most substantial documentary presence relating to a salary dispute that occurred in the 1830s under Hugh Falconer’s tenure as superintendent. In his petition for a pay rise, Singh outlined that when his father had been appointed head gardener by Zabita Khan’s government,

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61 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f52r. Hari Singh was initially appointed to joint charge with his brothers ‘Bowancee’ and ‘Dongee’ Singh.
this had included the support of three villages and ‘thus it remained during the whole of the Nawab’s possession as also during the time the Mahrattas’ had the garden. Singh went on to argue that ‘on the Company becoming its possessors Mr Chamberlain deprived me of the villages and in lieu thereof settled upon me a salary of 26 Rs monthly. Since then eleven having been cut, it has been reduced to fifteen rupees.’ Proby Thomas Cautley, perhaps best known for his ‘co-discovery’ of the Siwalik fossils with Falconer, outlined in a letter of 1838 the evidence he could find for this earlier arrangement. He suggested that Hari Singh’s two brothers had also held appointments, the joint value of which was 26 Rupees, and that Hari Singh himself had never earned more than 15. Cautley concluded that ‘on the grounds put forward by the petitioner therefore for an increase of salary I cannot see that he has any claim whatever,’ but demurred that ‘as an old servant of the Garden and as a man far superior in the botanical acquirements to any native that could in all probability be found to take his place, I would … recommend him to the consideration of … a monthly salary of 25 Rs.’ Though a backhanded endorsement, this is nevertheless indicative of Hari Singh’s importance to the functioning of the garden. Indeed, when Hugh Falconer later weighed in, he agreed with Cautley that while the grounds of the petition were inaccurate, given ‘the smallness of that salary for the duties he has to perform,’ an increase was nevertheless deserved.

As the head gardener at Saharanpur right across the period the garden facilitated Himalayan botany’s expansion on a global stage, Hari Singh’s contribution to the making of the mountains must have been significant. It is evident that he had a close working relationship with John Forbes Royle in particular, and played a key role in the production of Royle’s Illustrations. For example, Royle noted in this that the potentially valuable timber tree *pinus longifolia* ‘is called cheer, sullah, and thansa, also surul; but Huree Singh, the head native in the Saharunpore Botanic Garden, informed me that the last is a variety, if not a distinct species.’ More than simply providing local names and uses, the language of species and varieties implies Singh was engaging with a Europeanised approach to botany. It seems Royle was also on occasion happy to use Singh’s findings to correct the errors of Europeans savants. As he wrote regarding the way the ‘*Jatamansi* of the Hindoos has been considered to be the Spikenard of the ancients’:

> The proofs and reasoning of Sir Wm. Jones appearing to me so satisfactory … I considered the subject as perfectly settled. But one day accidentally asking Huree Sing, an intelligent and respectable native at the head of the establishment of the Saharunpore Botanic Garden, whether a plant (*Valeriana villosa*) in the Conservatory was not like the *Jatamansi*; he replied

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64 Cautley to Thomason, 31 March 1838,’ British Library, IOR/F/4/1828/75444, f36r.
65 Cautley to Thomason, 31 March 1838,’ British Library, IOR/F/4/1828/75444, f36v.
in the negative, and pointed to a *Plantago*, with lanceolate leaves, as that which most nearly resembled it. In following up on these discussions of *Jatamansi*, Royle also sought to tap into trade networks and obtain *materia medica* already circulating out of the mountains via fairs and bazaars. As we saw in the case of fossil specimens in the previous chapter, pre-existing networks were emerging as important sites for tracing the natural history of the high mountains, and individuals like Hari Singh were essential to navigating these. Royle noted that *Jatamansi*, ‘better known in Northern India by the name *bal-chur,*’ was brought down annually from the Himalaya. He procured some fresh roots and found they ‘exactly resembled those sold in the Saharunpore bazar as *Jatamansi.*’ He concluded that the original error had arisen because ‘either by accident or design, a wrong plant was sent from Bootan, and figured and described in the Asiatic Researches, at a time when it was not possible to detect the imposture, as it was long before we had free access to the hills.’ Here Royle’s suggestion of potentially deliberate deception indicates the way that the frontier continued to circumscribe the limits of scientific practice (as well as potentially provides opportunities to resist the appropriation of botanical knowledge).

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68 Royle, Vol 1, 243.

69 Royle did not always have time to go into the mountains himself to find plants, and sourced numerous seeds from the Saharanpur bazaar, some of which had come from as far afield as Kashmir. Indeed, Royle made a habit of this, and a number of his plants bore the epithet ‘grown in the Saharanpore Botanic Garden from seed bought in the bazar.’ Royle, Vol 1, 184; 197; 199; 312. Royle’s publications were also rife with information obtained from the bazaars, usually from invisible and unnamed vendors of *materia medica*, and in 1832 he published a ‘List of Materia Medica, obtainable from the bazaars of the Western and Northern provinces of India,’ including their Arabic, Persian and ‘Hindustani’ names. See John Forbes Royle, ‘List of Articles of Materia Medica, Obtained in the Bazaars of the Western and Northern Provinces of India’, *Journal of the Asiatic Society of Bengal* 1 (1832): 458–71. Royle’s editor noted that his method was as follows: ‘in the first place, he collected the various articles of *Materia Medica* procurable in the bazaars, and then employed *Kabzees* to bring in the plants which produced the respective medicines; by this means he was enabled to ascertain the Botanical names of many of the plants indigenous at several stations.’ ‘Proceedings of Societies - Medical and Physical Society, 3rd March, 1832’, *Journal of the Asiatic Society of Bengal* 1 (1832): 118. Like gardens, bazaars, as Christopher Bayly, David Arnold and Pratik Chakrabarti have variously shown, could thus become spaces for cross-cultural knowledge production, and the appropriation and extraction of Indian botanical and medical knowledge. For more on Royle’s experiments with ‘bazaar medicines’ see Arnold, *The Tropics and the Traveling Gaze*, 181; Herbert, *Flora’s Empire: British Gardens in India*, 152–53. See also Bayly, *Empire & Information*, 272–73; Pratik Chakrabarti, ‘Medical Marketplaces Beyond the West: Bazaar Medicine, Trade and the English Establishment in Eighteenth-Century India’, in *Medicine and the Market in England and its Colonies, c. 1450–c. 1850*, ed. Mark S. R. Jenner and Patrick Wallis (Basingstoke: Palgrave Macmillan, 2007), 216–37. Royle also had an interest in South Asian medical texts, noting that ‘it was necessary to become acquainted with the written works in the possession of the natives of India as well as with their personal and traditional information. I therefore caused the works on Materia Medica to be collated by competent Hakims and Moonshes, among whom I would mention, as my principal assistants, Sheikh Nam Dar, commonly called Nanoo, the head medical assistant in the Civil Hospital of Saharunpore, and Murdan Aly, the chief plant collector, and keeper of the Herbarium in the Saharunpore Botanic Garden. By them the arrangement of these works, according to the Arabic alphabet, was persevered in; but the substances mentioned in each were arranged under the three heads of the Animal, the Vegetable, and Mineral Kingdoms.’ John Forbes Royle, ‘On the Identification of the Mustard Tree of Scripture’, *Journal of the Royal Asiatic Society of Great Britain and Ireland* 8 (1846): 114.


71 Royle, Vol 1, 243.
Royle also consulted Hari Singh regarding juniper, and remarked of two varieties: ‘the former appears to be the plant called *theloo* by the natives, and seen by Huree Sing between Simla and Phagoo ... and by Murdan Aly, a very intelligent plant collector, near Saughee Ke Ghat, a high hill to the southward of Rol.’ As well as indicating that Hari Singh travelled in the mountains on behalf of the garden, Royle’s note serves to introduce another key figure in this story; namely, the *munshi* Murdan Ali, who was appointed ‘Herbarian’ at Saharanpur in 1825. Unusually for Asians in this period, Ali came to be considered a ‘botanist’ in his own right, rather than merely a ‘collector’ or ‘gardener.’ Like Hari Singh, his importance is revealed as an unintended consequence of the colonial paperwork generated around ‘a claim to consideration for augmentation of salary.’ This was, Hugh Falconer wrote:

> On the grounds of great merit, long service and inadequate salary at present. He has attained ... a fair knowledge of the natural arrangement of plants, and can distribute new species into their families and genera, with [a] considerable deal of accuracy. A rare attainment for a native and his merits have been strongly acknowledged by Mr Royle."

Falconer went on to recommend Ali’s salary be increased from 10 to 20 rupees per month, tacit recognition of Ali’s importance to the garden. Indeed, Ali’s talents as a botanist are here extolled by Falconer, if again in a culturally hierarchical fashion which conveniently serves to minimise the degree of dependency the European superintendent has to admit to.

Irish-born officer turned botanist Edward Madden also worked with Ali in the 1840s, and provides a little more information about his multiple contributions to Himalayan botany. While travelling in the mountains, for example, Madden noted a plant ‘discovered here by Moonshee Murdan Allee* of the Seharunpoor Botanic Garden.’ In the footnote he remarked that:

> *This very intelligent and respectable Syyud, the first of his race, perhaps, who addicted himself to Natural History or any useful knowledge, and in whose honor Dr. Royle established the genus Murdannia, has, under the occasional instruction of Messrs. Royle, Falconer, and Edgeworth, his masters and mine, attained a considerable proficiency in Botany."

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72 Royle, Vol 1, 351.
75 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f50r.
76 As Falconer also noted, ‘Ali’ was formerly on the same footing with Hurry Sing, but did not participate in the augmentation of 5 rupees per mensem which the chowdry [head gardener] got in 1831.’ Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f50r.
78 Madden, Vol 17, 416-17. Syyud or sayyid was an Islamic honorific for lesser nobles. On another occasion, Madden noted of *melia azadirachta* that: ‘Munshi Murdan Ali, of Saharanpoor, informs me that the “DeK” is a mere variety, only differing from the Bukuyun by a more spreading habit, which gives less shade; and one of the Saharanpoor
Even if this does much to minimise Ali’s agency and transfer it to his European instructors (similarly to the case of instrument makers in Chapter 1), this is nevertheless notable for revealing the etymology of *Murdannia*. A watercolour of this new christened genus can be seen in Fig. 4.6:

![Watercolour of Murdannia scapiflora](image)

**Fig. 4.6.** *Murdannia scapiflora*, named for Murdan Ali, the long-time Herbarian at Saharanpur. In his notes, Royle added that this plant ‘has some repute in Hindoo Materia Medica.’

While naming newly discovered Himalayan species after travellers was common practice in the early nineteenth century, including for relatively lesser known figures like Bengal infantry surveyors William Webb and Alexander Gerard, the naming of species for Asian assistants was highly unusual. Royle’s explanation of his dedication is thus especially interesting:

80 Royle, Vol 1, 403.
81 Pinus Webbiana and *Pinus Gerardiana*. This watercolour also serves as a reminder of another critical group of Indian technicians who assisted in the development of Himalayan botany at Saharanpur; namely, the so-called ‘Company school’ artists. Those who worked at Saharanpur include some of the most famous and acclaimed artists of this tradition, including Lakshman Singh and Vishnupersaud, who were seconded there from the Calcutta garden while Nathaniel Wallich was away in Europe. See ‘Extract Public Letter from Bengal, 1 July 1828, British Library, IOR/F/4/1191/30877, f3r. The literature on Company school artists’ contributions to Indian botany is now extensive, see Henry Noltie, *Indian Botanical Drawings, 1793-1868*, from the Royal Botanic Garden (Edinburgh: Royal
I have named *Murdannia*, in compliment to Murdan Aly, a plant collector and keeper of the Herbarium at Saharanpore, who collected many of the plants described in this work, and who had acquired a remarkable tact and quickness in detecting new plants, as well as in remembering the characters by which genera and families are distinguished, so as to be able at once to arrange a new discovery in its appropriate place.\textsuperscript{82}

That such an unusual honour was bestowed on an Asian botanist might thus be interpreted as recognition of just how important Ali was to the work that made Royle’s name.

It was not only Royle and Madden who Ali discussed plants with, and he later gave botanical advice to Richard Strachey, and assisted with specimens, an example of which can be seen in Fig. 4.7:

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**Fig. 4.7.** A specimen of *Thesium* marked ‘from Murdan Ali.’ Other specimens include notes such as ‘Royle and his man swear that this grows wild’ and ‘Royle’s man says…,’ though whether these refer to Ali or someone else is unclear. ‘Thesium hookeri Hendrych,’ Royal Botanic Gardens, Kew, Herbarium Specimens, http://specimens.kew.org/herbarium/K000880559.

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\textsuperscript{82} Royle, *Illustrations*, Vol 1, 403.
Perhaps even more intriguingly, Edward Madden indicates that Ali had ‘compiled a Hindoostanee work’ on botany (probably in Urdu) ‘containing a general introduction to the study, followed by a detail of the orders and genera, after the Natural System, comprising most of those indigenous to the upper provinces of India and the Himalaya.’\textsuperscript{83} He noted that ‘the work still languishes in MS. the expenses of printing being beyond the author’s means’ but ‘with some previous supervision, it is deserving the attention and patronage of the Asiatic or any other Society interested in the progress of Botany in India, amongst the Indians.’\textsuperscript{84} While this description places Ali’s work in a lower tier of practice – Indian rather than European botany – it is nevertheless highly interesting that Ali was producing a work according to the natural system in this period. Royle also recorded that Ali worked on plant catalogues, writing in 1825 that ‘I have also been employed in affixing systematic names to the native ones in the two catalogues prepared by Mr Alli: copies of which I have had the honour of forwarding, the first containing the Hindoostanee and the second the Hill names of plants arranged alphabetically.’\textsuperscript{85} Like Hari Singh, Murdan Ali had an exceptionally long career. Indeed, William Jameson’s superintendent’s report for 1866–7 acknowledges the contributions of Murdan Ali, now the ‘the Curator’ of Saharanpur’s newly formed museum, which aimed to showcase the botany, geology and agriculture of the Northwest Provinces.\textsuperscript{86} Although operating in a different context to Pati Ram (who we met last chapter equipping and advising expeditions) these individuals thus all demonstrate considerable ability to navigate institutional and patronage networks over multiple generations. This is important, not least because what little can be gleaned about Pati Ram, Hari Singh and Murdan Ali from the archives owes much to the longevity and breadth of their careers, which meant they were less likely to be elided from the record, unintentionally or otherwise.

**Collectors in the Mountains**

Before the myriad new and valuable plants of the mountains could be identified, catalogued, experimented on, and disseminated from Saharanpur and Mussoorie under the direction of Hari Singh, Murdan Ali and the superintendents, they first had to be brought down from the highest mountains in the world. As the example of the *Jatamansi* indicates, this was a task that involved both political and scientific challenges. The 1830s onwards saw an increasing number of expeditions in the high mountains, among the most significant for botany being those of Victor Jacquemont and William Griffith, and in the 1840s, those of Thomas Thomson, J.E. Winterbottom, and Joseph Dalton Hooker. These travellers all brought back substantial collections, and their herbariums were

\textsuperscript{83} Madden, ‘The Turaee and Outer Mountains of Kumaoon’, Vol 17, 416-7.
\textsuperscript{84} Madden, Vol 17, 417.
\textsuperscript{85} Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f160-1. Neither of these appear to have survived.
\textsuperscript{86} William Jameson, ‘Report on the working of the botanical gardens at Scharumpore, 1866-7,’ British Library, IOR/V/23/121 Pt 37 Art 4, f73v.
complemented by the significant incidental collecting of other European travellers, including surveyors. However, a significant proportion of the Himalayan plants that were brought down from the mountains to Saharanpur – and thence to the world – were gathered by Asian collectors. This reliance partly stemmed from the limitations on East India Company power in the high mountains, with Asians operating in parts of the Himalaya remaining off limits to Company control and European botanists, such as Nepal. Across the first half of the nineteenth century, the superintendents of the Saharanpur botanic garden (much as Calcutta superintendents like Nathaniel Wallich) extensively employed parties of collectors, as well as attempted to co-opt pre-existing networks of trade, pilgrimage and migration to obtain plants and seeds from the high mountains. In this section, we see that being a successful nineteenth-century Himalayan botanist meant, in no small part, negotiating Asian talent and labour, and directing it towards scientific ends. The most successful botanists, were, in other words, those who were best able to tap into networks to bring plants down from the mountains, and most capable of managing the Asian employees and botanical experts involved at all levels of the process, whether collecting, drying, identifying, arranging or painting.

As Royle’s interactions with Singh and Ali and visits to the bazaar indicate, he relied far more on collectors rather than his own travelling to obtain new plants. Royle’s duties – and perhaps temperament – meant he travelled infrequently, and he thus built the important collection that formed the basis of his Illustrations around the labour of local collectors. Beginning in 1824, once Saharanpur was functioning to such a standard that he felt he could spare the personnel, Royle had parties of collectors almost constantly employed. As he explained:

> These collections have been formed since 1824, as previous to that the garden itself required the labours of the whole establishment for its internal improvement and management. In 1825, I first endeavoured to get a collection of specimens from Kanáwar, but the gardeners whom I sent, unfortunately, ran away.\(^{87}\)

Such reporting inadvertently reveals the limits of Royle’s agency when it came to his collectors while they were in the mountains, and whose actions here might also be understood in terms of resistance. However, these were not the only setbacks encountered in employing collectors, and as Royle continued, problems often multiplied:

> The plants from Kashmir were first procured in 1828, by sending two of the gardeners belonging to the Sehánāpūr establishment along with the northern merchants who bring down fruit, &c. for sale. In the following year or 1829, the merchants themselves brought me down a number of dried specimens in a book which I had given them for the purpose, but these were generally duplicates of the former year. Last year I again sent two of the establishment, but they brought an indifferent collection in point of numbers, though the specimens were generally large and well dried.\(^{88}\)

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88 Royle, 48. He also indicated that ‘the most northern point of the Himalaya accessible to my plant collectors was the mountain barrier which encircles the valley of Cashmere: to reach this by the commencement of the rains, when from
Perhaps most intriguing here is the revelation that, once it was known that Royle wanted particular plants, merchants began taking their own initiative to bring them to him (even if there was apparently some level of misunderstanding over what was actually wanted). Royle went on to note that some of these collectors were established on a semi-permanent basis and ‘men have been stationed in the Hills for the purpose of collecting seeds and drying plants, of the former 4 or 5 parcels have been forwarded monthly to Calcutta.’ Similar, in obtaining rhubarb, Royle used collectors to establish trade with ‘Tibet, or Western Mongolia, by means of the Tatars who resort to the Hill Fairs.’ As he continued, ‘this trade might easily be encouraged by the government purchasing all the Rhubarb it requires, which might thus be employed for hospital use after crossing the frontiers, instead of now, after making a journey of 20,000 miles or nearly the circuit of the globe.’

By the time of Falconer’s tenure, beginning in 1832, networks of collectors had been set up to gather plants from the mountains on an annual basis, though this led to compromises over the allocation of labour and resources. As Falconer noted, ‘there being no separate establishment of plant collectors attached to the Garden, parties have to be detached from the other departments,’ and went on to explain that ‘they are generally sent off towards the close of the cold weather (or early in March) and return in November; and the workmen employed in the garden are reduced during these months to the extent of from 5 to 6 hands by this arrangement.’ The seasons dictated collecting in the mountains in other ways, and as Falconer recorded: ‘I left plant collectors in Cashmeer so that none of the summer flora might be lost during my absence.’ Whatever the complaints of Royle and Falconer around the accuracy and diligence of collectors, this system of collecting for the garden was evidently still in place at the mid-century. Jameson, for example, sent collectors all over the mountains ‘as far as Niti the frontier town’ and ‘to the jungles bordering on the snow, to collect all the seeds and plants procurable in these elevated regions.’ Collectors were also sometimes employed by European travellers and surveyors who were setting out for the mountains and enthusiastic to help with their botanical appropriation, but who were themselves wanting in botanical talent. For example, when Henry Strachey was presented with the opportunity to visit the frontier as part of the Tibetan Boundary Commission in the 1840s, he confessed in a letter to William Hooker at Kew that ‘I the melting of the snow the passes become accessible, they left the plains of India by the commencement of May. At different times they crossed both the pass of Bunal, entered by Forster, and that of Peerpunjal, described by Bernier when he accompanied the Emperor Aurungzebe into Cashmere. The latter I had always concluded, from the plants brought me, and allowing for its more northern position, to be at least ten thousand feet in elevation.’

89 Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f157.
90 Royle, Illustrations, Vol 1, 25-6. He nevertheless admitted that ‘as no naturalist has visited this part [of Tibet], and neither seeds nor plants have been obtained thence, it is as yet unknown what species yields this Rhubarb.’
91 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f15r.
92 Falconer to Currie, 18 April 1839, British Library, IOR/F/4/1828/75444, f11r.
93 William Jameson to J.W. Sherer, 14 August 1852, British Library, IOR/F/4/2528/145895, f5r.
am absolutely ignorant of Botany.’ In acknowledging this, he suggested that the solution was to: ‘apply to Dr Jameson (supt. Saharanpore Garden) for a botanical collector,’ and in so doing outsource his botanical obligations and compensate for his own deficiencies as a polymath.\textsuperscript{94}

Employing collectors, especially Asian collectors, nevertheless created particular problems in terms of the credibility of the knowledge produced about the mountains. Collectors’ efforts were placed lower in hierarchies of knowledge than the contributions of named assistants like Hari Singh and Murdan Ali. Just as there was a hierarchy of gardens, so too was there a hierarchy of gardeners and collectors. These hierarchies of trust and credibility come through especially in the writing of Edward Madden, and the curious case of \textit{melianthus major}, of which ‘we are told that the Doctor’s [Royle’s] plant collectors obtained a species … on “the lofty mountains of Kumaon” and a specimen of which was growing in the Saharanpur garden.\textsuperscript{95} Madden noted that this would make the \textit{melianthus} ‘remarkable for being found both at the Cape of Good Hope and in Nepal without any intermediate station,’ but of this he was suspicious, especially as ‘a considerable number of these lofty mountains of Kumaon have been explored by Lieut. Strachey, Mr. Winterbottom, and myself, and we could scarcely have missed so conspicuous a shrub if it existed in any of the localities visited.’\textsuperscript{96} Madden explained this discrepancy by suggesting that ‘“plant-collectors” are glad enough to load their Herbaria with garden specimens, and are for the most part not enthusiastic at all in exploring “lofty mountains.”’\textsuperscript{97} Of course, what Madden saw as laziness might also be seen as resistance, and he seemed to have a particularly antagonistic relationship with his collectors, venting to David Moore at the botanic garden in Dublin that ‘there is no trusting them, & so apathetic are they, that sooner than go out & gather me seeds for a good sound reward they will stay here and cut wood at 4 [Rs] a day!’\textsuperscript{98} He continued in a similar vein to William Hooker at Kew that ‘when the spring comes I will see what can be done about employing collectors – I have myself very little faith in them; they are quite up to the plan of staying at home & saying they have been to such & such a place.’\textsuperscript{99} Madden also went out of his way to denigrate the practice of using Asian collectors more generally, perhaps in order to assert his own value and contributions: ‘having resided for several years in the British portion of the Himalaya Mountains, and more especially in the province of Kemaon, which borders on the Nepalese territories, I possessed opportunities for examining its botany, which up to that period had been investigated by native collectors only.’\textsuperscript{100} Ultimately though, Madden’s complaints were hollow ones. Whatever the caveats and breakdowns endemic in these networks in the mountains, the use of Asian

\textsuperscript{94} Henry Strachey to William Hooker, 11 June 1850, Kew Archives, DC/54/485.
\textsuperscript{95} Madden, ‘The Turaee and Outer Mountains of Kumaon’, Vol 18, 627.
\textsuperscript{96} Madden, Vol 18, 627.
\textsuperscript{97} Madden, Vol 18, 627.
\textsuperscript{98} Madden to David Moore, 29 October 1845, Kew Archives, DC/54/337.
\textsuperscript{99} Madden to William Jackson Hooker, 5 November 1847, Kew Archives, DC/54/336.
\textsuperscript{100} Edward Madden, ‘On the Occurrence of Palms and Bambus, with Pines and Other Forms Considered Northern, at Considerable Elevations in the Himalaya’, \textit{Transactions of the Botanical Society of Edinburgh} 4 (1853): 185.
collectors remained essential across the period of this study, especially in places where the frontiers continued to circumscribe the acquisition of specimens.

**The Problem of Distance**

The centrality of the EIC’s ‘northern’ gardens to the acclimatisation of the flora of the vertical globe was always contingent on their locality and access to the mountains. However, even while creating privileged opportunities for knowledge production, displacement simultaneously presented challenges for scientific practice (and not only as a result of dependence on Asian gardeners and collectors). This final section examines the tensions around scientific practice in spaces removed not only from London, but also from ‘centres in the periphery’ like Calcutta, and the challenges – some real, some insisted – described by the East India Company surgeons and botanists who operated there. As an example, Hugh Falconer wrote in a letter to William Hooker at Kew that he had managed to ‘amass a large collection of plants from Cashmeer all along to the Nepal frontier’ but:

> Everything relating to the described Botany of this part of India has been brought out so much piece meal and detached that it is hard – indeed almost impossible for a person placed as I am – removed from European sources of information – to know how much of what I possess is new and how much already known and described.\(^{101}\)

Distance was also an issue in other ways, and as Royle noted in 1838:

> Numerous useful plants have been introduced into India by the Calcutta Botanic Garden, and others by that of Saharunpore. More might have been introduced into the former from the new world, had there been more frequent direct communication with different parts of South America, Africa and India, and the Northern Garden might have acclimated many of Europe and North American plants [sic] had it not been so remote from both Calcutta and Bombay.\(^{102}\)

Indeed, writing after he had retired to England to take up a professorship in materia medica at King’s College London, Royle suggested that more would have been achieved, but as ‘Saharunpore is remote from the sea, the means of obtaining European plants are few and difficult, and seeds in a vegetative state arrive but seldom.’\(^{103}\) Transfer into the mountains could be especially problematic, and circulation in both directions often broke down. Sometimes, this made the introduction of European species prohibitive: ‘attempts were also made to obtain some of the fruit trees of England … but the distances are so great, and the modes of transport were so little understood, that only one apple tree arrived alive at Saharunpore, and thus cost no less than £70.’\(^{104}\)

The other prominent issue around which the difficulty of displacement coalesced was the lack of a substantial, let alone comprehensive, library and herbarium, as well as the unreliable receipt of up-to-date European scientific journals. This was not only a problem for itinerant travellers as we saw

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101 Falconer to William Jackson Hooker, 20 May 1837, Kew Archives, DC/53/68.
104 Royle, 226–27.
in the previous chapter, but also for those operating out of decentred institutions. Without an adequate library and herbarium, the Saharanpur garden, in spite of its privileged access to the Himalaya, risked being reduced to simply a data gathering station, and its superintendents dismissed as mere collectors rather than philosophical botanists – or at least, that was their fear. As Royle wrote: ‘there is no library either public or private within many hundred miles of this station’ and ‘without books it is utterly impossible to make any progress in the study of any of the branches of natural history.’ He continued that: ‘possessed of only a few elementary works … I felt I could not do justice to the duties of my appointment if I did not possess myself of a library at whatever expense and pecuniary sacrifice this was to be effected.’ Royle indicated that he had spent more than 4000 rupees of his own money, and asked for an extra allowance to purchase what he considered the necessary books. However, while his work was complimented, the request was refused (although a few duplicates from the Calcutta garden were forwarded). This problem was ongoing, and Falconer was still complaining about the lack of a library in 1839, although an extensive herbarium of around four thousand specimens and five hundred drawings had by this time been accumulated by Royle (who left a set at Saharanpur while disseminating duplicates to Calcutta, and later to London). Even while naturalists in remote locations wrestled with the question of what sort of science they could or could not do with the resources available, others were already judging them from afar. Lacking access to books could cement inferiority, and mean that a botanist and their work might not be taken seriously. As English officer William Munro commented of Edward Madden: ‘I met him at Simla and did not form any very rich notion of his Botanical acquirements, indeed he had no books.’ When we last saw Madden, he was busy denigrating his collectors and placing them lower than himself in hierarchies of knowledge production, and it is thus worth taking a moment to appreciate the irony that others would, in turn, do the same thing to him.

As we have seen in previous chapters, the grafting of scientific interests onto official duties was an ongoing source of tension, and the role of the superintendent of the Saharanpur botanic garden was

105 Jim Endersby, in an analysis of New Zealand through the lens of Latourian ‘cycles of accumulation’ argues that: ‘colonial herbaria were tools with which Hooker persuaded colonial collectors to adopt his collecting and classifying practices,’ but ‘the undesirable side effect was that colonial botanists might feel that they, too, ought to be able to classify and name, and to challenge Hooker’s authority.’ Jim Endersby, “From Having No Herbarium.” Local Knowledge versus Metropolitan Expertise: Joseph Hooker’s Australasian Correspondence with William Colenso and Ronald Gunn’, Pacific Science 55, no. 4 (2001): 354.

106 Royle to Nathaniel Wallich, 1 December 1827, British Library, IOR/P/12/28, f25v.

107 Royle to Nathaniel Wallich, 1 December 1827, British Library, IOR/P/12/28, f25v-f26r.

108 Royle to Nathaniel Wallich, 1 December 1827, British Library, IOR/P/12/28, f27v; Nathaniel Wallich to Charles Lushington, 13 December 1825, British Library, IOR/P/11/46, f3r. As Royle continued, ‘from this it will appear that so far from having benefited from what is commonly considered a good appointment, I have been a considerable sufferer in a pecuniary point of view and am in consequence in debt and likely to remain so.’


110 William Munro to William Jackson Hooker, 21 March 1848, Kew Archives, DC/54/352.
always combined with that of district surgeon in the first half of the nineteenth century. As Royle lamented in 1825, the issue ‘principally tending to obstruct the full and efficient prosecution of my Botanical pursuits is the unceasing attention which the Medical duties of the Station demand,’ although from the Company’s point of view it was for these duties that at least part of his salary was paying.111 These medical duties were also limiting in that they restricted Royle’s ability to conduct what he considered to be essential travel. As he continued, discussing the outpost that Govan had established at Nahan (before it was replaced by Mussoorie), this nursery:

> Cannot be expected to thrive when left to the exclusive management of the native establishment, but evidently requires the occasional presence of the Superintendent. It is in the Hills also that the richest field for Botanical researches will be found and it is from them that the most rare and valuable plants have been obtained. These Botanical excursions have always indeed been considered as an essential part of the Superintendent’s duty and were frequently carried into execution by Dr Govan … [but] instead of occasionally examining the nursery of Hill plants, I have literally never had an opportunity of even seeing it.112

In 1839, Falconer was still making the same arguments to his superiors about the need to split the medical and garden duties, though with no more success than Royle.113

> Complaints about excessive duties and problems operating in a remote location like Saharanpur were, however, double-edged. If displacement brought challenges for scientific practice, there was always a tension arising from the opportunities it simultaneously conferred (see also Chapter 3). Indeed, Falconer went on to acknowledge some of the advantages: ‘the Garden at Saharanpore is happily situated in many important respects’ because ‘placed almost on the northern limit of the British possessions in Hindostan, it is adapted to supply the wants of the north western provinces, which the remote position of Calcutta, precludes the noble institution there, from doing with effect.’114 This distance could also give the superintendents’ authority from locality. As John Lindley wrote in 1839:

> With regard to the seeds which can be transmitted with the best hopes of success from England to India for distribution to public officers and other residents in the Himalayan range of mountains, it is impossible for one who is personally unacquainted with the country to advise the Honorable Company with so much confidence as another person might who has himself resided in the provinces referred to.115

Royle too, however much he complained about the limitations of being stationed at Saharanpur, was aware that the possibilities it opened up were ultimately responsible for his successful career as a naturalist. The prospectus for his Illustrations made this abundantly clear:

> Mr Royle having been for several years Superintendent of the Honorable East India Company’s Botanic Garden at Saharunpore, in 30° of latitude, one thousand miles to the

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111 Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f165.
112 Royle to Nathaniel Wallich, 1 June 1825, British Library, IOR/F/4/955/27123(2), f166-8.
113 Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f50v.
north-west of Calcutta, and within thirty miles of the commencement of the ranges of the
Himalaya, had necessarily, both from his situation and duties, considerable opportunities for
becoming acquainted with, and making collections of, the natural production of the parts of
these mountains, which he had an opportunity of visiting, or could reach by means of his
Plant collectors.\textsuperscript{116}

Operating out of decentred locations like Saharanpur was thus characterised by attempts to balance
often irreconcilable tensions between the scientific, economic, political and ornamental purposes of
the gardens. However, this was always a catch-22 for the superintendents (especially Royle and
Falconer) because it was their time at Saharanpur that they were able to leverage into positions of note
in the scientific world beyond India, transitioning with relative success to metropolitan careers in
London.

As the nineteenth century unfolded, new technologies seemed to offer to make the globe
smaller, and potentially alleviate some of the problems of distance. In particular, the use of steamships
was touted by several of the Saharanpur superintendents as a means of diminishing displacement.\textsuperscript{117} As
Royle argued, if ‘different ages of the world have been memorable for the different routes of
commerce, as well as for the interchange of the useful plants of different countries’ then ‘so may the
present time be distinguished by the more numerous introduction into India of useful plants, in
consequence of the facilities afforded by Steam Navigation.’\textsuperscript{118} Writing in 1838, Royle elaborated on
this in relation to Saharanpur, suggesting that ‘in the North of India therefore much may be done, and
here steam navigation proceeding from the South of Europe to Bombay and thence over land for seeds
or up the Indus for plants affords every desirable facility.’\textsuperscript{119} Hugh Falconer, the superintendent at the
time, was similarly enthusiastic about sending seeds via this route, as was Lord Auckland, the
Governor-General.\textsuperscript{120} However, extended discussions of the potential for steam technology to shrink
travel times actually serve to highlight that distance was an as yet unresolved concern. Indeed,
steamboats never managed fulfil their promise for the pursuit of Himalayan botany, at least in the first
half of the nineteenth century. William Jameson was still hopeful in 1852, writing ‘there are a great

\textsuperscript{116} Royle to William Jackson Hooker, 21 October 1832, Kew Archives, DC/53/102. The printed prospectus was
enclosed with this letter.
\textsuperscript{117} See Arnold, \textit{Science, Technology and Medicine in Colonial India}, 101–5.
\textsuperscript{118} Royle, \textit{Essay on the Productive Resources of India}, 440–41.
\textsuperscript{119} Royle to J.C. Melvill, 31 December 1838, \textit{British Library, IOR/F/4/1828/75444, f13r–f13v}.
\textsuperscript{120} Falconer to Currie, 11 April 1839, British Library, IOR/F/4/1828/75444, f70r. Auckland remarked that: ‘the
means of rapid communication now available between these provinces and England may at very inconsiderable
expense be turned to great account for purposes of Botanical Science.’ Lord Auckland to Court of Directors, 16
August 1838, British Library, IOR/F/4/1732/69955, f2r. These advantages were especially applicable to
Saharanpur, the Governor-General continued, which ‘from its proximity to the plains on one side, and to the
more temperate and fruitful valley of Deyra, and the high elevation of Mussoorie on the other … should be an
establishment of considerable utility and importance.’ He went on to conclude that this system would mean European
seeds could ‘be transmitted through the Government of Bombay to the officer in charge of the Botanical Garden at
Saharanpore, for distribution to public Officers and other Residents in the Himalayan range.’ Lord Auckland to
Court of Directors, 16 August 1838, British Library, IOR/F/4/1732/69955, f3r–f4r.
many interesting and valuable Himalayan Plants the introduction of which into England as up this time failed … [but] the experience that we have now gained in transmitting plants in Wardian cases, convinces me that all the plants so desirable to introduce might most advantageously be forwarded… to Calcutta by the first available steamer’ and then onto London, and unless this method of transportation was followed they ‘will never reach England alive or in a germinating condition.’ The ongoing imaginative panacea of steamships thus reminds us that this is far from a story of unfettered circulation and appropriation. As well as the issue of distance in transporting viable live specimens and seeds, drawings were lost in the post, labels were mixed up, and specimens went mouldy. Indeed, the history of botany has sometimes been told as one of accomplishment and the remaking of the world, and certainly the long-term impacts of the circulation of species on a global scale can hardly be underestimated. However, paying attention to the disconnects and moments that these practices broke down, can be just as enlightening.

**Conclusion**

This chapter has covered the period in which Saharanpur and Mussoorie became the facilitators of the botanical appropriation of the Himalaya, in a broader context of the scientific imagining of the vertical globe. Though never as lauded as Calcutta, when the eyes of European savants and gardeners turned to the Himalaya, Saharanpur had its moment as a nexus of global botany. Indeed, as Hugh Falconer wrote in 1839: ‘for the investigation of the Botany of the northern part of the plains of India and of the Himalaya mountains … the extensive and important contributions which it has made in this department, under the zealous management of Mr Royle have given the Botanic Garden a well known

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121 William Jameson to J.W. Sherer, 14 August 1852, British Library, IOR/F/4/2528/145895, f5v-f6r. There were nevertheless improvements in success rates in plant transportation in this period, and as Joseph Hooker recorded while in Calcutta: ‘during my stay at the gardens, Dr. Falconer received a box of living plants packed in moss, and transported in a frozen state by one of the ice ships from North America: they left in November, and arriving in March, I was present at the opening of the boxes, and saw 391 plants (the whole contents) taken out in the most perfect state. They were chiefly fruit-trees … more perfect success never attended an experiment: the plants were in vigorous bud, and the day after being released from their icy bonds, the leaves sprouted and unfolded, and they were packed in Ward’s cases for immediate transport to the Himalaya mountains.’ Hooker, *Himalayan Journals*, Vol 2, 247-8.

122 See for example, George Govan to Fraser, 14 April 1820, British Library, IOR/P/10/10, f12v-f13r.

123 Later in the century, especially through the middle and latter parts of William Jameson’s long superintendence, Saharanpur became most known for the promotion of tea cultivation, while Mussoorie also continued to operate, but in an increasingly commercial capacity. Jameson’s role evolved into that of Superintendent of Botanical Gardens, North Western Provinces, but by this time Saharanpur was no longer a major scientific clearing house. Indeed, in the second half of the nineteenth century the ‘northern’ gardens took on a more agrarian and horticultural focus, aimed at supplying seeds for both public and private gardens, and especially to line imperial roads and supply materials for the railways. George King, one-time superintendent at Calcutta, was rather scathing of the state of affairs at Saharanpur in the later nineteenth century: ‘Jameson, who for about 40 years was superintendent of the Saharanpur garden, was a botanist only in name; and under him the botanical part of the work of Saharanpur had been utterly lost sight of. When I was at Saharanpur (1868-9), there was hardly any material for a herbarium, there was no botanical library; in fact there were absolutely no appliances for botanical work.’ Cited in Kumar, *Science and the Raj*, 1857-1905, 80.
European celebrity.'  

Much has been made by scholars of Kew’s role as a global garden, but this could also be true of gardens in the peripheries. Saharanpur was from its earliest days a space of global science, oriented both upwards to the peaks and outwards to the rest of the globe, and ultimately serving as the interface between the mountains and the plains. The situations of the ‘northern’ gardens were globally compared by the superintendents in terms of both altitude and latitude, and in this manner fed into the scientific imagination of mountains more broadly. However, located in the foothills, the gardens of Saharanpur and Mussoorie also indicate the inherent uncertainty in differentiating between lowlands and highlands, existing – sometimes uneasily – in the grey area between the two. Indeed, the need for Mussoorie to compensate for the limits of Saharanpur, which had been founded only a decade earlier to compensate for the limits of Calcutta, is indicative of the haphazardness of early attempts to mark the graduations of the vertical globe, and to formulate the highlands and lowlands as distinctive spaces for thinking about environmental and scientific concerns.

By looking at two interconnected institutions, this chapter has broadened the focus of previous chapters on expeditions, many of which nevertheless relied on places like Saharanpur to facilitate their itinerant scientific and imperial activities in the high mountains. Indeed, while in Kashmir in 1848, Thomas Thomson used Saharanpur as his relay, writing to William Hooker at Kew that ‘in future I shall forward [seeds and specimens] through Jameson at Saharanpore addressed to Dr Royle as you recommend.’  

In this chapter, I have also particularly focused on way that obtaining, identifying and acclimatising specimens in order locate them on the vertical globe relied heavily on the likes of Hari Singh and Murdan Ali, who played key roles in hierarchical networks of Asian gardeners and collectors. Because the Himalaya were understood in this period in no small part through their botany, this dependency matters. However, as this chapter has simultaneously demonstrated, dependency was only one of many reasons that global sciences were prone to breakdown: whether through the imperfect circulation of material, the limits of the imagination, or as a result of East India Company politics and economics. The persistence of Saharanpur and Mussoorie, and their central – if uneven – part in the making of Himalayan botany nevertheless played a key role in providing material for the global imagining of mountains in this period, as the next chapter and final chapter on biogeography details.

126 Thomas Thomson to William Hooker, 26 April 1848, Kew Archives, DC/54/502. In a letter to the younger Hooker, Thomson nevertheless noted the problem of network breakdowns: ‘I never received Edgeworth’s paper which you sent out to me via Bombay – I was very anxious to see it to know how much of my plains collection was unknown.’ Thomas Thomson to Joseph Hooker, 4 June 1847, Kew Archives, DC/54/498.
Chapter Five

BIOGEOGRAPHY

In 1837, Robert Boileau Pemberton (1798-1840), then special ‘Envoy to Bootan,’ made an extended to the country with ‘two very excellent barometers’ firmly in hand. In an official report submitted to the East India Company and later published, he noted that:

> The accurate determination of heights is a point of such vital importance in every investigation relating to the geographical limits of certain descriptions of vegetation, and the habitats of animals and birds, that many most valuable and extensive collections have been rendered comparatively useless by inattention to it.¹

William Griffith, who accompanied Pemberton to Bhutan – officially as surgeon, but in practice as expedition naturalist – was similarly blunt: ‘the Botanist who travels without the means of determining these points, destroys half the value of his collections.’² Pemberton and Griffith were thus part of a new breed of travellers who were adamant that observations of the natural world were meaningless without being attached to precisely measured and quantified elevations above sea level.³

This chapter builds on the previous four, arguing that the first decades of the nineteenth century were decisive in the delineation of an imagined globe that was not only round but also vertical. In so doing, it continues to emphasise the unevenness with which information travelled over imperial and scientific networks, and show that necessary global comparisons could sometimes increase rather than alleviate uncertainties around the vertical organisation of the world. However, it also adds another important facet to this broader argument by focusing on the way horizontal and lowland norms inflected the imagining of the vertical globe.

While the previous chapter considered the mountain gardens of Saharanpur and Mussoorie and the appropriation of Himalayan botany through institutions, we now return to itinerant travellers in the spaces of the high mountains. In what follows, I consider the observation, comparison, and visual representation of a range of different (if often interconnected) altitudinal limits and zones in the Himalaya: of plants, of animals, of crops, and of human habitation. These limits were addressed by

² Griffith, Journals of Travels, 430.
naturalists and travellers especially through the lens (if not yet the exact terminology) of biogeography. Originally applied to the horizontal distribution of plants, biogeography was coming to be understood as equally important in the realm of the vertical. Among other aesthetic, imperial and scientific strategies for imagining this, European travellers in the Himalaya took existing horizontal divisions – tropical, temperate and arctic (or polar) – and, as had been done for the Andes, mapped them onto the vertical. In so doing, they analogised and stretched ideas about two-dimensional distribution to encompass the third. As John Forbes Royle wrote in 1839:

One regrets the poverty of the language at present applied to the geography of plants, as it is impossible to indicate the nature of mountain vegetation by merely using the name of the range; for as we have seen in the case of these mountains, the vegetation varies, and is analogous to that of very different countries, according to the elevation or as peculiarities of local circumstances cause a variation in climate. The inconveniences of this might, it appears, be considerably remedied, if botanical regions on the surface were more circumscribed according to their respective climates, or taking the several zones of latitude.

Accounting for a globe that was vertical as well as round was thus initially achieved by borrowing from the language of latitude, and adapting it to explain variations in the realm of up and down. This had both short and long term implications for understandings of mountain environments and mountain peoples. Applying existing horizontal divisions meant simultaneously overwriting pre-existing local cosmologies, and broader South Asian imaginings of the Himalaya. Much as inscribing ‘blank spaces’ onto maps erased indigenous presences, so too did dividing up the mountains according to European norms derived from the horizontal.

Indeed, it was only occasionally acknowledged that these vertical zones were being written over existing indigenous topographies. In a rare example, polymathic Himalayan scholar and diplomat Brian Houghton Hodgson remarked that: ‘the third region of Nepal is the juxta-Himalayan, called by [Francis] Buchanan the Alpine, and by the natives denominated the Kachár.’ Edward Madden,

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5 For a study that considers places of high altitude and high latitude together, see Cosgrove and Della Dora, High Places.

6 Royle, Illustrations, Vol 1, 310. See also Arnold, Science, Technology and Medicine in Colonial India, 52–53; Arnold, The Tropics and the Traveling Gaze. Brian Hodgson was more sceptical, noting that in ascending high mountains in tropical regions ‘one must necessarily meet with regions equivalent … to the three great zones of the earth, or the tropical, the temperate, and the arctic; and, in fact, our three regions above indicated correspond in the main with those zones, and might be named after them, but that it is desirable to avoid terms involving theory, when those designating mere facts will suffice.’ Brian Houghton Hodgson, Essays on the Languages, Literature, and Religion of Nepal and Tibet, Together with Further Papers on the Geography, Ethnology, and Commerce of Those Countries (London: Trübner & Co., 1874), part II, 10.

meanwhile, remarked that ‘the vegetation of Cheenur and Nynee Talthus presents some difficult problems, which the natives resolve at once by the assertion that the Oak, Cypress, Limonia, Colquhounia, &c, were imported from the snowy range and planted here by Devee herself.’ While framed as the dismissal of indigenous superstition and myth, Madden inadvertently acknowledges that these stories pointed to some fundamental questions about the distribution of plants in high mountains. To be clear, this chapter is primarily concerned with the European imagining, representation and appropriation of the Himalaya. It is not intended to reconstruct – as has been ably done by other scholars – the cosmologies that these scientific imaginings were imposed on top of, even while it pays careful attention to the vestiges of older notions of space that informed European visions of the mountains. Instead, it demonstrates that imagining the vertical globe through the language of latitude was implicitly a form of imperialism, and allowed for the subsuming and appropriation of the Himalayan landscape, flora, fauna and peoples into a framework that was explicable and therefore exploitable by European science and empire. As Janet Browne has characterised biogeography more broadly: ‘the nature of the assumptions and explanations put forward to account for biogeographical regions can be attributed to the overriding ethos of colonization … it provided metaphors and a rationale; the raw materials and a way to understand.’

Overwriting pre-existing spatial arrangements, and organising vertical zones according to horizontal sensibilities was thus essential to establishing the Himalaya as a coherent space – or high mountain ‘type’ – that could be used make long-distance comparisons. A central concern of this thesis has been the way European travellers in the Himalaya were constantly measuring their expectations against other mountain ranges. References were most frequently made to the Alps and the Andes, though Tenerife, North America, China and even Siberia also sometimes featured. As with altitude physiology and geology (see Chapters 2 and 3), the biogeographical imagining of the Himalaya inevitably played out through the making of global comparisons. This chapter thus serves as the culmination of a thesis-wide argument for the inherently comparative nature of mountain sciences in this period, and the dawning of a global consciousness of verticality. I have argued elsewhere (Chapters 3 and 4) that this globality had a material dimension, in the circulation and movement of enormous quantities of things – specimens, inscriptions, drawings and personnel. This chapter,

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8 Madden, ‘The Turacee and Outer Mountains of Kumaon’, Vol 17, 361.
9 See, for example, Mathur, ‘Naturalizing the Himalaya-as-Border in Uttarakhand’; McKay, Kailas Histories.
10 Browne, ‘Biogeography and Empire’, 320.
12 I take inspiration here from Michael Reidy’s use of the term ‘vertical consciousness.’ See Reidy, Tides of History, 280.
however, especially expands on the imaginative dimension of global comparison, and considers the way surveyors and naturalists envisioned their science on a global scale.

While the commensurate nature of mountain environments was increasingly recognised, comparisons nevertheless sometimes revealed significant differences. For example, as James Gerard wrote in a letter published in the first volume of India-based scientific journal *Gleanings in Science* (1829): ‘I came upon a village at a height of 14,700 feet; are you not surprised that human beings could exist at such an elevation?’ The question mark here is explained by the global comparative context, one that was both contradictory and surprising: ‘men, animals, and vegetable productions succeed better here than in the valley below, all thriving profusely in a zone that contracts and terminates every trace of plants in the Andes under the Equator.’ Comparisons made it clear that certain phenomena – such as a line of perpetual snow – occurred in high places everywhere, but inconsistencies in the heights at which these appeared could thus lead initially to more confusion rather than coherence. These issues were sometimes magnified, as we will see, by an overreliance on Alexander von Humboldt and the well-known norms of the Andes, which could cause interpretive problems when it came to addressing the Himalaya (much as occurred with volcanoes as discussed in Chapter 3).

Unravelling contradictory comparisons was also exacerbated by the difficulties inherent in operating in locations displaced not only from London, but also from ‘centres in the periphery.’ While John Forbes Royle, William Griffith, Victor Jacquemont, Thomas Thomson and Joseph Dalton Hooker – all of whom were recognised by their peers as botanists – play key roles in this story, it is nevertheless also significant that observations were often made by those with limited or no botanical training. This was especially so in the case of officers and surgeons seconded from the Bengal Infantry to work on surveys in the high mountains. As James Herbert instructed a fellow Bengal Infantry officer who was about take over his survey: ‘the elevation of the different zones of the vegetable kingdom, including its highest limit, (though strictly speaking not within the line of duty) yet may be deemed for their interest, not unworthy a little time and attention.’ As in early measurements of the heights of the Himalaya (and their superiority over the Andes), the social status of the India-based East India Company employees sometimes led to tensions. For example, James Gerard, confessing his lack of botanical expertise, nevertheless argued that:

The excessive cold that reigns at the highest cultivable levels of the *Intra Himalayan* regions during the greater part of the year, in no way cramps the progress of vegetation, since this is effected by the necessary quantity of heat during the appropriate season … and the solar rays of this parallel of latitude, in so thin and transparent an atmosphere,

15 Herbert to Thomas Oliver, [nd] October 1821, NAI/SOI/DDn. 152, f225.
are infinitely more powerful … these facts, and their effects upon the constitution of men, animals, and vegetation, are not properly understood in Europe, or if known, are explained upon theoretical assumptions which have no grounds of existence in nature." Ger
dard is here leveraging his authority from locality to elevate his contributions to the debate. Based
on his own observations from within the displaced spaces of the high mountains, he was able to argue
that received theories (developed based on the Alps and the Andes) could founder when it came to
ecompassing the Himalaya.

In what follows, these arguments are advanced in five sections. The first examines the absolute
limits of vegetation, sublime responses to the end of the ‘habitable world,’ and attempts to divide up
the highest mountain range on the globe using a vocabulary of verticality borrowed from the
horizontal. The second section extends these debates to animals. The third examines the temporal
dimensions of mountain biogeography, debates over the ‘tropicality’ of the Himalaya, and
inconsistencies in the line of perpetual snow. The fourth section considers the altitude limits of
cultivation, firewood and human habitation, and the ways these circumscribed life and movement in
the mountains. The fifth and final section considers attempts to represent and understand these
altitude limits visually. Throughout, I demonstrate that as much as from abstract natural historical
interests, observations of altitudinal thresholds were wrapped up with the concerns of empire.
Understandings of verticality informed discussions of the potential for European colonisation in the
mountains, and the question of how high was habitable was simultaneously a question of how secure
the frontiers were. Peter Bishop has suggested that, in this period, European travellers and
administrators looking up to the Himalaya struggled to impose imaginative coherence on the
frontier.17 Organising the mountains according to the language of latitude, and from norms derived
from the Alps and the Andes, thus represented a key – if never wholly successful – strategy for
addressing this imaginative incoherence.

Limits, Zones and the Language of Verticality
As they gained more reliable access to parts of the high Himalaya in the first decades of the nineteenth
century, European travellers were keenly interested in the absolute upper limit at which plants could
exist. The highest altitude reached in this period was probably that attained by the Gerard brothers on
Reo Purgyil (see Chapter 1). While painstakingly measuring this high point, Alexander Gerard also
took note of the vegetation: ‘we reached the elevation of 19,411 feet, and found mosses.’18 Travelling
two decades later, Bengal Infantryman Henry Strachey found ‘a few minute plants chiefly mosses [and]
lichens … at heights of 18,800 feet and the most stunted forms of lichens that gave a color rather than a coating to the surface of stones, seemed to extend one or two hundred feet higher. 19 Observations and specimens thus served to fix the upper ceiling at around 19,000 feet, which coincided with the limits of the high passes and pre-existing routes of travel through the mountains. Though impressed by the ability of certain species to survive in an extreme environment, there was nevertheless often a sense of melancholy at reaching the end of vegetation. Henry Strachey’s brother Richard wrote of the ‘cessation of life as we ascend in elevation,’ while Victor Jacquemont sighed that, at 11,500 feet on the side of the peak of Kedarkantha, ‘la forêt expira.’ 20 In a similar vein, James Gerard wrote of making ‘preparations for ascending the parent chain, and I may say, to take leave of the world for some time.’ 21 Reaching and recognising these thresholds thus often saw recourse to the sublime. This was never entirely melancholy, and elsewhere in the same letter, penned while wracked with altitude sickness in a cramped tent some 13,800 feet above sea level, Gerard remarked that ‘the idea that we are beyond the habitable world makes us catch eagerly the stir of the wind, the flutter of an insect, or the noise of some rock in its fall; and although we feel an emotion that we cannot describe, the mind still partakes of the serenity of the region around.’ 22 These romantic, picturesque and sublime modes were intimately linked with the scientific constitution of the mountains. Where the ‘habitable world’ ended, for what, and for whom was nevertheless a subjective judgment, and to some extent always relative. Brian Hodgson, for example, suggested that the central band of mountains were ‘splendidly wooded,’ and ‘this generally from 10 to 16,000 feet above the sea, up to the limit of habitability; where, of course, I stop.’ 23

As well as invoking the sublime, travellers operating in the Himalaya frequently speculated on the underlying causes of these vegetational changes and their ultimate ceiling. Beyond the obvious factor of decrease in temperature, they also considered precipitation, solar radiation, lack of soil and the rarity of the air. William Griffith suggested that temperature was crucial, using examples of microclimates he encountered: ‘I had here an opportunity of observing the curious effect of a patch of snow in retarding vegetation, all the plants about, being as it were a spring flora, even such as at similar elevations elsewhere, were all past seed.’ 24 However, he acknowledged moisture was perhaps equally important, and Thomas Thomson agreed, singling out ‘the change produced in the vegetation in the temperate and subalpine zones as we advance towards the interior of the mountains, in

20 Strachey, ‘On the Physical Geography’, 78; Jacquemont, _Voyage Dans l’Inde_, Vol 2, 127. [‘the forest expired’]
22 Gerard, 298.
24 Griffith, _Journals of Travels_, 396.
consequence of the diminution in the amount of rain.” The brutal debility experienced by human and nonhuman bodies as a result of the rarity of the air, even if still little understood (see Chapter 2) was nevertheless generally ruled out as a principal cause for the vegetational ceiling. As Joseph Hooker put it at the mid-century:

> It has long been surmised that an alpine vegetation may owe some of its peculiarities to the diminished atmospheric pressure ... I know of no foundation for this hypothesis; many plants, natives of the level of the sea in other parts of the world, and some even of the hot plains of Bengal, ascend to 12,000 and even 15,000 feet on the Himalaya, unaffected by the diminished pressure.  

Even if change in pressure could be dismissed, other environmental and climatic factors could not be easily isolated. Holistic explanations were thus required, indicating a shift towards an ecological way of thinking *avant la lettre*.

If the limits of knowledge meant that theories were in constant danger of contradiction, the idea that laws might be established was not in doubt. A logical extension of the discussion of altitude limits was to use them in a predictive capacity, and to estimate heights based on species that occurred. For example, Victor Jacquemont, relying on Kashmiri traders as plant collectors, wrote that:

> The wild and cultivated vegetable productions, taking into account the law according to which the temperature decreases from the equator to the pole, speak so precise a language to one who can interpret it, concerning the height of places, that, in the complete ignorance which existed before my journey of the level of this celebrated valley [Kashmir], I had fixed it at between five and six thousand English feet, from a small number of plants which I had seen brought by merchants.

When he later visited Kashmir, Jacquemont could smugly recount that: ‘now, my own observations make it about five thousand one hundred and fifty feet. It was with the most lively satisfaction, that I saw the final logarithm of my calculation transform itself into this number.’ Much as bodies might be calibrated to estimate height (see Chapters 1 and 2), so too it seemed that plants might become botanical barometers, even for places not yet visited by Europeans.

While searching out and trying to explain absolute limits, naturalists developed and applied various schemes for dividing up the Himalaya into altitudinal zones. Usually borrowed from the horizontal, these could help both imagine and explain the vertical realm. John Forbes Royle offered one of the most comprehensive of these schemata. Adopting the natural system of classification — ‘the only method which enables us to treat systematically of their Geographical distribution’ — he argued

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29 The term ‘botanical barometer’ is adopted from Bourguet, ‘Landscape with Numbers’, 102; 106.

that a new vocabulary was needed, and proposed that the language of latitude might encompass the vertical realm of the Himalaya:

Mountains might be similarly divided into zones or belts, according as elevation, climate, and vegetation, displayed sufficient differences to warrant the distinction. We have frequently seen, that according as we observe [sic] the natural phenomena, at the base or towards the apex of these mountains, the correspondence is either with tropical, European, or polar regions. This might be indicated by a word compounded of that of the mountain range, and of the zone to which the belt corresponded, as Tropico-Himalayan, Arcto-Himalayan, &c., which would sufficiently indicate the nature of the vegetation at different elevations, as well as the geographical situation.31

Royle was aware that these ideas were not necessarily his own or novel, but pointed out that they had never been systematically applied in the Himalaya. He also acknowledged that the 'bounds are in a great measure arbitrary to which each of these belts have been restricted, for the changes, both in temperature and vegetation, are so gradual.'32 Two decades later, Thomas Thomson was similarly conscious of the fundamental subjectivity of dividing up the range into belts given the way they bled into one another. He nevertheless argued that:

Some mode of subdivision is quite necessary for the purpose of description, as otherwise the mind would be puzzled by the multitude of facts. The less complicated, however, the mode of division is, the more intelligible it will be; it appears therefore quite sufficient to refer the forms of vegetation to three groups, similar to the three zones interposed between the equator and the pole, namely, tropical, temperate, and arctic; or to use the term more commonly applied in the case of mountains, alpine vegetation.33

More so than some of his predecessors, Thomson was interested in the significant differences in vegetation that occurred laterally across the vast span of the Himalaya and its associated ranges. He remarked that describing elevational changes would be relatively easy if vegetation was uniform across the range, but: 'few indeed of the plants of the eastern extremity of the Himalaya being identical with those which occur in the far west. In general terms, it may be said, that to the eastward the vegetation is very much more luxuriant and tropical.'34

Aside from the language of latitude, another key criterion for divisions, and an analogical language for imagining, understanding and appropriating the Himalaya, was the appearance of so-called 'European' forms. These were associated with the temperate bands of the Himalaya, or the middle zone in Royle’s triptych between ‘tropical, European, or polar regions.’ Comparisons with Europe could nevertheless engender contradictions, and Victor Jacquemont wrote of several species on Kedarkantha which were ‘tous genres européens’ but ‘trouve pareillement associés dans les Alpes à

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31 Royle, 311.
32 Royle, 16.
33 Thomson, ‘Sketch of the Climate and Vegetation of the Himalaya’, 200.
34 Thomson, 196–97.
Lachlan Fleetwood

une hauteur de moitié moindre.’ (William Griffith also added a somewhat wry caveat to his own observations: ‘European vegetation continues, so far as such a statement is assumable by one who never was beyond Paris.’) Royle was particularly enamoured with the similarities to home, stating that a European:

On his first arrival in a tropical country, is struck by the magnificent peculiarities of its vegetation; but to one who has long resided in such a clime these become familiar, and his attention is more quickly excited by the re-appearance of forms with which he was familiar in his youth, and which characterize the more humble and verdant, but not less beautiful Flora of temperate climates.

Royle thus found himself nostalgic for the ‘familiar’ flora of the mountains, as opposed to the ‘exotic’ flora of the plains. As he continued:

In proportion as we ascend these mountains, the plants of India disappear, and we are delighted at finding the increase in number and variety of those belonging to European genera. At first we see only a few straggling towards the plains, which in a more temperate climate would be their favourite resort; and it is not until we have attained a considerable elevation that, having apparently lost all traces of tropical vegetation, we enter a forest of pines or oaks, and lofty rhododendrons, where none but European forms are recognizable.

Royle’s characterisation of ‘European’ vegetation ‘straggling towards the plains’ might easily be read as a metaphor for European bodies. Indeed, David Arnold suggests that insecurities about mortality in the tropical lowlands ‘gave added poignancy to this discovery of “European” flora in upland India.’

These biogeographical imaginings thus fed into highly fraught debates about the long-term colonial possibilities for India, which hinged on the potential for European bodies to adapt and acclimatise (see also Chapter 2). The analogical language of ‘European forms’ went hand-in-glove with the construction and popularisation of colonial hill stations at places like Shimla and Darjeeling, beginning in earnest in the 1830s. As Victor Jacquemont wrote when he first arrived in the Himalayan foothills, ‘the English are so rich that no obstacle can stop them. I shall find them everywhere on the first and second stories of the mountains.’ In terms of the vertical globe, these intermediate elevations – or ‘first and second stories’ – came to be seen as the subcontinent’s goldilocks-zone for European bodies. At moderate altitudes they might thrive, much as ‘European’ plant species appeared to. Lower down in the hot plains, pestilence abounded, while climbing too

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15 Jacquemont, *Voyage Dans l’Inde*, Vol 2, 124. [‘all European forms’ but ‘found similarly associated in the Alps at less than half the height’]
16 Griffith to William Jackson Hooker, 6 August 1840, Kew Archives, DC/54/231.
18 Royle, Vol 1, 15.
19 Arnold, ‘India’s Place in the Tropical World, 1770-1930’, 12–13. Arnold also argues that such language served to ‘render the novel and exotic more familiar by attaching it to the cultural norms and epistemological systems of Western Europe while simultaneously emphasizing what was alien about India’s Oriental or tropical landscape.’ Arnold, *The Tropics and the Traveling Gaze*, 31.
20 Harrison, *Climate and Constitution*; Arnold, ‘Race, Place and Bodily Difference’.
21 See Kennedy, *Magic Mountains*.
high into the ‘arctic,’ ‘polar’ or ‘alpine’ zone meant returning to a state where habitability was again questionable (albeit for very different reasons).

Brian Houghton Hodgson explicitly linked this vertical zone of colonisation potential to plant biogeography: ‘the small or hill species of bamboo, which prevail from 4,000 to 10,000 of elevation, mark with wonderful precision the limits of the central healthful and normal region of the Himalaya.’ He also put forward some of the most formulated – if fanciful – thoughts on settling the mountains in this period, in an essay titled ‘On the Colonization of the Himalaya by Europeans’ (1856). He argued that this was a political imperative and the:

eminent fitness for European colonization having once been taken up, will never be dropped till colonization is a ‘fait accompli’ and that the accomplishment of this greatest, surest, soundest, and simplest of all political measures for the stabilitation [sic] of the British power in India, may adorn the annals of the present Viceroy’s administration.44

Hodgson did acknowledge that this would have to be a long-term process: ‘but observe, I do not mean wholesale and instantaneous colonization, for any such I regard as simply impossible’ given the ‘distance and unpopularity of India’ and especially its reputation for disease ridden mortality. He thus thought it necessary to demonstrate that:

In regard to the Himalaya, the vulgar dread of Indian diseases is wholly baseless – to show also, that its infinite variety of juxtaposed elevations, with correspondent differences of climate … offer peculiar and almost unique advantages (not a fiftieth part of the surface being now occupied) to the colonist, as well on the score of health as on that of opportunity, to cultivate a wonderful variety of products ranging from the tropical nearly to the European.46

Hodgson presented a rather rosy view, stating that ‘there is, in fact, no end [to] the mineral and vegetable wealth of the Himalaya.’ Writing in 1848, however, Edward Madden had been far less optimistic, arguing that:

Data, fortified by experience, will enable us to rate at its proper worth the colonization cant which so often fills the gazettes, combined with the most exaggerated pictures of Himalayan resources, and the most chimerical schemes for railways, in a country where we are only too happy to find any roads at all. In sober truth, the resources of the mountains are not many, and are already as much developed as the nature of the country will admit of … The soil, except in the low vallies where the European colonist cannot exist, is generally poor, besides being pre-occupied, and often exhausted, by the aboriginal population. Of the feelings with which these would regard any extensive immigration of agricultural Europeans, we may judge by the dissatisfaction with which they relinquished the comparatively trifling lands

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44 Hodgson, Essays on the Languages, Literature, and Religion of Nepal and Tibet, part II, 88.
45 Hodgson, part II, 88.
46 Hodgson, part II, 88. In particular, he thought it would ‘be a perfect god-send to the starving peasantry of Ireland and of the Scotch Highlands.’
47 Hodgson, part II, 85.
required for the Tea plantations. The fine tracts of rich meadow, which flank the Snowy Range, are too remote for settlers, and are too high and too cold to ripen grain.48

Madden thus recognised the significant differences between the lower valleys and the high meadows, even while arguing that both offered insurmountable challenges. He concluded his pessimistic picture by reflecting on what he saw as the implications of this for the security of the empire:

If the above be a true view of the case, it appears chimerical to hope that the Himalaya can ever maintain an independent body of colonists, such as might supersede the necessity of drawing recruits from Europe, or such as, on any emergency, could be brought down to act in the defence of the Lower Empire. This is a very different question from that of the fitness of the mountains for sanatory settlements occupied by those in the service of Government, and whose means of subsistence are drawn from the Plains: that, indeed, is no longer a question: a hundred applications for every vacant appointment in the mountains attest the 'deep damnation' of a life in Hindoostan.49

While the foothills of the Himalaya – and the hill stations of Shimla, Mussoorie and Darjeeling – were to become central to colonial governance in India, the impossibility of an 'Upper Empire' and the colonisation of the higher reaches of the mountains thus remained a source of insecurity.

**Vertical Zoogeography**

The limits of plants and people were rarely treated in isolation, and naturalists also traced zoogeographical distribution on a vertical globe. Brian Hodgson was the most prolific writer on Himalayan zoology in this period, and in his zoogeographical imagining of the mountains, he divided them into three vertical zones, based on those for plants.50 For John Forbes Royle, it was also about plants first, and animals second, with the latter situated according to the biogeographical picture he had developed for vegetation: ‘the animal kingdom affords many of the same indications of the Alpine nature of the country, as we have seen presented by the vegetable kingdom.’51 In terms of absolute limits, Henry Strachey’s observations also followed this hierarchy: ‘the Zoology of all countries is probably proportionate to their Botany. Such any way is the case in Ladak; the stock of animal life being as scanty as the vegetation, and to the best of my knowledge, confined to the same limit of elevation vizt. 19,000 feet.’52 These priorities reflect that colonial zoology was usually considered less important than colonial botany, in part because of its lack of obvious utility.53

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49 Madden, ‘The Turaee and Outer Mountains of Kumaoon’, Vol 17, 423.

50 Hodgson, ‘On the Mammalia of Nepal’, 338. David Arnold nevertheless notes that: ‘significantly, before 1848 Hodgson seldom used the terms “tropical,” “temperate” and “alpine” in his work, perhaps because they appeared less pertinent to zoology than to botany.’ Arnold, The Tropics and the Traveling Gaze, 211.

51 Royle, Illustrations, Vol 1, 24.


53 Arnold, Science, Technology and Medicine in Colonial India, 44.
It is thus unsurprising that the most sustained interest in high-altitude fauna in this period was directed towards a handful of commercial and domestic animals. One species with widely discussed (though ultimately unfulfilled) economic potential was the so-called 'shawl wool' goat. As Hugh Falconer noted: ‘the fine silky fleece, from which the Cashmer shawls are wove, is abundantly developed at the roots of the long hairs of the domestic goat in the plains of Tibet, at, and upwards of, 16,000 feet above the level of the sea, where a highly rarified atmosphere is combined with severe winter cold.’ Of Himalayan fauna, however, no species fascinated European travellers, nor was more important to high-altitude populations, than the yak (or its many, and indeed more common, hybrids). The most widely circulated depiction of a Yak in this period comes from Samuel Turner’s journey to Bhutan and Tibet in 1783, and can be seen in Fig. 5.1:

![Image of a Yak](image)

**Fig. 5.1.** ‘The Yak of Tartary.’ Engraving based on a painting by George Stubbs, and figured in Samuel Turner’s *Account of an Embassy to the Court of Teshoo Lama in Tibet* (1800). Joseph Hooker suggested that ‘the artist is probably a little indebted to description for the appearance of its hair in a native state, for it is represented much too even in length.’

The Yak – depicted here in front of an idealised Tibetan landscape – would become one of the key orientalised, exotic symbols of the Himalaya. In the early decades of the nineteenth century, however, much was also made of the yak as a species seemingly exclusive to high mountains, restricted to the upper bands of the vertical globe. Turner did famously manage to transport a yak to England (another died in transit), where it survived for several years, and sired several hybrid

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offspring with domestic cows.\textsuperscript{57} This would nevertheless become the exception that proved the rule, and other travellers including John Wood and Joseph Hooker reported that yaks quickly deteriorated and perished in the lowlands.\textsuperscript{58} In his extended zoogeographical picture, Brian Hodgson noted that ‘the \textit{Bos grunniens} or Yak of Tibet likewise flourishes in the Kachár [alpine zone]: but not south of it.’\textsuperscript{59} These elevational sensitivities could, however, be partially altered by crossbreeding, and as Hugh Falconer remarked, many if not most of these animals, especially at lower elevations, were hybrids rather than true yaks.\textsuperscript{60}

Some naturalists also made more eclectic investigations into the vertical range of insects, birds and fish. They often expressed or affected surprise at the heights at which this fauna not only existed but also thrived (see also Chapter 2). Henry Strachey remarked that: ‘the absolute height above the sea to which Birds are found ascending in these regions is remarkable … elevated 18,400 feet my brother Richard and I saw large kites soaring high above us with the same slow and easy movement as in the plains of India.’\textsuperscript{61} Strachey went on to discuss insects, writing that even at high altitude:

\begin{quote}
An entomologist would find something by searching; and I have been reminded of Humboldt’s question \textit{‘Les insectes sont ils moins haut que les plantes?’} by a beetle and a moth buzzing about my candle in camp above 17,000 feet, which is the highest I have ever seen insects: but I do not think such a negative and isolated observation can warrant an answer to that question in the affirmative.\textsuperscript{62}
\end{quote}

As with botany, Strachey acknowledged his limitations as a polymath, instead relying on his informants: ‘I am incompetent to give a technical account of the zoology, but subjoin some notice of the principal animals known and named by the Tibetans.’\textsuperscript{63} Thomas Thomson meanwhile observed the altitude limits of fish, explicitly comparing them to the range of humans in a three-dimensional world (see also Chapter 2). As he recorded, ‘the occurrence of fish in streams at 15,000 feet I considered at the time an exceedingly interesting fact [and] I don’t think it likely that they can exist much higher – the same point seems to be about the highest level of human habitation & of cultivation.’\textsuperscript{64} He also indicated that expectations based on received theories broke down, and ‘\textit{à priori}, it would scarcely have been expected that they would have existed’ especially ‘as it would certainly not have been very

\textsuperscript{57} \textit{Turner, Account of an Embassy to the Court of the Teshoo Lama}, 186–89.
\textsuperscript{58} \textit{Wood, Narrative of a Journey}, 322–23; \textit{Hooker, Himalayan Journals}, Vol 1, 212-5.
\textsuperscript{59} \textit{Hodgson, ‘On the Mammalia of Nepal’}, 348.
\textsuperscript{60} \textit{Falconer, Palaeontological Memoirs}, Vol 1, 581-2.
\textsuperscript{64} Thomas Thomson to William Jackson Hooker, 26 April 1848, Kew Archives, DC/54/502.
surprising that air at that elevation should, from its rarity, be insufficient for the support of life in
animals breathing by gills.'

And what of that most notorious of Himalayan fauna, the yeti? In the period before 1850, the
only reference in European accounts is a fleeting mention by Brian Hodgson in a footnote to ‘On the
Mammalia of Nepal,’ published in the first volume of the Journal of the Asiatic Society of Bengal in 1832.
In this he wrote: ‘my shooters were once alarmed in the Kachár [alpine region] by the apparition of a
“wild man,” possibly an ourang, but I doubt their accuracy. They mistook the creature for a
cácodemon or rakshas, and fled from it instead of shooting it. It moved, they said, erectly: was
covered with long dark hair, and had no tail.’ Here Hodgson records the anecdote as information
obtained from his assistants, who were in turn likely basing their depiction on existing Nepalese
stories. Hodgson was immediately dismissive of the claims, while John Forbes Royle offered his own
interpretation:

The improbability of finding a real Ape in such a situation led him [Hodgson] to question the
truth of the report; but it is well known that the woods of the lower ranges to the east of
Nepal contain at least one species of Gibbon, Hylabates Scyritus, called Hooloo or Hooloe by the
Assamese; and it is not improbable that individuals may occasionally wander to the higher
and more remote forests of the Central Hills.

As Peter Bishop notes, nothing more on the yeti appears to have been written or recorded by
European travellers until the 1880s, which was strange as ‘stories about wild hairy men had long been
integral to the folklore of the Tibetans and other Himalayan peoples.’ Indeed, given the prevalence
of records of other myths such as the Bis (see chapter 2), this singular reference is surprising.
Whatever the explanation, even if the yeti would go on to become one of the most enduring
orientalised symbols of the Himalaya, in the period before 1850 it did not yet roam the imperial
imagination.

Time, Tropicality and the Line of Perpetual Snow
Investigating the distribution of plants and animals across the vertical globe meant paying attention to
not just space but also time. Understandings of time were themselves in flux in this period, which was
especially important for geology (see Chapter 3), but also for biogeography. As Marie-Noëlle
Bourguet summarises: ‘as much as a natural science, the study of plant distribution was to become a

65 Thomson, Western Himalaya and Tibet, 153; 165. William Griffith also made extensive investigations into the fish of
the Himalaya, and in Afghanistan, often consulting with local fishermen. See especially Griffith, Journals of Travels, x–
xi; xiii–xxix.
67 Royle, Illustrations, Vol 1, lx.
69 Bishop, 156–58.
historical discipline.’ Michael Dettelbach meanwhile suggests that for Humboldt ‘a study of the spatial relations of plants could yield a picture of the earth’s geological, botanical, zoological, even human history.’ Observers were thus increasingly aware that the natural world they were attempting to map was far from static. Given a long enough timeframe, mountains moved and vegetation with them. The investigation of plants that coexisted in a place not just in the present, but also in the past, was thus a growing concern. As William Griffith wrote, ‘the investigation of the real nature of our Indian fossil flora, has now become a matter of paramount interest,’ not least for tracing possible coal deposits. He went to speculate that ‘further discoveries may prove the flora of the globe at a certain remote period to have been entirely tropical. At any rate it is quite certain, that such floras of the now tropical countries, were never boreal, or even temperate.’

Bound up in Griffith’s speculations was imaginative disconnect around the idea of ‘tropicality,’ and how this related to the Himalaya. David Arnold has argued that India was rendered ‘tropical’ in the first decades of the nineteenth century. Here ‘tropicality’ was imagined rather than real, ‘a collection of ideas’ that amounted to ‘an especially potent and prevalent form of othering’ or orientalising in contrast to the temperate norms of Europe. Where the Himalaya fitted into this tropical picture was nevertheless something of a vexed question, not only in relation to the imperial imagination, but also in material terms of latitude and vegetation. Indeed, even leaving aside the cultural and moral connotations of ‘tropicality,’ global comparisons based on the language of latitude pointed to an inconsistent picture. As Royle argued, in the Himalaya, altitude could be seen as ‘counteracting the effects of latitude,’ or put differently ‘elevation, as in other tropical parts of the world, compensates for lowness of latitude, and allows the existence of plants of the temperate zone.’ William Griffith made a similar point:

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72 Griffith, Itinerary Notes, 398.
73 Griffith, 398. For the broader context, including debate about the discoveries of possibly tropical vegetation in the Arctic, see Rudwick, Worlds Before Adam, 55–57.
75 Royle, Illustrations, Vol 1, 62; 78.
Plants of very high latitudes, require corresponding high elevations to cause their appearance, at, or near the tropics. Thus the genera found constituting the flora of Melville Island, may be expected to be deficient on the highest land known to us near the equator, at least the extreme altitude required for their existence at the equator, would necessarily be very great, perhaps greater than we may really know to occur. Yet it is to great elevation in such low latitudes, that we are to look for our deficient genera.26

The Himalaya thus presented seemingly insoluble contradictions, and as Brian Hodgson summarised: ‘the suite of the seasons is tropical, as before; and, occasionally, the heat is extreme. But the season of heat is short; and, upon the whole, the climate of this region more nearly resembles that of high than that of low latitudes. It has nothing tropical about it but the course of the seasons.’77

Closely connected with these questions of latitude were investigations into the line of perpetual snow. What was meant by ‘perpetual’ remained a source of considerable uncertainty, exacerbated by the lack of awareness of some earlier travellers about the nature of glaciers (see Chapter 3).

Confusion, partly arising from imprecise use of terminology, led to a rather bombastic disagreement in the pages of the India-based *Calcutta Journal of Natural History* and *Journal of the Asiatic Society of Bengal* in the 1840s. These played out between Thomas Hutton, John Hallet Batten, and Richard Strachey, over apparent differences in the height of the snowline on northern and southern slopes.78

Alongside these local disagreements, significant differences when compared to the Andes and the Alps became a source of controversy in both India and Europe. Alexander Gerard mused that: ‘the inferior limit of perpetual snows, does not appear to follow the same regularity on the Himalaya mountains, as on the Andes, and mountains in Europe, there being a very great difference between the outer and inner ranges.’79 His brother James elsewhere recorded that: ‘the marginal limit of the snow, which upon the sides of *Chimborazo* occurs at fifteen thousand seven hundred feet, is scarcely permanent in Thibet at nineteen thousand.’80

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80 Gerard, ‘Observations on the Spiti Valley’, 254. Later observations, backed up by precise barometrical measurements, suggested that in the southern parts of the range, despite their near-tropical latitude the snowline was not less than 16,000 feet, while in the northern Himalaya it could be as high as 20,000 feet in places. See Cunningham, *Ladak, Physical, Statistical, and Historical*, 77; Hooker, *Himalayan Journals*, Vol 2, 394–6.
Indeed, various theories that attempted to predict the elevation of the line of perpetual snow based on latitude came unstuck in the Himalaya. Here we again find James Gerard gleefully taking on metropolitan savants, writing for example that:

The barometer gave for the highest field 14,900 feet of elevation ... The yak and shawl goats at this village seemed finer than at any other spot within my observation. In fact, both men and animals appear to live on and thrive luxuriantly, in spite of Quarterly Reviewers, and Professor Buckland, who had calmly consigned those lofty regions, and those myriads of living beings to perpetual ice and oblivion. What would have become of the beautiful shawl goats which furnish those superb tissues, that adorn the ivory shoulders of our fair countrywomen, had the Professor and the Quarterly the management of these matters their own way?

Gerard thus points to the absurdity of theories received from Europe, when compared with his own direct experience (see also Chapter 3). Such moments, when metropolitan theories broke down, were seized upon (and perhaps exaggerated and caricatured) to argue for the value of scientific work being done in displaced locations in Asia. As Gerard continued elsewhere, noting the existence of forests above 10,000 feet:

A limit beneath which on the equator (according to Baron Humboldt) the larger trees of every kind shrink; a limit which Mr. Colebrooke and clever reviewers placed close to the marginal snow in the region of the torpid lichen; but the Himalaya peer over the Andes, laugh at philosophers and closet speculators, and dwindle Dr. Buckland and his fossil bones into utter insignificance. The phenomena which are presented in obscure caves in Europe, are appealed to in the mountains of Asia, but they answer by exhibiting a superb contrast.

This indicates that William Buckland was not alone, and Humboldt’s theory (drawing on Henry Thomas Colebrooke) that predicted the relationship of the height of the perpetual snowline to latitude, also failed spectacularly when transferred to the Himalaya. As Alexander Cunningham put it at the mid-century: ‘the long-unsettled question of the snow-line, which, on the joint authority of the great Humboldt and the learned Colebrook, had been fixed at 13,000 feet, between 30½ and 32° of latitude’ was patently too low.

Thomas Thomson went out of his way to excuse Humboldt, noting that ‘whether the error originated in India or in England I have no means of ascertaining. There can at all events be no doubt that on the part of Baron Humboldt, it arose from an over confidence in the

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83 Cunningham, Ladak, Physical, Statistical, and Historical, 77. For his part, Colebrooke was wary of theory in explaining these kinds of phenomena: ‘I shall not stop to contrast these estimates and computations: but remark that observations of voyagers towards polar regions, and of travellers in Alpine countries, do not coincide with the assumptions of theory, and the tables computed from it. Nor can it, consistently with experience and analogy, be expected, that one and the same scale shall serve both for northern and southern hemispheres, and for eastern and western continents; for solitary peaks, and for vast mountain-masses.’ Henry Thomas Colebrooke, ‘On the Limit of Constant Congelation in the Himalaya Mountains’, Quarterly Journal of Literature, Science and the Arts 7 (1819): 43. Colebrooke did revise his views by the 1820s, see also Rosane Rocher and Ludo Rocher, The Making of Western Indology: Henry Thomas Colebrooke and the East India Company (Abingdon: Routledge, 2014), 152.
accuracy of Mr Colebrooke.\textsuperscript{84} Regardless of where the fault lay, in this case global comparisons – however necessary – led to more rather than less confusion.

While the distribution of plants allowed for reflection on a range of timescales, the limits of the perpetual snowline particularly saw discussions of the more recent past. As with the related question of glaciers, this sometimes relied on knowledge from the inhabitants of the mountains, and intergenerational oral histories. For example, the deputy commissioner of Kumaon, George Traill recorded in 1832 that:

The interior of the Himalaya, except at the passes and paths in question, is inaccessible, and appears to be daily becoming more so from the gradual extension of the zone of perpetual snow. The Bhottias bear universal testimony to the fact of such extension, and point out ridges now never free from snow, which, within the memory of man, were clothed with forest, and afforded periodical pastures for sheep: they even state, that the avalanches, detached from the lofty peaks, occasionally present pieces of wood frozen in their centre.\textsuperscript{85}

Here both anecdotal reporting and material evidence are called on to demonstrate changes in climate and the snowline, explicitly linking them to consequences for habitation. Hugh Falconer later picked up on this account, and offered a word of caution:

Falconer thus points to the possibility of an alternate explanation, arising from his discussion of the geological processes that had upheaved the Himalaya (see also Chapter 3 and the case of the ‘lightning bones’). He expanded on this reasoning, relating it back to Humboldt’s failed theory linking the line of perpetual snow to latitude:

Now, in regard to the first supposition of the lowering of the line of perpetual snow, the conditions which regulate the limits of that line are only very imperfectly understood, but it may safely be asserted that there are no grounds to believe, so far as our knowledge at present goes, that it oscillates more than the mean temperature of a place does; and the variation in this case does not extend beyond a few degrees of Fahr. Humboldt found that in the Andes, under the crater [sic], the oscillation of the line of perpetual snow does not exceed thirty fathoms. In the Himalayah Mountains the present elevation of the line of perpetual snow is a huge anomaly, the plane being upwards of an English mile in excess of the amount yielded by calculation, with a formula for the latitude and height above the sea. If, therefore, we suppose that the pieces of timber mentioned by Mr. Traill got enveloped in


an avalanche by a lowering of the zone of perpetual snow, it would necessarily be implied that the plane of congelation was formerly more elevated, and would involve a still greater irregularity than the enormous extent at present ascertained, a position which it would be unphilosophical to admit, except on the strongest grounds.  

Falconer is thus cautious, noting the intense contradiction the snowline already presented, and goes on to prefer the explanation that saw forests upheaved to the elevation of the perpetual snow. While looking to longer timescales on this point, Falconer did not necessarily think these geological explanations ruled out the possibility of a more modest descent of the snowline within the cultural memory of Himalayan people. In a footnote to his essay, other evidence was compiled in support on this idea, for example that:

There is an artificial mound, at a place called Kutlean Kotee, which the Pularees say is the remains of a large hill city, that became deserted in consequence of the increased cold or descent of the snow zone. Charcoal and remains of pottery are found in it, and [Michael] Edgeworth says the mound is, beyond all doubt, artificial.

Falconer may not have had all the answers, but he concluded his essay by restating the value of Traill’s local knowledge in demonstrating ‘that the zone of perpetual snow is gradually extending; and that ridges which, within the memory of man, were clothed with forest and afforded periodical pasture for sheep, have an obvious and important bearing on the question.’

Cultivation, Habitability and Movement in the Mountains

The centrality of Bhotiyas’ testimony to Traill’s and Falconer’s speculations about the perpetual snowline was tacit acknowledgement that the Himalaya had long been lived (and managed) landscapes. It was clear to European travellers, who were entirely dependent on pre-existing routes and networks of labour, that human beings had inhabited the high mountains for millennia. Just how high nevertheless remained an open question. James Gerard, placing his observations in a comparative context, thought that given the limits of knowledge in the 1820s, ‘it is no vague conjecture to entertain that tracts of land will one day be discovered, where the abodes of mankind and cultivation surpass in height the summits of the Andes.’ While travellers paid attention to the altitudinal ceilings of all types of vegetation, they were especially drawn to the limits of crops and cultivation. They also had a vested interest in any vegetation that could be used as firewood, a staple of existence in the high mountains (not to mention a necessity for boiling thermometers to measure altitude, as we saw in Chapter 1). The material possibilities for obtaining food and fuel (as well as guides and local knowledge of routes and conditions) thus circumscribed movement through the sparsely populated highlands. The altitude limits of these resources were bound up with questions about the potential for

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87 Falconer, Vol 1, 184.
88 Falconer, Vol 1, 185.
89 Falconer, Vol 1, 185.
colonisation in the mountains, and insecurities around the frontier. These political and practical realities are thus inseparable from the broader biogeographical and scientific imaginings of the Himalaya that emerged in the first half of the nineteenth century.

Surveyors were keenly interested in the limits of cultivation and habitation, especially when operating near the high frontiers. As Alexander Gerard recorded in 1821, the village of Nako is:

The highest village that occurs to the traveller who traces round the frontier of Busahir. Separate measurements ... indicate a little above 12,000 feet from the level of the sea; yet there are produced the most luxuriant crops of barley and wheat: rising by steps to nearly 700 feet higher, where there is a Lama’s residence occupied throughout the year.91

Elsewhere he wrote that the fields he had seen ‘at 13,600 feet were very poor, and the people said they would never be properly ripe, although in Chinese Tartary grain comes to maturity in the vicinity of Koongloong, which must be almost 16,000 feet above the level of the sea, and within the circle of congelation.’92 Gerard concluded that ‘nature has adapted the vegetation to this extraordinary country, for did it extend no higher than on the southern face of the Himalaya, Tartary would be uninhabitable either by man or beast.’93 Later naturalists like Thomas Thomson built on these observations and added their own, to determine the maximum heights for successful cultivation and subsistence farming:

In favourable exposures, and sheltered spots, villages may even be seen as high as 14000 feet, and a few fields as high as 14500 feet... in the neighbourhood of monasteries which are at times built at higher levels than cultivators ever venture to ascend to attempts at cultivation are now and then made as high as 15000 feet, with what success I do not know.94

When recording the grains that could be successfully grown at these elevations, Thomson drew explicitly on the agricultural practices of his Bhotiya guides: ‘a variety of common barley, with the seeds lower in the ear called in Ladakh Shirokh, is that which thrives best at high elevations according to the inhabitants.’95

The limits of the habitable world, for both permanent residents and itinerant visitors, were also circumscribed by a mundane yet critical relationship with firewood. As Alexander Gerard wrote of Lake Manasarovar (15,060 feet), which was just beyond the assumed frontier with Tibet:

The only firewood near Mansurowur is the prickly bush before mentioned; but notwithstanding the extraordinary altitude of this spot, lamas and nuns, who subsist chiefly by the offerings of pilgrims, reside in houses on the bank of the lake throughout the whole year; and this is most likely the highest inhabited land on the face of the whole globe.96

92 Gerard, Account of Koonawur, 64.
96 Gerard, Account of Koonawur, 133.
At altitudes where vegetation was scarce or non-existent, travel could become impossible or dangerous, deepening the dependency of travellers on local knowledge of route conditions. For example, Alexander Gerard wrote that ‘the distance of todays march is only 3 miles, & we might have gone much farther but the guides objected, as there was no firewood nearer the Pass.’ 97 Certain passes were rendered notorious by their lack of firewood, such as the Shatul, where James Gerard’s notebooks (not to mention the lives of two of his porters) had been lost (see Chapter 1). Although relatively low in elevation, the Shatul Pass was considered highly dangerous because there was no firewood for thirteen miles on the approach. 98 Withholding firewood was also one of the key strategies employed by Tartars (seconded as border guards by the Qing empire) to prevent East India Company surveyors entering Tibet. As Alexander Gerard described his unsuccessful attempt to penetrate the Tibetan frontier in 1821: ‘the chief person of the place paid me a visit, and informed me, that orders had been received from Lahassa, some months ago, to make no friends of Europeans, and to furnish them neither with food nor firewood.’ 99

That firewood was a longstanding concern among Himalayan peoples is evident in naming practices. Alexander Gerard recorded, for example, a traveller’s resting place called ‘Nama Cheen,’ which he remarked ‘is named after the species of Juniper called Nama, which is the only Wood for fuel found in the vicinity.’ 100 Thomas Thomson meanwhile remarked in a footnote that: ‘there is a village marked Shing in [Godfrey] Vigne’s map, at the bend of the Indus, but as Shing is simply the Tibetan for wood, it may be inferred that his informants meant that fuel was procurable at the place in question, and that it was in consequence a habitual halting place.’ 101 One of the most important species in the pantheon of Himalayan firewood was the so-called ‘Tartaric furze’ (*genista versicolor*), which Alexander Gerard recorded was called *Tama* or *Tamak* by the Tartars. Gerard continued that he ‘could not get the upper limit of furze on this (the Tartaric) side, but I reckon it fully 17,000 feet.’ 102 This was important because ‘it is the only kind of fire-wood, and … it blazes like turpentine. How fortunate for the travellers who cross these bleak and frozen mountains to be so well accommodated!’ 103 As he continued, ‘were it not for this provision of nature, these lofty Passes would only be encountered by the intrepidity of a few.’ 104 A specimen of this furze can be seen in Fig. 5.2:

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104 Lloyd and Gerard, Vol 2, 118.
Fig. 5.2. ‘Tartarie Furze’ (Genista versicolor). This specimen was collected by Bengal Infantry surveyor William Webb in Tartary. It is annotated with the name ‘Dama’ and a note that it is ‘eaten by all animals.’ Thomas Thomson described ‘the Dama of the Tibetans’ as ‘a very curious stunted shrub, which is very extensively distributed at elevations which no other woody plants attain, and which, therefore, is much prized and extensively used as fuel.’


Joseph Dalton Hooker, who would go on direct the Royal Botanic Gardens at Kew as one of the most important botanists of the nineteenth century, also reveals himself as a connoisseur of firewood.

Writing at the mid-century he suggested that ‘as the subject of fire-wood is of every-day interest to the traveller in these regions, I may here mention that the rhododendron woods afford poor fires; juniper burns the brightest, and with least smoke. Abies Webbiana, though emitting much smoke, gives a cheerful fire, far superior to larch, spruce, or Abies Brunoniana.’

106 For those living and operating in the high mountains, the limits of vegetation was thus far from only an abstract scientific interest. As
Richard Strachey put it, knowledge of vegetation ‘is of no less importance to the mountain shepherd than of interest to the naturalist.’ He might have added that it was of no less importance to the prospects of empire, given the way vegetation circumscribed the ability to move safely over the high passes, secure the frontier, and entertain thoughts of colonisation in the higher reaches of the mountains.

**Visual Representations of Verticality**

While continuing to anecdotally trace the altitude limits and zones of the vertical globe, Himalayan naturalists increasingly also turned to attempts to visually represent their data. Graphs and charts not only represented relationships, they also became tools to investigate and test biogeographical ideas. Humboldt explained this with reference to his highly influential profile of Chimborazo, which was ‘useful not only for developing new ideas regarding the geography of plants; I believe that it could also help us understand the totality of our knowledge about everything that varies with the altitudes rising above sea level.’ In mapping and graphing their data, Himalayan naturalists were certainly inspired by designs popularised (if not necessarily invented) by Humboldt. As William Webb remarked in an account of the survey of Kumaon: ‘since M. HUMBOLDT’s account of New Spain has been published, and from other considerations, it is probable, that the work will be thought incomplete, if not accompanied by vertical sections.’ Representations of the Himalaya produced in this period were nevertheless eclectic in style and content. Some depicted only the limits of a particular species, while others featured an encompassing range of characteristics, such as the line of perpetual snow, geological features, places of habitation, the range of fauna, and even important ascents and feats of exploration.

William Griffith was one of the most enthusiastic experimenters with representing verticality visually. His notebooks contain a variety of charts and graphs, many of which were adapted for publication in his *Journal of Travels* (1847) and *Itinerary Notes* (1848). (These were compiled posthumously by EIC surgeon and naturalist John McClelland after Griffith’s untimely death in Malacca in 1845.) An example of the simple style of chart Griffith employed most frequently can be seen in Fig. 5.3:

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The dotted line indicates relative elevations in Bhutan (this is more clearly seen when rotated 90° anticlockwise). This chart represents the ascents and descents during a day’s journey, from ‘Bulphai’ to ‘Roongdong,’ and serves to illustrate and quantify the accompanying journal. The majority of observations refer to plant species, but fauna, habitation, and cultivation also feature.

Though never offering an extensive explanation of his methodology, Griffith did comment on his intentions with this type of graph: ‘the annexed table of the distributions of plants in relation to altitudes … may render the subject of the preceding observations more clear and distinct. The dotted line along the left hand margin represents the elevation of the mountains.’

John McClelland later worked these up into more comprehensive diagrams, presented as ‘constructed from Information contained in Private Journals and Itinerary Notes of William Griffith.’ Produced in India and consumed by scientific audiences both there and in Europe, these represented entire sections of the mountains, as can be seen in the example for Bhutan in Fig. 5.4:

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111 Griffith, Journals of Travels, 224.
112 Griffith, 162.
113 Griffith, Itinerary Notes, 403.
Fig. 5.4. Composite of elevational information from Griffith’s travels to Bhutan in 1837.114 Though perhaps less aesthetically pleasing than Humboldt’s famous profile of Chimborazo, this nevertheless contains an enormous amount of information about elevational relationships, and organises the natural world in terms of verticality. The chart incorporates the line of perpetual snow, the geology of the mountains, the limits of fish, yaks, and various types of cultivation, culminating in the point where ‘all woody vegetation ceased, except shrubby Rhododendron.’115

For a different approach to visualising the verticality of scientific relationships in the Himalaya, we might also consider the mid-century efforts of Richard Strachey. While employed by the East India Company, he undertook a major expedition with botanist J.E. Winterbottom, sneaking across the frontier and surveying the lakes of Rakas Tal and Manasarovar in 1848. Strachey and Winterbottom collected some 2000 specimens of plants at various elevations along the way, many of which are now preserved at Kew Gardens in London. Based on this journey and the specimens gathered, as well as those sourced from others, Strachey attempted to create a chart that would represent a single continuous line section of the Himalaya, from the plains through to the summit of Nanda Devi (25,643 feet).116 An unpublished East India Company report indicated that ‘the principal object in view was the completion of a sectional drawing of the Himalaya illustrative of the Botanical

114 Griffith, 402.
115 Griffith, 402.
116 The peak itself was well beyond the altitude range of naturalists in this period.
Geography of the mountains exhibiting in a graphical way the distribution of the plants at different altitudes. Strachey’s endeavours were generously supported by the EIC (more so than many of his predecessors), whose involvement was couched in apologetic terms with the suggestion that the sections ‘will throw much light on the natural history and geology of a part of the British territories which is the subject of curiosity on the continent of Europe & towards the scientific examination of which the British Government has up to the present time contributed little or nothing. The intention was that once the botanical section was complete, Strachey would prepare equivalent sections for the zoology and geology of the mountains, while sections for meteorology and magnetism were also mooted. At the mid-century then, these sections sought to imagine the vertical world of the Himalaya graphically, and to consolidate the vast amounts of scientific knowledge about the mountains (and the EIC’s northern frontier) that had been acquired in the preceding decades.

While representing a notable attempt to address the ongoing imaginative incoherence of the Himalaya, the project was not without difficulties and delays. A draft was eventually completed, of which Strachey explained:

I propose to divide this into 4 parts each of a size that can be lithographed easily, and I would propose that they should be published in the Asiatic Society’s journal at Calcutta. As the drawings can only be looked upon as provisional they will I think be quite well enough done in this way, and in my opinion a more careful execution of them would not only give rise to expense that would misdirected, but tend to produce a false idea of the degree of accuracy at which they aim.

The drafts of the first and last of these sections can be seen in Figs. 5, 5 and 5.6:

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119 ‘Extract Agra Public Narrative,’ 10 April 1848, British Library, IOR F/4/2356/124635, f1-2. These appear not to have been completed.
Fig. 5.5. Richard Strachey’s ‘Section of the Himalaya (Botanical Geography).’ Part 1 of 4. British Library, Mss. Eur. F127/202. The inset shows part of the line along which Strachey collected plant specimens, overlaid onto his map of the mountains. While broadly perpendicular to the range, the line nevertheless meandered to follow weakness in both the terrain and frontier politics, much as exploration of the mountains did more generally. Courtesy of The Society of Authors as agents of the Strachey Trust.

Fig. 5.6. Richard Strachey’s ‘Section of the Himalaya (Botanical Geography).’ Part 4 of 4. British Library, Mss. Eur. F127/202. Strachey intended to produce similar sections for the geology and zoology of the mountains along the same line of section, but never completed them. Courtesy of The Society of Authors as agents of the Strachey Trust.
In taking on these sections, Strachey freely acknowledged his limitations, noting that the government ‘was aware that I made no pretension to any knowledge of Botany’ (the same was true of his brother Henry who, as we saw in the last chapter, resorted to requesting a collector from Saharanpur). The official correspondence made it clear that it was to be a collaborative effort: ‘[Strachey] will have on the spot the assistance of Doctor Jameson, of Major Madden … and of Mr J.H. Batten, and he will also be able to consult with Doctor Falconer, Mr Edgeworth & Major Cautley.’ Completing the sections in India nevertheless proved challenging, much as had the production of botanical texts in the ‘mountain’ gardens. Strachey thus found himself coming up against the limits of working in a displaced location: ‘assistance has on all occasions been most freely given but to examine and name so large a collection of specimens as I have is not only an operation that requires much time & labor but is impossible without books or a properly named herbarium for comparison which do not exist at Almora.’ While the sections were enormously detailed, and represented a consolidated understanding of Himalayan biogeography that corrected some of the uncertainties, speculations and failed theories of earlier decades, Strachey was nevertheless very conscious of the ongoing limits of knowledge: ‘the more northern part of the line of section it is still impossible for me even to attempt as it had never before been visited by Botanists and a very great proportion of the plants collected on it are still not named.’ Richard Strachey’s sections, as much as they were intended to demonstrate scientific and imaginative mastery over the previously ‘blank spaces’ of the mountains, thus inadvertently reveal the scale of ongoing limits – not least because they remained incomplete and unpublished.

**Conclusion**

Whatever their limitations, these developments in the biogeographical understanding of the Himalaya, and the global comparisons that they allowed, had broader implications for science. These are apparent in correspondence between two of the most influential naturalists of the later nineteenth century, Joseph Dalton Hooker and Charles Darwin. In 1848, early in his visit to the Himalaya, Hooker wrote Darwin the following: ‘I will give you but one Botanical fact, & that is regarding the vegetation of heights; You have often asked if Mts, especially isolated ones, in the Tropical & S. Latitudes had closely allied representatives of Arctic or N. Temperate forms.’ Here Hooker

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125 Hooker to Charles Darwin, 20 February 1848, Kew Archives, JDH/1/10, f52-54.
referred to an important problem in explaining the migration of species (and ultimately in explaining evolution): how did ‘arctic’ plants move from mountain to mountain (especially isolated peaks) when they were unable to grow in the warm intervening valleys? Hooker later discussed this in terms of changes in climate brought about by the upheavement or subsidence of the mountains, but as he wrote to Darwin in 1850:

> I have been somewhat disappointed in my expectations of finding that Sikkim would tend to clear up your doctrines to my mind. I thought that the transitions from one form to another would be more apparent in a country where under a perfectly equable climate the floras of the tropical temperate & arctic zones blend in the same Longitude & Latitude. Such has not been the case I think.  

Mountains mattered to Darwin’s not yet fully formed ‘doctrine,’ Hooker knew, because ‘a country combining the botanical characters of several others, affords materials for tracing the direction in which genera and species have migrated [and] the causes that favour their migrations.’ Even if Hooker was not yet quite convinced of Darwin’s theory, the global comparison of mountain biogeography thus underpinned the framework by which he ultimately would be.

But verticality mattered not only because it provided the tools to advance scientific understandings of the globe. In the vertically ordered world that was laid out in the first half of the nineteenth century, almost nothing was off limits to elevational speculation. Thomas Thomson, for example, tied altitude to ethnography:

> The gradual transition, in ascending the Sutlej, from Hinduism to Buddhism, is very remarkable, and not the less so because it is accompanied by an equally gradual change in the physical aspect of the inhabitants, the Hindus of the lower Sutlej appearing to pass by insensible gradations as we advance from village to village, till at last we arrive at a pure Tartar population.

Religion and physiology are here explicitly linked to elevational change, ideas that would coalesce into myths around the supposed purity and morality of mountain peoples in the later nineteenth century (see Chapter 2). Representing the world on a vertical scale, with precise elevations secured by new instrumental practices, thus had wide-ranging consequences for the long term understanding of mountains and those who lived in them. Scholars of ‘Zomia’ have demonstrated, for example, that

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126 For more on this, see Browne, *The Secular Ark*, 124–28; Arnold, *The Tropics and the Traveling Gaze*, 199–200; Reidy, ‘From the Oceans to the Mountains: Spatial Science in an Age of Empire’, 31–32. As Darwin would later put it in the *Origin of Species*: ‘On the Himalaya, and on the isolated mountain-ranges of the peninsula of India, on the heights of Ceylon, and on the volcanic cones of Java, many plants occur, either identically the same or representing each other, and at the same time representing plants of Europe, not found in the intervening hot lowlands.’ Charles Darwin, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (London: John Murray, 1859), 375.

127 Hooker to Charles Darwin, 6 April 1850, Kew Archives, JDH/1/10, f274–276.


mountains and mountain peoples are often pushed to the peripheries of states and empires. A central concern of this chapter has been that the new language – or vocabulary – of verticality borrowed heavily from the horizontal, and that this reinforced lowlands as the point of reference. As we will see in a series of European atlases that bring this story full circle in the conclusion, this was ultimately insidious, and meant that the mountains were subsumed into a framework of empire as aberrant and marginal places.

130 For an overview see Michaud, ‘Editorial – Zomia and Beyond’.
CONCLUSION

This thesis has traced the incorporation of the Himalaya into a global framework of mountains in the first half of the nineteenth century. At the same time, it has demonstrated that this imagined framework was itself in the making, and co-constituted with the Himalaya. Focusing on the comparison of mountain phenomena in a context of empire has allowed for the historicisation of what were – and what could only be – global sciences. Doing so has required following the practice of five interrelated sciences across five chapters, rather than focusing comprehensively on just one. Only by looking at the measurements that made global comparisons possible, the uncertain physiology of high places, and by considering the geological and botanical questions that underpinned three-dimensional biogeography, has it been possible to see the emergence of verticality as a central organising principle for both human and nonhuman worlds. Simultaneously, we have seen that measurement, physiology, geology, botany, and biogeography were intimately and inextricably linked with imperial expansion and control. As Michael Reidy argues for the first half of the nineteenth century more broadly, ‘ordering the natural environment enable[d] imperial regimes to project power more efficiently across space … for this reason, Western imperial powers attempt[ed] to standardize quantities of all types, both physical and imaginary’ such that in this period ‘vertical and horizontal spaces were created anew, a conceptualization that legitimized both the spatial turn in science and the expansionist programs of the enabling imperial power.’¹ In other words, historicising global sciences matters because the allegedly universal categories they sought to impose originated in explicitly imperial interests.

In taking the view from the Himalaya, we have seen that understanding the mountains was an inherently comparative process. Whether in instrumental scales, the behaviour of glaciers, or the difficulty of respiration, scientific practice in the Himalaya always involved figuring out where Asia’s mountains fit on an imagined globe that already prominently featured other peaks, most canonically Mont Blanc and Chimborazo. Throughout, I have nevertheless emphasised that making the Himalaya globally commensurable was far from a story of the seamless accumulation of knowledge, and that theories developed based on norms derived from the Alps and the Andes often initially failed to

¹ Reidy, ‘From the Oceans to the Mountains: Spatial Science in an Age of Empire’, 17; 34.
account for the Himalaya. We have seen travellers finding crops in regions purportedly locked in ice, volcanoes assumed into being where none existed, and instrumental scales revealed as laughably inadequate. These moments of failure were often compounded by the equivocal social status of East India Company employees, especially those grafting eclectic scientific interests onto their official duties, and those operating away from ‘centres in the periphery’ with limited resources and a want of up-to-date libraries, instruments and herbariums. Together, these overlapping limits of imagination and practice have demonstrated the necessity of tracing global histories of science through unsuccessful as much as successful moments of comparison. Indeed, these failures and dead-ends, and reorientations and reconfigurations, ultimately reveal the uneven, incomplete and contested processes that underlay the making of supposedly universal categories in an age of empire.

**Imposing the Global**

Having spent the previous five chapters firmly within the mountains and valleys of the Himalaya, focused on the making of knowledge within these particular spaces, it is now time to expand the lens. In concluding, I want to zoom out to consider global comparisons made not by surveyors or naturalists from the altitude-sickness inducing high passes of the Himalaya themselves, but by atlas makers and publishers a world away in Europe. In so doing, we can examine how the observations and comparisons made by actors in the Himalaya were absorbed into a broader story of global verticality, one which inevitably – and in many ways insidiously – flattened the nuances of local observations and the laboriousness of the processes we have observed in the preceding chapters.

Across the period of this study, European publishers drew extensively on material acquired via the imperial networks this thesis has traced to create new types of images of mountains, for example that depicted in Fig. 6.1:
In this image, the three mountains selected to represent the Himalaya are Dhaulagiri (believed at the time to be the highest mountain in the world), Nanda Devi (not, as we saw in Chapter 3, a volcano) and Reo Purgyil (on which the Gerard brothers’ high point, as discussed in Chapter 1, is clearly marked). Ambiguously straddling the highlands and the lowlands (see Chapter 4), Saharanpur is marked on the right-hand side, as are Landour (a village on the same ridge as Mussoorie) and Nahan (the site of George Govan’s temporary ‘hill nursery’). Various limits of cultivation and crops are depicted, as well as zones of vegetation more broadly. The latitude of the Himalaya, which vexed theories about the line of perpetual snow (see Chapter 5), is prominently displayed below the section. At the bottom of the frame, some of the sources of the information used to compile the image are acknowledged, including several key figures in this thesis; namely, James Herbert, Alexander Gerard, George Govan, and John Forbes Royle. In combining these diverse phenomena and sources of information, the image thus presents a holistic vision of the mountains. In the preceding chapters we
have seen such all-encompassing approaches in practice, and here we see their culmination in an ecological picture of the world *avant la lettre*.

In both layout and aspect, Fig. 6.1 is a highly-stylised, composite image, and one which imagines relationships of all kinds through the lens of verticality. In this image, the Himalaya were laid out as a high mountain ‘type,’ and one which can then be compared globally. This is evident in the full tableaux, as seen in Fig. 6.2:

![Fig. 6.2. The full version of ‘Umrisse der Pflanzengeographie’ (1838), which maps botany in terms of both altitude and latitude; that is, on globes both vertical and round. Heinrich Berghaus, *Dr. Heinrich Berghaus’ Physikalischer Atlas* (Gotha: Justus Perthes, 1845). Reproduced by kind permission of the David Rumsey Map Collection (www.davidrumsey.com).](image)

The full image includes, as well as the Himalaya, profiles of the Alps, the Andes, Lapland and Tenerife, all of which became exemplar ranges for constructing a picture of global verticality. In these profiles, it is noteworthy that all information is presented as equally reliable in order to achieve a totality of expression. This undifferentiated approach results in contradictions, and to take one example, glaciers cascade down the Alps but in the Himalaya there are as yet none. It is also notable that in the full world map below the mountain profiles, the Tibetan plateau and the uplands beyond the Himalaya remain conspicuously blank, serving as a reminder of the way the frontier continued to circumscribe the limits of knowledge. This ‘blank space’ stands out as a stark affront to imperial
mastery, and a source of ongoing frontier insecurity, which as we have seen was a key driver of exploration and the scientific imagining of the mountains across this period.

The production of these sorts of global and comparative images was given considerable impetus, if not actually invented, by Alexander von Humboldt with his ‘Tableau physique des Andes et pays voisins’ and accompanying Essai sur la géographie des plantes (1807). Indeed, Henrich Berghaus worked closely with Humboldt, and his atlas was originally intended as a visual counterpart to Humboldt’s later work Cosmos. Jon Mathieu is thus right to suggest that with Humboldt’s ‘generation there began a new phase in the globalisation history of natural observation and especially mountain perception,’ even if, as this thesis has demonstrated, accounting for Humboldt’s influence and place in this story is a complex issue. As Mathieu continues, envisioning mountains as a global category was not inevitable and ‘it takes some imagination to bring them together and to see them as one distinct region on a global scale’ and ultimately, ‘the idea of viewing these regions as a universal whole does not arise through simple observation.’ Indeed, as we have seen, whether in hauling instruments to high points, drawing vertical sections, or hunting fossils in bazaars, making the mountains globally commensurable required enormous amounts of labour, both intellectual and physical. Whatever these impetuses towards a global picture, however, it is worth remembering – as Thomas Simpson reminds us – that because mountains ‘have rarely if ever seemed lifeless or inert … no variant of modernity has flattened them through entirely subsuming them into universal schemes.’

This is not to say that atlas makers did not try, squeezing the world’s mountains onto a single page and asserting an encyclopaedic sense of the known. Especially from the 1810s onwards, all-encompassing comparative tableaux of mountains (and often also rivers) enjoyed considerable popularity in European atlases, and were circulated widely by the middle of the nineteenth century. Perhaps the most fully realised example of this style can be seen in Fig. 6.3:

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2 Humboldt and Bonpland, Essai Sur La Géographie Des Plantes.
3 See Rupke, ‘Humboldtian Distribution Maps’, 95–96. Rupke also notes that ‘Humboldt’s global approach has been interpreted as non-ethnocentric, equitable and holistic. Yet the Humboldtians used distribution maps in a way that underpinned Eurocentric and imperialistic perceptions of the world, and, within Europe, the cause of the nation-state.’ Rupke, 93. For more, see among others Godlewska, ‘From Enlightenment Vision to Modern Science?'; Romanowski, ‘Humboldt’s Pictorial Science’.
4 Mathieu, The Third Dimension, 22.
5 Jon Mathieu, ‘Globalisation of Mountain Perception: How Much of a Western Imposition?’, Summerhill: BAS Review 20, no. 1 (2014): 8. As Mathieu continues elsewhere: ‘the history of European mountain perception has in many ways followed the history of colonial and imperialist expansion. This is evident already in terms of periodisation and general orientation. First the European observers looked to the West, where, above all, the sprawling mountain system of the Andes drew their attention. In Asia, territorial dominance came only later and with greater difficulty. This was an important reason why the highlands of central Asia became objects to be surveyed only in the nineteenth century.’ Mathieu, The Third Dimension, 30.
7 These then declined and disappeared in the later nineteenth century, as topographic approaches centred around watersheds became preferred. For more on the production of these tableaux, see John A. Wolter, ‘The Heights of Mountains and the Lengths of Rivers’, The Quarterly Journal of the Library of Congress 29, no. 3 (1972): 186–205; Mathieu, The Third Dimension; Jean-Christophe Bailly, Jean-Marc Besse, and Gilles Palsky, Le Monde Sur Une Feuille: Les
This evocative and stylised image depicts elevational relationships of all kinds, from the line of perpetual snow through to Joseph Louis Gay-Lussac’s famous hot air balloon ascent to 23,018 ft feet over Paris in 1804. Alexander von Humboldt’s high point on Chimborazo is clearly marked, although unlike in Fig. 6.1, the Gerards’ competing elevational record is not. Just as in Berghaus’s *Atlas*, Dhaulagiri is here depicted as the highest mountain in the world (it is now known to be the seventh highest). Produced in 1836, only around twenty years since Chimborazo had been displaced as the world’s ‘highest’ mountain, this tableau indicates just how rapidly the vertical globe was evolving in the first half of the nineteenth century. However, that this is a snapshot of a mountain world in the making is unacknowledged, because to do so would be counter to purpose.

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8 This version was based on an image originally made in 1829. See also Mathieu, who notes that in this style of tableaux, ‘the mountains are all lumped together and form a kind of global mountain.’ Mathieu, ‘Globalisation of Mountain Perception’, 12.
Indeed, while these comparative tableaux present an ordered and orderly world, they belie the way understandings of the vertical globe remained in flux, not least because of ongoing efforts to fit the unprecedented heights of the Himalaya into the picture. This is graphically illustrated by an updated version of the ‘Umrisse der Pflanzengeographie’ produced in 1851, and seen in Fig. 6.4:

Fig. 6.4. Revised ‘Himalaya’ section of the ‘Umrisse der Pflanzengeographie,’ produced in 1851 and published in the 1852 edition Berghaus’s Atlas. Heinrich Berghaus, Dr. Heinrich Berghaus’ Physikalischer Atlas, 2nd ed. (Gotha: Justus Perthes, 1852).\

In this version of the image from 1851, Kanchenjunga – by this time measured and confirmed as higher than Dhaulagiri – is awkwardly tacked onto the original profile (see Fig. 6.1 above). Inserted on the side and behind, it appears as a clumsy addition to the original artistic rendering. Little did the

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10 Jon Mathieu notes this problem more broadly in the production of tableaux, and that when it became apparent that the Himalaya were higher, publishers had to adapt and ‘for economic reasons, the giants first appeared only near the margins of the page, to avoid having to redesign the entire composition. Then, however, truly new representations of the global ensemble were designed and made accessible in many different versions.’ Mathieu, The Third Dimension, 32.
11 There is also an 1854 version of the profile, this time substantially redrawn with Kanchenjunga in the middle, and Herbert and the Gerards deleted for ‘Hooker, Thompson, Jacquemont, Royle &c.’ This was titled ‘Geographical
artist know, however, that in less than five years the Himalaya would have to be redrawn again, and space finally made for Sagarmatha/Chomolungma – or as we now know it – Mount Everest. Kanchenjunga is not, however, the only addition and the by this time celebrated Pindari Glacier (see Chapter 3) has been inserted, flowing down into the vegetated zone, as has the lake of Rakas Tal, now surveyed by the Strachey brothers (see Chapters 1 and 5). As these sometimes-awkward additions indicate, the Himalaya were constantly being made and remade, as new measurements and specimens were acquired, and new scientific theories rose and fell. In the updated image, the names of Richard Strachey and Joseph Hooker, whose contributions to Himalayan biogeography and geology occurred after the original profile was produced, have also been added onto the bottom of the frame. (Notable names remain absent, especially Victor Jacquemont and William Griffith, perhaps reflecting the state of their collections following their untimely deaths in Asia.) With these additions, different generations of travellers are nevertheless linked, and presented as contributors to a supposedly coherent project. Indeed, beyond simply failing to account for a vertical globe in flux, these images suggest a completeness to imperial and global visions and actions that are belied by the heterogeneity of the perspectives – from French savants to Scottish surveyors – that produced them. These images present a homogenous picture of a mountain world, glossing over the way it emerged from and for disparate purposes: imperial and scientific, aesthetic and cultural, religious and economic.

Perhaps even more significant than what is added, however, is the way that imposing global commensurability brought about multiple erasures, both intentional and unintentional. As the preceding chapters have demonstrated, the appropriation of botanical, geological and physiological knowledge about the mountains was beset by uncertainties, especially around scales and frontier insecurities. Bourguet, Licoppe and Sibum argue that in this period ‘both geographical distance and cultural diversity came to be regarded as obstacles to scientific practices when they would not allow for meaningful comparisons. Instruments, measures and data were meant to travel and provide templates for standardisation.’ However, this thesis has spent much of its length demonstrating and explaining the many ways that constituting the global sciences of mountains in this period was laborious and prone to breakdowns. Travellers’ bodies were pushed to and beyond their physiological limits, and operating in the mountains required mobilising large expedition parties and negotiating with stubborn border guards. In this context, expedition sociability and frontier politics often reveal the limits of explorers’ mastery, whether in the discarding or theft of geological samples, or in the inability to take instrumental measurements for fear of detection. In focusing on displaced locations in the high mountains and decentred institutions, this thesis has shown that breakage and repair, limited

resources, and theorisation without access to the most up-to-date journals was endemic to scientific practice in the mountains. These atlases erase such moments of disconnection and failure in preference for an orderly and aesthetic sense of completeness. As we see in the images above, making the Himalaya into a high mountain ‘type’ capable of being compared globally necessarily meant erasing both ongoing uncertainties and the laboriousness of knowledge making in the mountains themselves. The messy and contested way science was practiced in response to the human and nonhuman worlds of the Himalaya is here suppressed, if not entirely deleted. These self-consciously global visions thus allow for the erasure of locality and the imposition of commensurability that made global comparisons possible, but they also occlude half of the story.

Most insidiously, these erasures are not equally applied. One of the key threads running throughout this thesis, in both argument and structure, has been the centrality of Asian expertise and labour to the making of the mountains. Making the Himalaya global involved locating, identifying and moving literally tons of material – dried and live plants, stuffed and pickled animals, rock and fossils, notebook and journals – both into and out of the mountains. Similarly, knowledge of fossil locations, the availability of firewood for safe travel, and changes in the perpetual snowline over generations all depended on the expertise of Himalayan peoples. In this period, scientific practice was thus overwhelmingly reliant on eclectic networks of Bhotiyas, Lepchas and Tartars, all of whom are rendered invisible in these comparative tableaux. As we have seen, some explorers like the Gerards, Royle and Hooker survive the transition to these global atlases (even if the laboriousness and inconsistency of their enterprises does not). The many Asian actors we have met in this thesis – from Hari Singh to Murdan Ali, and Pati Ram to Rechu – are, however, entirely effaced. The practical, everyday interactions by which expeditions and institutions functioned have disappeared from the picture. Similarly, the ongoing cosmological significances of the Himalaya in South Asian traditions – such as Nanda Devi as site of pilgrimage or Rakas Tal as a place of scripture – are here overwritten and subsumed within a language and framework of scientific biogeography.

Paraphrasing Haitian academic Michel-Rolph Trouillot, there are multiple places at which silences enter our histories. In this context, the production of knowledge in the mountains is one, these atlases represent another, and the creation of the archives is a third (my choices in this thesis undoubtedly represent a fourth). If we have seen many small and large moments of silencing in the journals and fieldbooks of travellers and surveyors, in these atlases we see silencing on an even greater scale. However, as Trouillot continues, if there are multiple places at which silences originate, then this also means that there are multiple places at which silences might be recovered (however unequally and imperfectly). This thesis has sought to historicise the global sciences of mountains, and in turn historicise particular forms of the global. It has demonstrated that the global was made – sometimes

painfully and laboriously – as much as it was found. These atlases indicate, however, that the idiosyncrasy of local practice and Asian agency were ultimately anathema to imposing global visions. The constitution of global mountains in this period was thus both an intensive exercise in material terms, but also an intensely imperial form of globality predicated on erasure and silencing.

Marginalising Uplands

This story has been anchored in the early nineteenth century, when increasing imperial access and insecurity around the limits of knowledge converged in the Himalaya, in tandem with the recognition that they were the highest mountains on the globe. By the time we reach the mid-century and this study takes its leave, some of the imaginative incoherence around the mountains that characterised this early period had been alleviated (even if imperial anxieties remained largely unabated and particular scientific questions, such as around latitude and tropicality, continued to vex the coherence of the Himalaya’s place in a global mountain world). Medical topographies had been sketched, but acclimatisation remained little understood. New ascents were contemplated, but the summits continued to elude both naturalists and climbers. Uniformitarian explanations were increasingly adopted, but plate tectonics was not yet in geologists’ toolboxes. Looking forward, a degree of mid-century confidence in the coherence of the Himalaya would give way to later-century doubts about whether the mountains were truly knowable at all. Intractable limits to operating in decentred spaces of science, and ongoing dependency on labour and expertise meant mastery continued to prove elusive. Likewise, topography and politics continued to circumscribe knowledge production, and to impose limits in the mountains (sometimes magnified by the machinations of the so-called ‘Great Game’). Most notoriously, Tibet remained unattainable. As Scottish traveller Andrew Wilson (1831-1881) noted in his *Abode of Snow* (1875), any traveller kicking at its ‘doors’ was ‘likely to find himself suddenly going down the mountains considerably faster than he went up them.’

From the mid-century onwards, global comparison remained a key lens for unlocking the mountains, even as it was reconfigured. Equivalency was increasingly assumed, even if material realities continued to make this sometimes hard to reconcile. The topography of the vertical globe nevertheless evolved less rapidly – brief late-nineteenth century rumblings of the possible superiority of K2 over Everest notwithstanding – as more and more elevations were secured and confirmed (even while associated political and imaginative framings remained malleable and contested). More travellers also had opportunities to visit different ranges in person, and this brought about new configurations to rhetorical claims for authority (even as they drew on the language of the verticality consolidated earlier in the century). As Andrew Wilson continued, ‘I have had the privilege of discoursing from

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14 See Bishop, *The Myth of Shangri-La*; Simpson, “Clean out of the Map”.
and on many mountains – mountains in Switzerland and Beloochistan, China and Japan – and would now speak,’ a lofty pedestal not afforded to many of those we have travelled through the Himalaya with in this thesis. Meanwhile, tourism and mountaineering, in both discourse and practice, added to the available vocabulary for interactions with the Himalaya. While beginning in the period of this study – as evident in travels like those of James Baillie Fraser – these practices took on new significance in the second half of the nineteenth century. In particular, hill stations emerged as important centres of governmentality and medicine, and the higher mountains increasingly served as canvases for imperial leisure, and the performance of hunting and sporting prowess.

In summing up this increased access, Andrew Wilson wrote that ‘the change in modern travel has brought the most interesting, and even the wildest, parts of India within easy reach … nowadays, old ladies of seventy, who had scarcely ever left Britain before, are to be met with on the spurs of the Himálaya.’ In this gendered lament, Wilson comes across as vaguely disappointed, his words anticipating turn-of-the-century anxieties around the filling in of the last ‘blank spaces’ and Joseph Conrad’s gloomy reflections on an era of ‘Geography Triumphant.’ The opening up of the mountains thus heaped even greater imaginative resonances on Tibet, and those high places that remained isolated. As Wilson noted, ‘the valley of Spiti is secluded in such a very formidable manner from the civilised world that it has very few European visitors’ and elsewhere remarked that it is ‘tolerably well raised out of the world.’ In such formulations, it is significant that the lowlands are the ‘civilised world’ and the uplands of the Himalaya are a place beyond, and a land apart. This imaginative geography of Shangri-La type isolation and ‘sanctuary’ increasingly appealed to the imperial imagination in the period after the mid-century. Though not necessarily negative – being seen as spaces of purified air and insight, free from disease and political corruption – these were nevertheless heavily ‘othered’ places. If the earlier period provided the tools for privileging a vertically oriented view, and the language to describe human and nonhuman worlds in three dimensions, we see here some of the consequences of enshrining the lowlands as the point of reference.

It thus becomes necessary to return now, one last time, to the high spaces of the Himalaya, and to consider the implications of imposing not only global commensurability, but also distinctions between uplands and lowlands. While the mutual formulation of the Himalaya and the global sciences of mountains has been the key thread running through this thesis, the mutual formulation of the Himalaya and the subcontinent is no less important. Placing bodily performance, the possibilities for

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16 Wilson, 3.
17 Wilson, 5.
18 For more on Conrad, and the longue durée history of this tension between ‘Geography Militant’ and ‘Geography Triumphant,’ see Driver, Geography Militant, 3–8.
cultivation, and the occurrence of glaciers into a globally commensurable framework was not a priority for those who had long traversed the high passes, farmed the valleys and navigated the masses of moving ice. This study has thus been about the making of the Himalaya as a high mountain ‘type,’ even while acknowledging the potential lack of coherence of this concept to many of the historical actors. Indeed, the idea of the ‘Himalaya’ would not necessarily have been meaningful or useful to those who lived in the mountains. To gaze down on an image of a contiguous mountain belt from on high is, after all, the conceit of a modern observer (or perhaps, as we have seen, a mid-nineteenth century European atlas maker). More broadly, taking this perspective might also inadvertently perpetuate Eurocentric legitimisations of empire, and lowlanders’ perceptions of their own cultural and civilizational superiority.

Indeed, homogenising uplands – whether as spaces of shared experience or as commensurable within global frameworks – was central to the process of ‘othering’ that confirmed the mountains as the margins. The area that this study has encompassed is hugely diverse in terms of demography – linguistically, ethnically, culturally and religiously – as well as in terms of climate and environment. Any simplistic distinctions between upland and lowland geographies and populations thus elide great deals of difference. As Chetan Singh argues, ‘the study of mountain societies has usually carried with it some implicit assumptions. To begin with is the commonly held view that mountainous physiography was itself reason enough to delineate highlands as distinct geographical regions’ such that even ‘unconnected and distant highland cultures’ have often been seen as related and ‘their difference from non-highland regions has come to be perceived as the basis of similarities.’ He goes on to note that ‘even though they occupy a position of considerable significance in the popular imagination of most South Asian societies, the Himalaya have remained marginal in almost every other respect.’ While simultaneously the cosmological home of the gods (conveniently ignoring heterodox religious practice among the highlanders themselves), the geographical source of life-giving rivers, and the barrier that could protect empires, the Himalaya and their peoples were long considered peripheral. The global scientific visions and imperial insecurities that were applied in the early nineteenth century only amplified this, as new imaginative geographies of the mountains enshrined the worldviews of their lowland makers.

In this thesis, ‘Zomia-thinking’ has helped to frame the perspective of the Himalaya when viewed from the subcontinent and vice versa, even while acknowledging significant heterogeneity.

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21 See Michaud, ‘Editorial – Zomia and Beyond’; Shneiderman, ‘Are the Central Himalayas in Zomia?’
22 Singh, Recognizing Himalayan Diversity, 1. He expands on this to note that a ‘primary tension persists’ in that ‘the Himalaya certainly stand apart as a large identifiable region … but can anyone speak for the Himalaya as a whole? Are not the diversities within the region too obvious and distinct?’ concluding that ‘this is an incongruity that requires us to simultaneously recognise the Himalaya as an entity and each of its diverse constituents as an identity.’ Singh, 11. He also argues that ‘studies of specific mountain areas have almost invariably been contextualised within an integrated picture of highlands in opposition to an ‘other’ – the lowlands.’ Singh, 2–3.
23 Singh, Recognizing Himalayan Diversity, 3.
within these perspectives. It has pointed to the way that the mountains could, in a sense, only exist when constituted simultaneously and in contrast with the lowlands. This early phase of the imaginative constitution of the Himalaya as a high frontier was thus inevitably entangled with the accelerating imperial appropriation of the subcontinent, which – by default – cast the mountains as peripheral. Whether in applying horizontal divisions of latitude to vertical changes in vegetation, delineating ‘normal’ bodily reactions to the atmosphere, or determining the location for a ‘northern’ garden, the lowlands remained the point of reference. The mapping of these phenomena through the norms of the plains (and of temperate Europe) was as pervasive as it was ultimately insidious. Indeed, the imaginative, scientific and political engagements with the mountains that this thesis has traced ultimately only served to confirm them as marginal spaces and peripheral places.
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