EDITED BY
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POLITICAL GEOLOGY

ACTIVE STRATIGRAPHIES AND THE MAKING OF LIFE

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Adam Bobbette · Amy Donovan
Editors

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Political Geology: An Introduction

Adam Bobbette and Amy Donovan

What Is Political Geology?

This volume delves into the politics of the earth. It aims to shed light on the mysterious forces within the wider discourse of geopolitics, thinking through the geological aspects of "vertical territory" (Braun 2000). It will expose the political to geologists with their rock hammers, seismometers, compasses, and maps, their multiple ways of making sense of the density and movements of what is below us and often too old and slow-moving for us to grasp, and that may be more readily explored in art and literature (Grosz 2008). It will also open geopolitics to the sensory capacities of geophones and tilt meters, plumb lines and rain

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gauges and consider how geologists, with their tools, expedition equipment and teams, are themselves politicians operating in spaces, on behalf of others, and seeking authority (Coen 2013; Donovan and Oppenheimer 2015a; Hopwood et al. 2010; Rudwick 1985; Schaffer 2003; Shapin and Schaffer 1989). It follows these geologists as they enter into the depths of the *geos* of politics, its strata, veins, and structural tectonics, and exposes how politics moves—its frictions and alliances; and how its structures form and endure. The premise of this is to create a productive, generative symmetry between geology and politics that can be understood both as the politics of geology and the geology of politics.

The classical, and now often criticized, conception of the basis of geopolitics, drawing on the modern legacy of geographers such as Friedrich Ratzel, claimed that "the basic concept is that the state is a particular spatial grouping on the earth's surface" (Dickinson 1969: 69). In this framework, the earth is a surface upon and across which unfolds the dramas of sovereign territories and their politics. Critical geopolitics (Dalby 1991; Tuathail and Agnew 1992) challenged this framework, demonstrating the hidden assumptions and biases of flat representations of the world—and feminist geopolitics has interrogated the everyday implications of geopolitical machinations (Hyndman 2001). More recently, political geographers such as Bruce Braun (2000), Stuart Elden (2013), and Gavin Bridge (2014) have added thickness to this horizontal scope by demonstrating how state space is constituted vertically and the depth of political processes extend into and through the geos, while feminist geopolitics has also embraced the material world (Dixon 2016).[1] Social and political space, in these renderings, is fundamentally geological. This means, more familiarly, that the basis of politics is in geological resources such as fossil fuels, minerals, and sand and is ordered by their appropriation,

[1]There is also much work showing the deep connections between nineteenth century geographical thinkers and the influence of mining engineering and techniques of conceptualising resources. This is to say that the epistemology of the *geos* as a superficial entity was often in a complex dialogue with other ways of framing it. Consider for example the influence of Humbolt's mining work on his own vertical conception of territory and habitat (Anthony 2018). See also Guntau (1996) "The Natural History of the Earth".

processing and distribution; but less familiar is the suggestion that geology too emerges in and through political processes, as it is demarcated, framed, and becomes an object of knowledge. This volume engages both of these processes as they reach the subsurface and the substance of geology: the earth's organization into strata, and the depth of geological time and transformation—territory in four dimensions (Bridge 2014). The essays here engage the contact zones between politics and the gradual but incessant transformation, production and destruction of the earth's surface. We intend this volume to contribute to how we understand the relationship between politics and geology by pressing on the nature of their relationship: to ask what its substance is and how it has defined and continues to define our world and what is possible in it.

It is only recently that political geology has emerged as a framework concept. In 2012, a symposium was organized under the title, "Political Geology: Stratigraphies of Power" at Lancaster University in the Centre for the Study of Environmental Change that brought together (mostly) geographers. This was followed by two workshops with the title given to this volume, "Political Geology: Active Stratigraphies and the Making of Life," in the Department of Geography, University of Cambridge in March and November 2017 that brought together the historians of science, theologians, anthropologists, political ecologists, and human geographers whose papers form the basis of this book. There has also been a slow emergence of the term in published papers as its analytical work begins to circulate and gain purchase (Swanson 2016; Barry 2017). For the most part, the term has been taken up by anthropologists and geographers, and as keywords can do when they begin to work, they do not invent whole cloth but channel existing energies and intuitions around them to make something newly sensible; in other words, to focus discourse and cross disciplinary registers: "they clear a way through the complex and opaque" (Amin 2016).

One of the influences on political geology, as Nigel Clark, Bronislaw Szersynski and Simone Kotva demonstrate in their chapters here, has been the fruitful debates around the Anthropocene: a proposed geological epoch that explicitly acknowledges human impact on the stratigraphic record (Crutzen 2006). This has had profound implications for the ways that social scientists, humanists,

and scientists conceive of humanity's relationship with the planet, the history of politics in relation to geology, and how we inherit the legacies of Enlightenment humanism as it puts humanity on a par with the geological (Castree 2014; Dalby 2007a; Johnson et al. 2014). It also raises difficult questions about scientific and technological development and the human conquest of the earth—and of other humans. The term was first proposed by Paul Crutzen in 2000 in the halls of geological societies and the International Commission on Stratigraphy, but it quickly opened the science of stratigraphy to social and political questions (Castree et al. 2014; Palsson et al. 2013; Szerszynski 2012, 2017a, b). By 2014, the Anthropocene was a keyword in the social sciences and humanities, speaking to pressing political, social, environmental, and geohistorical issues (Clark 2014; Clark and Yusoff 2017; Dalby 2007b; Johnson et al. 2014; Lorimer 2012; Lövbrand et al. 2009). It resolved controversies within the social sciences and humanities raised by postmodernism and post-structuralism because the Anthropocene was a scientific framework developed by geologists and other solid-earth scientists that was redefining the human and presenting, as Jamie Lorimer (2012) has put it, "a more-than-human politics". It seemed like the twilight of the modernist ontological distinction between humans and nature—and was sanctioned by scientists themselves: those whom social scientists, including Bruno Latour (2017), had argued were central in developing that distinction in the first place. Voices from establishment science were proposing the notion that the human was a geological force that would leave a trace in the stratigraphic record: the human would become one more layer of material among materials. As of the publication date of this collection in 2018, disciplinary formalities and debates are still to be resolved before the Anthropocene is officially adopted into the nomenclature of the geological sciences; and in the meantime, much of the fevered pitch of its original moment has settled as the term has saturated the academic industry and spilled into mass media films and newspapers.

Political geology has been galvanized by this flourishing of geological discourse brought on by the Anthropocene because it has surfaced new vocabularies. It has turned a new generation of social

scientists and humanists onto scholarship in the history of the geological sciences as they have sought to understand how it came to be that the West understood what geology was, how the stratigraphic record became a narrative of the earth, and the role of geologists in shaping the imaginaries of what the earth is and how it works.[2] In this volume, this recent legacy is clear to see as scholars are taking stock of the impact of the Anthropocene as a redefinition of what it means to be human and therefore of what constitutes politics. In this respect, it has a clear home in the recent theoretical moves towards materialism and Deleuzian philosophy, under a critical realist ontology (DeLanda 2006; Deleuze and Guattari 1988; Grosz 2008).

Another reason for the emergence of political geology lays in the recent troubling of the distinction between the geological and biological (Whatmore 2006). The conventions of the modern Western sciences did not come to be organized according to this distinction until the nineteenth century, with the biological sciences concerned with "life", its genesis, transformations, and structures, while the geological sciences have generally been concerned with "non-living", inorganic things, and "once-living" things as they reconstruct the past environments of life.[3] Discourses around the Anthropocene, because of their insistence on the interweaving of the human with the geological, the living with dead matter, have emboldened rethinking this division and making clear that it is both an ideological and political one as much as a historical one (Whatmore 2006, 2013). Scholars have asked, why and how did this distinction come about? What are its stakes and who benefits from where the line is drawn? How does governance operate through the difference, and how is the realm of politics itself constituted by this distinction? How does it make possible the fundamental distinction between what constitutes the human and non-human, nature,

[2]For example, Martin Rudwick (1985), James Secord (1990), and Stephen Jay Gould (1990) are among many other scholars working in the history of geology and earth sciences that have been read lately by social scientists and humanists.

[3]Natural scientists of the eighteenth century did not recognize this distinction though they worked with today's geological material. See: Martin Rudwick, 'Minerals, strata and fossils' (Rudwick 1996: 266).

and culture? The chapters in this volume for the most part take a critical stance to this distinction by historicizing it or showing the porosity between the *geos* and *bios*—as Deborah Dixon does as she describes Hashima as an imperial accretion involving geological violence to human bodies; and as Adam Bobbette argues in his chapter, suggesting that the distinction of *geos* and *bios* is culturally and geographically determined. The distinction between the *geos* and *bios* is, as the chapters ahead attest, an epistemological, political and material matter of concern at the centre of political geology.

The rest of this introduction expands on these core premises by outlining the three main themes of the volume: epistemology, modernity, and the future. These also define the structure of the book. In doing so, we set out to characterise political geology as defined by neighbouring and overlapping sets of problems. Political geology does not have a single method or discipline; it rather has common concerns and traditions that energize it.

Political Geology of Knowledge

The first axis that characterizes the essays in this volume is an engagement with the history of the Western geological sciences as a complex architecture of epistemological practices. This means understanding these sciences as ways of knowing and speaking for the earth—as Rachael Tily does in her article here on geomorphological practices at Oxford. Her political geological enquiry stresses both the mechanisms and embodied practices that bring about particular ways of knowing the earth, and the social relations that constrain and make them possible, open or foreclose them.

Before the emergence of the modern split between *bios* and *geos*, natural historians were concerned with how rocks, mountains, landscapes and fossils have told the story of Earth, its changes, and structure (Rudwick 1996, 2005). The emergence of modern geology introduced new narratives of the age of the earth and ideas of species extinction, and later laid the groundwork for Victorian theories of

biological species modification and descent through time.[4] Geologists sought to put what often appeared obstinately static—rocks—into motion and because of this, the earth sciences have been sciences of learning how to see and sense (Rudwick 1976; Hopwood et al. 2010). To understand the significance of this to the sciences, consider as an example the Prussian geologist Eduard Suess' *The Face of the Earth*, published in English in (1904) in four volumes, as a "comprehensive work… devoted not to the formulation of laws, but to the comparison of observations scattered over the whole earth…" (iii). In the frontispiece to volume one, the reader holds a massif of the central Indian Himalayas in their hands with each of its peaks notated: "S = Silurian, C = Carboniferous, P = Permian, T = Triassic (ii)" naming their epochal origin and representing them through unique detailing of their textures and forms (Fig. 1.1). The linear order of their placement gives the appearance that they are stacked in a row like books on a shelf. This simple, clear and precise arrangement was crucial to the effect of the drawing: the compression of space, time and material. As Bruno Latour (2013) has argued, these aesthetic tools are mechanisms for seeing and acting with places at a distance; of displacing places for us and transporting us to other places. They make the earth sensible as a story of material transformations that can be registered by the human body, while opening the body outwards to the expanses of geological time.

The differences in the liveliness of the earth between places were also the subject of considerable investigation as the extent of geological time became clear. Take for example the debates over the origins of basalt—a dark-coloured volcanic rock, found all over the world. In the mid-eighteenth century, the dominant view of the earth's interior was that it was filled with water (Young 2003) and that lava was

[4]As Martin Rudwick has shown, this transition did not take place in a simple way that replaced one story with the next; Western geological narratives were made by scientists, priests and learned men of the clergy in ways that did not contradict religious doctrine; see Rudwick (2005, 2009) for a full account of "the differentiation of properly distinct spheres of enduring meaning, both scientific and religious". See also Gould (1987) on the relationship between science and religion in geology.

FOLDING OF STRATA ON ONE SIDE OF A TRIBUTARY TO THE RAMADHURA GLACIER, LISSAR VALLEY, DHARMA VALLEY, KUMAON
S = Silurian, C = Carboniferous, P = Permian, T = Trias, in the middle of the picture folded into the dark Permian beds
Highest visible peak about 21,000 feet
After a photograph by C. L. Griesbach, communicated by permission of the Director of the Geological Survey of India

Fig. 1.1 Plate 1.1 from Suess' *The Face of the Earth*

formed from heating of coal seams. As the century progressed, links were made between the basalts of Giant's Causeway and the Massif Centrale in France, suggesting that basalt may be of volcanic origin. James Hutton, however, came to the conclusion that basalt was a plutonic rock—formed from the cooling of melt deep in the earth. These three schools of thought—neptunist, vulcanist and plutonist—were played out and contested alongside the sensible eruptions of Vesuvius and Etna in the late eighteenth century, and the geographical investigations of geologists such as George Greenough (Rudwick 1962), George Poulett Scrope and Leopold von Buch (Young 2003). These scientists, like many others, toured Europe and witnessed eruptions of living mountains—feeling the heat and describing the moving productivity of the earth. They learned geology through their senses, by making comparisons across space of the shapes, chemistries, and appearance of different rock formations. Indeed, the

Fig. 1.2 Plate XXV from William Hamilton's Campi Phlegraei, showing Hamilton himself at the crater Forum Vulcani, examining the hydrothermal activity

neptunists were ridiculed in part because they had "never visited volcanic countries": they therefore lacked the experiential knowledge required to interpret the earth (Pinkerton 1811, in Young 2003: 51). William Hamilton (1730–1800), often cited as the "first volcanologist", undertook extensive study of the Neapolitan volcanoes (Fig. 1.2). He also visited the newly discovered towns of Pompeii and Ercolano (Fig. 1.3), in which the remains of past, flourishing societies were entombed in rock and now formed part of the stratigraphy. Ascents of Vesuvius became regular activities for Hamilton and his friends, and for many other visitors to Naples who wished to see and sense the volcanic activity themselves (Vesuvius erupted regularly between 1631 and 1944).

As sense-making techniques, the geological sciences are inseparable from forms of media and representation which have co-evolved with other forms of media and representation (Parrika 2015). This means more than that the science of geology relies on representation to do its work; it also means that the earth itself is a form of media. Many early naturalists and geologists, including Hamilton (Sepkoski 2017) understood the earth to be an inscription surface, like a vinyl record

Fig. 1.3 Plate XLI from Campi Phlegraei, showing the Excavations of Pompeii (the Temple of Isis)

or wax cylinder; or as a kind of giant colonial bureaucratic filing cabinet that echoed the cabinets that gentlemen natural historians kept their geological samples in. Notions of the cabinet, box, crate, and other systems of ordering, archiving and transporting geological samples mirrored the very understanding of the earth as itself a filing system. The transformation of concepts of aesthetic serialization in the eighteenth and nineteenth centuries in the scientific and engineering disciplines informed the idea that the subsurface of the earth is also a serialized object, stacked in stratified layers (though often a turbulent one [Young 2003]). Geological modes of representation included the burgeoning media of photography and cinema, in which the serialization of discreet units created representations of movement and transformation in time. In the early twentieth century, many geologists relied on multiple visual and rhetorical strategies to bring alive the movements of the earth. One example is that of the great Dutch-Indonesian geologist Reinout Van Bemmelen (1949), who, in his two volume *The Geology of Indonesia*, employed, like others at the time, a combination of photography, cross section, axonometric, plans,

maps, and diagrams, to create a kind of animated portrait in book form of the deep historical evolution and change in the Indonesian archipelago. Historians of geology have shown how these techniques of representing the interior of the earth came to be considered self-evident representations of what happens underground, instead of an active engagement with wider technological practices and ideas about the capacities and limitations of representation (Daston 2007, 2017; Secord 2018).

The geological sciences have long been productively contaminated by these adjacent aesthetic practices even if those sciences project an image of purity (Oreskes 1999). This is one of the ways that geology is political: through what it makes sensible and what it excludes; how it allows the *geos* to become an object of understanding; and how the tools through which it achieves that shape and bring into being what can be understood. Interpreting the geological sciences through its representational practices then also means understanding how those practices circulate among other knowledge practices and reproduce them. This is important because there has long been a struggle to represent the *geos*. One example is the turn in Western geophysics towards laboratory-based work alongside technical fieldwork, rather than observation alone, in the second half of the twentieth century. The French volcanologist Haroun Tazieff was one of protagonists of this debate. He had significant popular appeal throughout the 1950s until the 1980s as a prolific producer of volcano films and often included himself as the presenter and heroic scientist figure circulating, probing, sampling, and pontificating on ridges and outcrops of the world's most famous volcanoes. Even Jean-Luc Goddard celebrated Tazieff's films in the *Cahier du Cinema* in 1985 when he positioned his scientific work within a trajectory that led from Renaissance painting to avant-garde cinema:

> …showing the underwater eruption of the volcano in the Azores, graces with such a terrifying richness of forms that only Tintoretto would have dared to paint it, and by showing us a river of lava twisting

> through a cauldron of purple and gold, [Tazieff deployed] colors that Eisenstein alone dared to use in the banquet of *Ivan the Terrible*…[5] (Conley 2014)

It is in these shifts between the borders of art and science that we can see the controversies of contemporary earth sciences waged. It was Tazieff's rival Claude Allègre who championed the drive for precision and exactitude that field instrumentation and laboratory work promised when he eventually expelled Tazieff from teaching at the Institut de Physique du Globe de Paris where Allègre was the head. In a debate that circulated through newspapers, the pages of *Nature*, and on French television, Tazieff was accused of irresponsibly misleading the public about a potential eruption of Soufrière volcano in 1976, when he argued, based on his first-hand experience travelling up and down the volcano, that it would not dangerously erupt. Allègre instead pointed to information from an inexperienced colleague that volcanic rock had reached the surface and recommended an evacuation of the population on the slopes—an evacuation that turned out to be costly and unnecessary, but that was arguably justified in an uncertain context (Hincks et al. 2014). Allegre and his supporters framed Tazieff as "overwhelmed by modern science"—meaning pushed out.[6] Such debates were driven in part by a crisis of legitimacy in the earth sciences as they competed with the dominance of physics and mathematics (Oreskes 1999). In order to appear to be an "exact science" with the authority to manage populations, the earth sciences would have to produce the authority of exactitude. This transformation affected the representations of the *geos* as it became a numerical model inside computers—and a laboratory of its own right in the field—and a whole new generation of geologist technologists swept through the fields of the earth sciences.

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[5]For the original see Godard, Jean-Luc (1959: 53–55) "Le conquérant solitaire". *Cahiers du cinéma*, March.

[6]M. Mattauer, in a circular sent to representatives of the Institut. He was subsequently sued by Tazieff for defamation—for details, see the timeline http://www.ipgp.fr/~beaudu/soufriere/forum76.html (in French).

The plural knowledges that make up the modern Earth Sciences thus emerged in an active and lively *geos* that was itself in conversation with the sciences. Earth science courses today emphasize field work even as they also embrace numerical models, experimental petrology and high-precision measurement. Seismometers, tilt meters, and spectrometers sit on the sides of volcanoes all over the world, constantly recording their heartbeat and listening for periods of heightened activity. Field experiences are part of the activity of geologists—and, for many, a reason for remaining in the discipline—but they are accompanied by long periods of laboratory work or computer modelling that seek to measure and detail the intricacies of rocks, fault lines and continents. Such models and measurements lead to the products of geological science, in the form of maps and charts—many of them three dimensional and colourful in their depiction of the past, present, and future of the *geos* for human consumption and reworking. An important example of this is resource geology: the identification and representation of potentially lucrative mineral deposits or energy sources, as charted by Kärg Kama and Magdalena Kuchler in their paper. The history of exploitation of earthly resources is particularly politically rich, evidencing the geopolitics, imperialism, and brutality of past and present cultures. An example of this in a post-colonial context is given by Deborah Dixon, as she argues for a feminist political geology in her chapter.

The political geology of knowledge traces how the geological sciences have made the *geos* knowable and sensible as a political dimension of the science of geology. It shows that representing and acting at a distance have been a part of demarcating the differences between society, culture, nature; and that representing the *geos* is a process of articulating the relationship between nature and culture, and of constituting and managing their differences. As we have long known, representations are never neutral, and they are shaped by the technological histories, the tools available and the ecology of representations at a particular cultural moment. Political geology takes the representational techniques of geologists seriously as a window onto the politics of how and what we know of the *geos*.

*A*modern Political Geology

This story of modern geology and its representations, as is often the case, has been told as if it were a Western one. And like many of the other modern Western sciences, it has been told as though it was diffused through a West-to-the-Rest movement, from the centres of imperial knowledge outwards. Charles Darwin's accounts of how Charles Lyell helped him to see the deep history of the landscape while he was on the Beagle stand out as just such a case in which the geological sciences formed the framework that Europeans applied to distant places (West 1938). On his travels, Darwin collected rock samples from the Pacific islands and South America, which he brought back for inspection; and the establishment of natural history collections and prototypes for public museums contained samples from around the world in a way that told the story of the earth's evolution in Western geological terms. Influential geologists of the time were in similar contact with travellers in the networks of empire that extended beyond Europe. Suess' frontispiece was a lithograph based on a photograph sent to him in Vienna by Carl Ludolf Griesbach, working for the British colonial Geological Survey of India in the late 1870s. Lyell himself travelled extensively in the USA and Canada in the 1840s and 1850s, collecting samples while on lecture tours (Dott 1998). Alfred Russel Wallace, during his trips through the Malay archipelago, sent letters containing his geological observations back to Darwin. The emergence of the modern story of the earth was, in these terms, a project developed by Western men (and a few women) circulating through the long-range colonial networks, trade routes and way-stations and, as was often the case, were themselves functionaries of those empires as administrators, officers or the wealthy donors that made colonial expeditions possible (Scott 2008).

In their travels, these scientists gave their names and provincially oriented stamps to their stories of the earth. The British founders of modern geological sciences such as Adam Sedgwick, Roderick Murchison and Charles Lapworth named geological epochs based on local places and peoples in England such as the Devonian (from Devon), Cambrian

(the ancient people of Cumbria), Silurian (the ancient Silures of Wales) and Ordovician (after a Celtic tribe), which they then projected outward and applied, naming the earth in their own image. Suess named the biosphere and lithosphere based on Greek nomenclature and embedded within it the ontological distinction between the organic and inorganic, *bios* and *lithos*. Griesbach's name, in honour of his work, was given to a minor stage in the formation of the Triassic.

These two movements—of men and of nomenclature—have characterized the narrative of modern geological sciences as a West-to-the-Rest movement in which geological knowledge is distributed outwards and the story of the earth indexes imperial modes of expansion and exploitation. In this process, the adoption of modern geological sciences into various state and national cultures, and often the displacement of indigenous knowledges, became a sign of modernization (Bobbette 2018)—as noted widely in the literature about science and colonialism (Bonneuil 2000; Seth 2009). This has continued in twentieth century post-colonial contexts in which the bureaucratic and scientific institutions of the geological surveys that played such crucial roles in the exploitation of the colonies were often left intact and their officials replaced with locals. Sukarno and Suharto era Indonesia stands out as one example because the republican state maintained its Netherlands East Indies colonial geological institutions and relationships with European geologists throughout the 1960s and 1970s, and these geologists would regularly return with the most up to date expertise and equipment. During this time, many of Indonesia's leading earth scientists were trained in Europe (sometimes by Allègre himself) before returning to occupy top positions in the civil service. Enacting the most contemporary practices in the field and laboratory lent credibility to states wanting to demonstrate techno-scientific modernity—and similar dynamics are evident in Latin America and the Indian Subcontinent, for example (Chambers and Gillespie 2000; Rodriguez 2006). This circulation of geological knowledge has to be understood as the political lining in ideas of development and progress; and the dams, bridges, roadways, mines, and techniques of geological risk reduction (such as earthquake seismology and volcano science) articulate this state power in material form (Braun 2000; Bridge 2014; Donovan 2016; Lövbrand et al. 2009; Bobbette 2018).

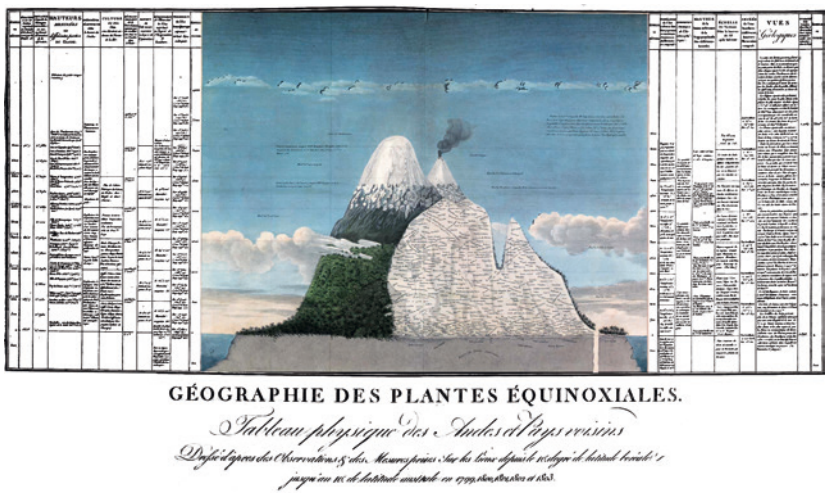

Fig. 1.4 Alexander von Humboldt's cross section of Chimborazo in the Andes

What facilitates this politics is a principle that lies buried deep in the epistemology of geological science and practice: the "view from nowhere". Modern geology has long sought the disembodied, non-cultural, objective projection of the *geos*. Mapping and measuring stands as one example. Alexander von Humboldt's magnificent cross section of Chimborazo in the Andes is seen as if the mountain is sliced in two, and like Suess' portion of the Himalaya's, we can take it all in at once (Fig. 1.4). Its flora are named, while the hours of walking, painstaking and careful hauling of instruments, cold, altitude sickness and the fatigue of Humboldt, Aimé Bonpland and Carlos Montúfar are erased. It was crucial to the modern scientists that their bodies, fragility, placedness, errors and wounds be erased so that the production of empirical knowledge could gain authority (Shapin and Schaffer 1989; Shapin 2010). This radical transformation of a gruelling expedition to a view from nowhere was at the same time the production of the view from anywhere. This turn of events is important because it seemed to mean that anyone, anywhere could take up the project of modernist geological sciences as long as they were taught the appropriate methods, techniques and way of erasing themselves while universalizing. This was geology as a political

project of effacing the scourge of subjectivity, the internal and the point of view: the human body in general (Oreskes 1999; Daston 2007; Coen 2013). As Rachael Tily's chapter on the development of geomorphology at Oxford so admirably demonstrates, the view from nowhere is a somewhere, and scientists themselves understand their own histories in far more complex and specific embodied narratives than is often conveyed in papers.

The pervasiveness of the view from nowhere, even if it did not capture how geological knowledge was made, co-constituted that other highly modern notion, objectivity (Porter 1996). It is the dream of natural entities which lie outside of disagreement and dissensus, the realm of facts, of those kinds of things upon which, with the right and correct use of reason and technology, we can all agree (Fleck 1979 [German original, 1935]) (Latour 1999). In this story, to produce a fact is to produce an entity which is objective, beyond the situatedness and relativity of a point of view and the body. To be modern is to insist upon the purification of facts and views from nowhere (Latour 2013). This insistence is bound up with the idea that the task of modern geology is to penetrate into the murky world of the ground and synthesize the complexities of topography in order to return with an objective picture that we can all agree upon about the world beneath our feet. This purification of nature, the erasure of the body, the discovery of the universal in the production of facts is the conceptual architecture of modernist geology.

What then is *a*modern about political geology? It is the tactical intervention in this architecture of modern geological thought. It is neither pre- nor postmodern, but sits uncomfortably in relation to the modern because it both is and is not modern. It abandons the idea that there is a non-modern, primitive, or savage state that preceded the modern, or that the achievement of scientific objectivity was the result of a long-fought Enlightenment that lifted (select parts of) humanity out of the darkness and that because of this, time is characterized by a progressive betterment and upward lift of knowledge. As an axis which reorients our understanding of geological practices then, the *a*modern shifts the kinds of stories that can be told about geology and its knowledge. In place of these conventional modernist frameworks, the *a*modern pluralizes the world of geological practices and traditions. Instead of a diffusionist

West-to-the-Rest model of geological knowledge, political geology tells stories of the multiple traditions of geological thinking and of encounters between traditions of geological thought, because it is not only in the Western tradition that geological thought has been used to tell origin stories of the universe, the place of humans on earth, or what is beneath our feet. This is in all thought and is created as different geological worlds have been projected and other origin stories, conceptions of matter, time and bodies enacted (Ramaswamy 2017). This means pluralizing geological thought as a political project of resisting, transforming or escaping the Western tradition from within it—as is described by Angela Last in her paper. Political geology seeks to do this by beginning with an understanding that the formation of geological knowledge can be a cosmological project in a world of multiple cosmos-in-formation; it stresses the encounters and relationships between these different geological traditions, as Adam Bobbette, Angela Last and Amy Donovan do in their chapters. If the story is not such a simple one that geological knowledge travelled from the hills and cliffs of Devon outwards to ensnare the rest of the globe, other stories need to be told that stress the encounters between these traditions, their fights and trials, how they have hybridized, transformed each other or violently appropriated and suppressed one another. *A*modernity supposes that geological knowledge is born, tested and practiced in a community of plural actors, views and traditions.

The importance of hybridity to geological knowledge means explaining and understanding how, in circulating around the globe, geological knowledges encountered and suppressed other forms of geological knowledge. When Cook and his crew installed cosmological instruments to chart the transit of Venus in the Pacific Islands, they instructed local Pacific Islanders to treat the instruments as property. This meant instructing—and likely unleashing—as Simon Schaffer has argued (2012), a new relationship to objects. In a similar vein, struggles continue to be waged in many indigenous communities over the use of geological knowledge (including its laboratories and instruments) to serve the goals of the extractive industries, viciously transforming geology into resources for human exploitation (Yang 2012). As Bobbette's chapter demonstrates, on Mount Merapi in Java, shamans continue to practice animist metaphysics as a way to resist

the incursions of mining companies, predatory capitalists and modernist state scientific experts. By insisting that landscapes and geology are living entities, they push back against the idea that nature is a dead resource to be churned up, processed and transformed into a commodity. Political geology zeros in on these encounters as the sites where violence and oppression operate under the guise of an ecumenical scientific objectivity. It is important to stress too that these encounters are rarely unidirectional and that domination in the history of geological knowledge does not operate through a strict imposition of ideas and practices onto other people but instead, as Anna Tsing (2005) has shown of globalizing knowledge, emerges through the "frictions" of encounters between local and global, old and new, the powerful and subaltern. Mediation operates between cultures and in itself needs to be explained, as Schaffer (2009) has offered, by go-betweens: the people who do the translating, carrying and moving between friction-full encounters. This means including the people that Cook taught to use instruments, and giving full attention to those who take up, transform and creatively undermine the dissemination of knowledge.

In addition to considering the frictions within the movement of geological knowledge, political geology "takes seriously" non-Western traditions of geological thought and experience. Recent work in philosophical anthropology has oriented itself to indigenous thought not as a pre-modern reflection of human thought, nor as a "world view" different from northern and/or western thought, but as a thought to be engaged with because its architecture can undo the presuppositions of Western geological thought. The method of "controlled equivocation" developed by Eduardo Viveiros de Castro (2015) and Martin Holbraad (2012) is a strategic encounter with the thought of others in such a way that their epistemological axes are engaged to critique northern Western metaphysics. In other words, the categories and terms that structure other people's thought have the capacity to dislodge "our" own categories and terms—such as animist traditions which do not recognize the distinction between *geos* and *bios*. Or, in the case of shamans on Mount Merapi, it is possible to "give" to a volcano and therefore also possible for a volcano to "receive" and "ingest" the objects given (Bobbette 2018; Schlehe 1996). One approach to this idea is to say that it is one shamanic "world view"

among many worldviews. This way of framing the problem, as John Law (2015) teaches us, is a multiculturalist conception of many cultures projected onto one nature that he warns produces a kind of cultural relativism. Isabelle Stengers (2011) has argued that this kind of relativism avoids encountering cultures in the name of tolerance by allowing them to have "beliefs" that the secular, disenchanted West can "appreciate", document and catalogue but ultimately avoid because modernization has stripped us of the very conditions for belief.[7] To put it another way, relativist multiculturalism does not "take seriously" *how* a volcano can *really* ingest because that conception, for a multiculturalist, can be relativized to an others' "world view" and/or "belief system". Controlled equivocation, however, takes the proposition seriously and "*runs with it*", as Martin Holbraad and Morten Axel Pedersen (2017: 2) put it, in order not only to understand what it could mean for a volcano to receive and ingest what it is given, but to be *transformed* by it. That a volcano can receive and ingest undoes basic conceptions of modernist Western geological metaphysics of nature. As Holbraad and Pedersen tell us of controlled equivocation, "…this way of thinking in anthropology seeks deliberately to take these moments as far as they will go, making full virtue of their capacity to stop thinking in its tracks, unsettling what we think we know in favour of what we may not even have imagined" (2). But the purpose of this is not the thrill of mental gymnastics; it is in the service of the "decolonisation of thought" (De Castro 2014: 40).

In conclusion, the *a*modern ambitions of political geology are twofold. The first is to upset the convention that says that modern geological ideas are universal and that they spread across the globe without transformation. Showing this requires careful attention to how knowledge and practices move and what happens to them

[7]In "The Curse of Tolerance," *Cosmopolitics II*, Stengers (2011: 303–323) states that tolerance is a way that secular moderns treat those 'others' who still have beliefs as compared to the 'truths' of our disenchanted world. "Tolerant is he, or she, who measures how painfully we pay for the loss of the illusions, the certitutdes, we attribute to those who we think 'believe.' Therefore, happy are those whose confidence has remained intact. They dwell where we, moderns, cannot return to other than as caricatures, sects, and despots" (303). Ontological anthropology is precisely a project of taking those "believers" seriously in order to unsettle our own modernist conviction of living in a secular, post-metaphysical world.