

Helge Jordheim (Oslo)

Thinking with Rocks

Henrik Steffens and the Anthropocene

On 20 March 2024, the International Union for Geological Sciences (IUGS) communicated their decision to reject the proposal to include a new stratigraphic unit in the Geological Time Scale, more specifically a new epoch named the Anthropocene.¹ This put a temporary end to the work that started when the atmospheric chemist Paul Crutzen famously blurted out with the suggestion for a new geological epoch that should mark the beginning of irreversible anthropogenic changes to planet Earth,² and continued in the Anthropocene Working Group (AWG), founded in 2009, which submitted its formal proposal to the IUGS, more specifically to the Subcommittee for Quaternary Stratigraphy (SQS) in October 2023, including a suggestion for a location of the GSSP, the so-called “golden spike”, at the bottom of Lake Crawford in Ontario, Canada. In an interesting, but also puzzling document, the IUGS went through the procedures for discussing and voting on the proposal from the AWG, as well as the results, which showed a clear majority against the proposal to declare the Anthropocene a new geological epoch.

Despite the rejection, the Union fully acknowledged “that the term Anthropocene is now well established in the public domain, and will no doubt continue to be used in popular and scientific discourse”.³ The problem was that it did not meet the criteria for a chronostratigraphic unit and a geochronological epoch, as defined by the Geological Time Scale. If anything, the IUGS suggested, the Anthropocene should be thought of as an “an event, similar to the great transformative events in Earth history such as the Great

1 IUGS 2024.

2 Carruthers 2019, 115. See also Crutzen and Stoermer 2000, 41.

3 IUGS 2024.

Oxygenation (2.4 – 2.1 Ga), the Cambrian Explosion, or the Great Ordovician Biodiversification events”.⁴

The document mentions three main reasons why the Anthropocene cannot be accepted as a geological epoch. All of them have to do with time. Whereas two of them focus on temporal intervals, the third makes a more fundamental argument about the quality of “the human effects on global systems”: they “are time-transgressive and are also spatially and temporally variable, so that their onset cannot be adequately represented by an isochronous horizon as reflecting a single point in time”.⁵ In other words, these anthropogenic changes cannot be grasped by any absolute universal time scale, or delimited by isochronous horizons, but need to be understood according to their own durations, speeds, and rhythms. They cannot be contained by chronological, let alone geochronological time scales but have their own inherent temporalities. The only way to conceptualize them is according to their own inherent processes, their own dynamism, or event-character.

In earlier essays, I have discussed how the Anthropocene challenges both our social, political, and scientific time scales.⁶ In this article, however, I want to ask the question differently: What if the irreversible accelerating anthropogenic changes that we associate with the Anthropocene cannot be measured and managed in Newtonian time – empty, universal, and mathematical? What if these changes – as suggested in the 18th century by Newton’s rival Gottfried Wilhelm Leibniz – can only be understood as inherent to objects and relations between them?⁷ And finally: What if the most appropriate temporal framework for understanding these pluralistic, embodied and relational times, is not the Geological Time Scale, or any kind of Newtonian, absolute time, but another temporal framework, which we usually refer to as “history” – the time of events and actions, assembled in processes and narratives, moving from the past, through the present and into the future? If this is the case, however, we also need to revise our concept of history, to

4 Ibid.

5 Ibid.

6 Jordheim 2023. See also Jordheim and Ytreberg 2021.

7 A more comprehensive version of this discussion is found in Jordheim and Bjordal, ed, 2025.

include both human actors and natural phenomena, both human and natural history, in the same temporal framework.

To achieve this, we have to look elsewhere for help and inspiration than to the periodizations contained in the Geological Time Scale, or to other versions of chronological, geochronological, and Newtonian time. We need to look for concepts and frameworks that seek to theorize a fundamentally mutable and dynamic world, in which everything finds itself in constant transformation, even what appears solid and immutable, like rocks. Of course, there are many places to look, both inside and not least outside the Western scientific tradition – one of them is German *Naturphilosophie*, more specifically the works of its most prominent geologist, a former student of the greatest mineralogist in Europe in the 18th century, Abraham Gottlieb Werner, who went on to write a German bestseller and for a while was one of the most influential thinkers in the German principalities. His name was Henrik Steffens, and he came from Stavanger on the west coast of Norway, where he was born in 1773.

From Natural History to *Naturphilosophie*

Steffens was part of and indeed a seminal contributor to the moment in the history of knowledge that marked the “end of natural history”, as Wolfgang Lepenies puts it.⁸ “Natural history” – that several centuries-old activity for collectors and antiquarians – was transforming and splitting up, into an entire field of disciplines and knowledge endeavors. They all had one thing in common: they were thinking about how the earth had come to be what it is, and how these processes are still on-going and would continue into the future. Whereas other scholars were developing new specialized disciplines, like geology, cosmology, biology, chemistry, and not to forget, history, in the modern sense, Steffens and his like-minded philosophers, poets, and naturalists were making a last-ditch attempt to keep all these forms of knowledge together – by turning natural history, *Naturgeschichte*, into natural philosophy, *Naturphilosophie* – as a comprehensive, all-encompassing knowledge project proposing

8 Lepenies 1978.

the answer to the Faustian question – *was die Welt im Innersten zusammenhält*.

According to Lepenies, Steffen's moment in the history of knowledge witnessed how natural history "ended" and made way for the modern order of disciplines. However, rather than giving in to differentiation, Steffens and his friends in Freiberg and Jena went on to suggest a new whole, *Naturphilosophie*. The term itself needs to be kept in the German original, to separate the brand of thought practiced by master-thinkers like Johann Gottlieb Fichte, Friedrich von Schelling, and to a certain extent, Johann Wolfgang Goethe, but also by lesser figures like Franz von Baader and Lorenz von Oken, from previous forms of natural philosophy, in the tradition from Johannes Kepler to Isaac Newton, from Rene Descartes to the French materialists. Different from Newton and his followers, the German *Naturphilosophen*, including Steffens, were not searching for the mathematical principles of the universe, Newton's *principia mathematica*, or their mechanical operations, but a dynamic spiritual inner core of everything that exists, what Schelling called the *Weltseele*.

In the history of science, this moment has been regarded as a kind of deviation, or blip, before the progress of rational, specialized disciplines, in other words Newtonian science, got back on track. A different view is offered by the British historian of science, Nicholas Jardine, when he makes the point that *Naturphilosophie*, in the way it was practiced by Steffens and others, destabilized and subverted what he refers to as the "fundamentally scientific dichotomies science/art, discipline/anarchy, reason/irrationality".⁹ Again, parallels to the current moment come into view, when modern sciences – both disciplined and disciplinary – are continuously challenged by both more anarchic and artistic approaches, in their attempts to deal with the challenge of anthropogenic change on a planetary scale, tipping points, and extreme weather events.

Nevertheless, despite its speculative, metaphysical nature, German *Naturphilosophie* can also be perceived as a response to the fragmentation and even collapse of another comprehensive, all-encompassing knowledge endeavor, which had mobilized scholars across Europe for at least three centuries, "natural history", or by its Latin

9 Jardine 1996, 244.

name *historia naturalis*. This form of knowledge, which took shape during the Renaissance, drawing on works from Greek and Roman Antiquity, such as Aristotle's *Physics* and Pliny's *Natural History*, based its claims on the practices of observing, collecting, and describing external objects, with the aim to produce an account of the earth and its life forms, their origins and their characteristics. In the 18th century, natural history found its most influential and pivotal expressions in the classificatory practices and tables of Carl von Linné, in Comte de Buffon's *Histoire Naturelle*, published in 16 volumes between 1749 and 1789, as well as in an unattributed entry in the *Encyclopédie*. The opening of the entry reads: "natural history is as vast as nature", and encompasses "all beings that live on the earth, that fly in the air, or that dwell in the depths of the waters: all the beings that cover the face of the earth; and all those hidden in its deepest recesses."¹⁰

Elements of this holism and universalism still echo in the works of Steffens, who also continued the French materialists' gradual shift away from a mechanistic toward a more organicist world view. However, whereas the entry in the *Encyclopédie* based its vision of natural history on living "beings", Steffens is thinking with, through, and by means of rocks, minerals, and lithic formations – rendering his fundamentally dynamic concept of nature all the more surprising and original.

Steffens was never a very successful, nor a very talented geologist. Indeed, in a terminological sense, he was not a geologist at all, but what in his own time was referred to as a "geognost", a practitioner of "geognosy" – thus aiming to achieve *gnosis*, the Greek word for deep knowledge, of the *ge*, the earth. In the 18th century, geology was emerging as a term, but was still not much used. Instead, a range of other terms applied, including "mineralogy", "oryctognosy", meaning knowledge of minerals and rocks, "mining sciences" – or as we shall see shortly – simply the "the inner natural history of the earth", the operative word being "inner". These are all different names for what the historian of science Martin Rudwick has labeled "geothory", but which also, more colloquially, can be described as

10 Anon, "Natural history", 225.

“thinking” or “philosophizing with rocks”, which I consider to be the best phrase for what Steffens was actually doing.¹¹

In this activity, Steffens emerged as an early proponent of the often anarchic and artistic science practiced in the name of the “Anthropocene”, which might never become an official chronostratigraphic unit or geochronological epoch, but will continue to mobilize knowledge and political action across fields and disciplines. In the way he was thinking with rocks, Steffens became an important theorist, or even philosopher, of the earth as a dynamic system. At present, there are a range of methods for representing the world as a changing, dynamic, even volatile system, first and foremost by accumulating enormous amounts of data from the past, in order to project the future, in the framework of what is today known as Earth System Science. To put it bluntly, what Steffens and the German *Naturphilosophie* offered was in some respects an Earth System Science *avant la lettre*, less datadriven, in a sense less empirical, and certainly more speculative – but nevertheless, a kind of knowledge in the same mould, connecting all the elements in the world into a living, breathing, constantly changing system.

Steffens practiced and disseminated, very successfully, his thinking with rocks mainly in three published works, in addition to his well attended Copenhagen lectures: his doctoral dissertation, *Über die Mineralogie und das mineralogische Studium*, which he defended in Kiel in 1797, then the work that made him famous, written during his time at the Mining Academy in Freiberg, *Beyträge zur inneren Naturgeschichte der Erde*, published in 1801, together with a number of essays in the orbit of that book, and then finally his textbook, or manual, *Vollständiges Handbuch der Oryktognosie*, published in four volumes between 1811 and 1824. In addition to these works that all made it clear in their titles that they belonged to the field of geology, another source to Steffens’ thinking with rocks, was his ten-volume autobiography, *Was ich erlebte*, published much later, between 1840 and 1844, when he had become an established academic and conservative Christian, looking back at his years as the Norwegian *Wunderkind* of German *Naturphilosophie*. In this work, the times of rocks became entangled with another set of times: the autobiographical, retrospective lifetimes of Steffens himself.

11 Rudwick 2005, 133–138.

The Immense Graveyard

After having completed his studies in Copenhagen and joined a highly unsuccessful, almost catastrophic expedition to Norway to collect fossils and minerals, Steffens left the capital to get his doctoral degree in mineralogy at the university of Kiel, financed by some of the leading citizens of the double monarchy Denmark-Norway. During his entire life, Steffens remained a reluctant geologist. He considered the mining sciences to be too much of a bread-winning activity – and he was also in doubt whether rocks, mountains, and soil was really the right stuff for thinking about the innermost secrets that held the world together. However, Steffens also had a keen eye for where the most interesting innovations in knowledge about the earth were taking place. In the late 18th century the sciences of mineralogy and geology were promptly finding their way to the forefront of scientific progress. They were very much the spur of the moment; they represented the knowledge of the avantgarde. In 1792, the Hungarian mineralogist Johann Ehrenreich Fichtel quipped:

[P]eople told me that in this century's penultimate decennium more was written about minerals than about theology, philosophy, and law together during half a century. Mineralogical papers abound, like hay and grass in this present fertile year.¹²

Something similar can be said about the first decennia of the 21st century. Again, the science of geology dominates the *res publica literaria*, prompted by the concept of the Anthropocene. Rather than eclipsing other sciences, like Ehrenreich suggested, it has taken them over, by inserting into their conceptual logic the idea of anthropogenic change at a geologic time scale.

What was – and still is – at stake was the age, duration, and transitions of the earth. In the late 18th and early 19th centuries, an increasing number of scholars were asking how long the earth had existed and indeed how much time must have passed for the planet to reach its current state, by means of either fire or water – volcanic eruptions, as claimed by the so-called “Plutonists”, or flooding and sedimentation, as argued by their adversaries, the “Neptunists”. At present, the temporal vector has shifted, and scholars in all disci-

12 Fichtel 1993, 5.

plines are asking for how long the earth will remain habitable to the human race, keep its current human-friendly, greenhouse condition. At the same time, the old discipline of chronology has returned, in the guise of controversies regarding the dating of the Anthropocene – which again, although in different terms, raise the question how long time it must have taken us to arrive at the current highly instable moment, and when the processes started, of which we are currently seeing the results.

Steffens knew how to make use of the sudden demand for knowledge about minerals, rocks, and landscape formations. The need for mining engineers in Denmark-Norway prompted the patrons of the double monarchy to finance his education. From Kiel, Steffens made his way to the mining academy in Freiberg, to be taught by one of the most admired geognosts on the European continent, Abraham Gottlob Werner. Instead of travelling directly to Freiberg, however, Steffens veered off to Jena to meet Schelling, Fichte, and the Jenaer Kreis, and was initiated into their discussions, which moved along less practical and use-oriented, more speculative paths. After two years, his sponsors had become tired of waiting for him to fulfill his plans to study mineralogy in Freiberg and told him to leave Jena and make his way there at once.

In Steffens work, his doctoral dissertation from Kiel, published in Altona in 1797, is often the book that gets the least attention, simply because at this time Steffens had not yet met the man who was going to inspire his thinking for the most part of his life, Friedrich von Schelling. Although Steffens claimed that he had read both Spinoza and Fichte already before he wrote his dissertation, it has been perceived as the work of a somewhat precocious student in mineralogy, and not much more. However, to understand how Steffens began his philosophizing with rocks as well as his transition from natural history to natural philosophy, the dissertation entitled *Über die Mineralogie und das mineralogische Studium* is a key text.

The scene, with which he opened his reflections about the nature of rocks and minerals, comes across as depressing, as if Steffens was already disillusioned with the part of nature and the field of knowledge he had chosen for his studies:

The site itself appears to always be the same. There is no changing scenery that can draw the attention of spectators. Even the organic bod-

ies turn inorganic – when they die. The ruins of thousands of creatures that used to be alive or vegetating cover the surface of our earth. [...] The entire non-organic kingdom appears as an immense graveyard.¹³

In this way Steffens perceives the lithic world in the opening of his 1797 doctoral dissertation. The language of death and ruin is striking and prefigures the imagery of the gothic and the dark romanticism about to take its effect on European art and literature, for example in the paintings of Caspar David Friedrich. Echoing into contemporary Anthropocene discourse, the passage takes on a post-apocalyptic tone – as if Steffens was referring to extinction events that took place millions of years ago, and again in the present. In “World Scientist’s Warning to Humanity: A Second Notice”, published in the journal *BioScience* in December 2017, 15,364 scientists from 184 countries joined forces to issue a warning that mankind has unleashed what they refer to as a “sixth mass extinction event”, wherein many current life forms could be annihilated by the end of this century.¹⁴ In other words, there have been five others before us. Together these events span 540 million years. The fifth took place 66 million years ago and was caused by the impact of an asteroid; the third and biggest – a volcanic eruption – happened 251 million years ago and killed 96 percent of life on Earth. Even though Steffens has no inkling of the scale of these mass extinctions – neither spatially nor temporally – his vision of the lithic world conjures similar imagery.

The work Steffens saw cut of out for him in the 1797 dissertation, prior to his first stay in Jena with Schelling, was to bring this graveyard to back to life, by returning it to history, to the world of historical processes and changes. That meant transforming traditional natural history – what he summed up as „many boring walks through the dry area of a micrological nomenclature“ – to a new kind of knowledge about the changing and dynamic planet.¹⁵ Until now, he

13 Steffens 1797, 9: “Der Schauplatz selbst scheint immer derselbe zu sein. Hier sind es keine abwechselnden Szenen, welche im Stande wären, die Aufmerksamkeit der Zuschauer zu erregen. Selbst die organischen Körper gehen zu den unorganischen über – wenn sie sterben. Die Ruinen von tausenden vormals lebendigen und vegetirenden Geschöpfen bedecken unsere Erdoberfläche [...]. Das ganze unorganische Reich scheint ein unermeßlicher Kirchhof zu sein.”

14 Ripple et al, 2017.

15 Steffens 1797, 22: “viele langweilige Wanderungen durch das trockene Gebiet einer mikrologischen Nomenclatur.“

went on, mineralogy has been “a toy for unreflecting collectors or a tool for fantasizing physicotheologists” – the latter term referring to those who saw the physical world as the workings of a higher power.¹⁶ Together, these four critical, even dismissive phrases – “boring walks”, “micrological nomenclature”, “unreflecting collectors”, and “fantasizing physicotheologists” – aptly sum up key practices in Early Modern natural history: expeditions, classification, collecting – and indeed, for some, among them Steffens’ compatriot, the Norwegian Protestant bishop Erik Pontoppidan, religious speculation.

Luckily, the young student of geology in Kiel had discovered the key to changing this sorry state of natural history: to study rocks not as dead, immutable, non-living things, but as what he calls *ehrwürdige Denkmähler alter Revolutionen*, “honorable memorials of old revolutions”, and thus as testimonies to a changing and dynamic world.¹⁷ Different from his French contemporary, the naturalist George Cuvier, Steffens was no catastrophist, who believed that change only comes about through cataclysmic events. Although there are innumerable revolutions in the history of the earth, Steffens argued, there are no *Totalrevolutionen*, “total revolutions”, which so far had been the standard solution every time someone were unable to understand how different rock layers have developed – rather, he went on, we should understand them as products of *den stillen allmählichen Gang der Natur*, “the quiet gradual movement of nature”.¹⁸ He concluded:

Every mineral [...] carries in them the traces of their genesis, and the sole goal of mineralogy consists in discovering the purposefulness of inorganic nature, which lies in the changes that the inorganic things have gone through and are going through.¹⁹

Of the three kingdoms, *drei Reiche*, which were so central to *Naturphilosophie*, Steffens selected the “kingdom of minerals” as his preferred area of study. His task was to wrestle it out of the hands of

16 Ibid.

17 Steffens 1797, 68–69.

18 Ibid.

19 Steffens 1797, 87: “Ein jede Mineral ...trägt die Spuren seiner Entstehung bey sich, und die ganze aufzufindende Zweckmäßigkeit der unorganischen Natur, als Zweck der Mineralogie, liegt lediglich in den Veränderungen, welche die unorganischen Körper erlitten haben und noch erleiden.“

natural historians, who treated it as “cemetery”, and bring it back to life, by entangling it the “kingdoms” of animals and plants, that is, of organic, rather than inorganic matter. To reintegrate nature into a dynamic whole, much like Scheeling’s *Weltseele*, was the final goal of his philosophizing with rocks.

Into the World – and Out Again

After more than two years delay, Steffens had arrived at his destination, the mining academy in Freiberg in German Saxony and the lectures of Werner. Recently, Werner had made his name through his refutation of James Hutton and the other Plutonists, and at least in Steffens’ eyes, secured a resounding victory for the Neptunists. During a visit to the Scheibenberg, one of the large basalt mountains in the Erzgebirge, he convinced himself that all rocks had been created through sedimentation in areas that were once covered by water. To Werner, this theory also supported the Christian diluvian doctrine, that the pivotal event in the pre-history of the earth was the Biblical Flood. Steffens, who went on to become one of Werner’s most renowned students, was less interested in *Totalrevolutionen* and more in the on-going processes unfolding in both organic and inorganic material.

In the late 18th century, Werner was a dominating force in German intellectual life, no matter field or discipline, at a time when the intellectual center of Europe was generally shifting from French- and English-speaking to German-speaking regions. From all German states as well as from the rest of Europe, even from other continents, young men with a proclivity for the natural sciences gathered in Freiberg, at Werner’s feet – even a Mexican and a Brazilian, Steffens recounts in his autobiography,²⁰ in addition to the Danish-Norwegian Jens Esmark, who taught at the mining academy in Kongsberg, Norway. But the most prominent students were Germans: Friedrich von Hardenberg, called Novalis, Alexander von Humboldt, Christian Leopold von Buch, Franz Xaver von Baader, Gotthilf Heinrich von Schubert and Lorenz Oken all came by for shorter or longer periods to learn about rocks and minerals.

20 Steffens 1841, 127–128.

Even though Steffens deeply respected his teacher, he still found Werner to be too much of a mining engineer, more interested in practical knowledge than speculative philosophy. Werners's method consisted in classifying rocks and minerals according to their appearance, as announced in the title of his most famous work *Von den äusserlichen Kennzeichen der Fossilien* from 1774. Werner's goal was to become the Linneaus of rocks and minerals, by classifying, naming and ordering them according to *Klassen, Arten, and Geschlechter*, based on external characteristics. Although he practiced mineralogy and taught at a *Bergakademie*, a "mining academy", Werner's work had a lot in common with natural history. For him, mineralogy consisted in doing a taxonomy of rocks based on their surfaces, how they looked and felt, like collectors and naturalists had been doing it for centuries already, only in a much less systematic fashion. The final result was a table that he used for teaching his students.

As far as I know, Steffens never commented directly on the contrast between the title he chose for his second book and Werner's *magnum opus*. The latter dealt with "external characteristics", the former with an "inner history": *Von den äusserlichen Kennzeichen der Fossilien* versus *Beyträge zur inneren Geschichte der Erde*. The movement from the external to the internal was striking, launching an entirely new epistemology, but so was the ontological shift from the spatial distribution of fossils to the temporal duration, the "history", of the Earth. Natural history was the study of external elements distributed in space, whereas *Naturphilosophie* wanted to uncover the inner forces that moved and transformed everything on earth. Since these processes unfold in time, the "history" that Steffens and other German natural philosophers uncovered at the inside of all things, was no longer the Aristotelian *historia*, the study of particularities, but a singular dynamic development, through which earth came into being. In the entry on *Geschichte*, "history" in the lexicon for political and social concepts in German language, *Geschichtliche Grundbegriffe*, the chief editor Reinhart Koselleck points out how not only the human world, but also nature is temporalized, invested with time and history, linked to genesis, transformation, and persistence.²¹ Since then, this shift has been the topic of several comprehensive studies. Historians of science Martin Rudwick and Rhoda

21 Koselleck 1975, 678–682. See also Jordheim 2022.

Rappaport have both studied how natural history went through a process of temporalization at the end of the eighteenth century.²² Before that *historia*, in the Aristotelian tradition, meant little more than empirical knowledge, gained through induction. From the mid-18th century onwards, this changed. Both natural and human *historia* were temporalized. Temporalization of nature found its primary disciplinary form in geology, which organized itself around a deep and multi-layered time.

At the same time, natural history split up in disciplines, which still dominate the field of the natural sciences. Even though Steffens did not comment on the contrapuntal relationship between the two titles, by the master and by the student, he noticed that Werner's one-sided focus on the external characteristics of things, ignored the rise to prominence of a new discipline: chemistry. At the same time as Werner, Courvoisier, Hutton, Lyell, and others, gave shape to geology, chemistry was also emerging as a science in Europe, initially at the hands of the supporters of the phlogiston theory, like Georg Friedrich Stahl, Andreas Sigismund Marggraf, Lorenz Friedrich von Crell, Anders Johan Retzius, and Joseph Priestley, who were then heavily criticized and eventually supplanted by the French chemist Antoine Laurent de Lavoisier, who replaced the phlogiston theory with the theory of oxidation. Although a student of Werner, Steffens sided with the chemists, and shifted his interest from the exterior to the interior of rocks and minerals – and thus from a more or less static, even dead world – to a world where everything, even rocks, found themselves in constant transformation. As he put it in the *Beyträge*:

Can we regard the exterior as anything but the expression of something interior, or find in the conformity of the exterior of something that is formed anything but the infallible sign of a conformity on the formation?²³

This is also where he gives his own intellectual transformation, the culmination of his *Bildung*, its most memorable form: *Ich steige*

22 Rudwick 2005; Rappaport 1997.

23 Steffens 1801, 49: "Können wir wohl das Aeussere für etwas anderes, als Ausdruck eines Inneren ansehen, oder in der Uebereinstimmung im Aeussern eines Gebildeten, etwas anderes, als das untrügliche Criterium einer Uebereinstimmung in der Bildung finden?".

langsam aus dem Grab der Natur, um ihr rastloses, thatenvolles Leben zu erkennen, “I ascend slowly from the tomb of nature to discover its restless, deedful life”.²⁴ He returns to the image from *Über die Mineralogie* of the nature as grave and a graveyard, covered in rocks and fossils that show no sign of life, much like a gothic landscape of ruins. But now, following his stay at the mining academy in Freiberg, his vision of the world has changed. Rocks, minerals, and mountain formations have come to life. This was partly due to his encounter with Schelling, who set him on the path of his search for the *Weltseele*, partly due to his reading of more recent works of chemistry, in which minerals were understood based on their chemical components and processes of formation. Finally, it is impossible not to link the image of slow ascent – *ich steige langsam aus dem Grab der Natur* – to his frequent visits to the mines of Freiberg, as part of his studies to become a mining engineer. In his autobiography, Steffens offered vivid descriptions of his descent into the endless tunnels that surrounded Freiberg, situated in the mountain area Erzgebirge, literally “ore mountains”, in Saxony, which had extremely rich deposits of silver, copper, iron, cobalt, tin, and nickel. A couple of times a week, he wrote, the students would change into “miner’s clothes”, *Bergmanns-Habit*, and venture down into the mines, on Werner’s advice, beginning with the most accessible ones, which had names like *Abraham* and *Himmelfahrt*, “ascension”. Steffens remembers how his “imagination was stirred” by “enormous extension” of the system of tunnels expanding endlessly below the surface, in all directions. What he found, however, was not a dead world, no “immense graveyard”, but a “subterranean world” of smells, sounds, and movement. He wrote:

To me, the subterranean world, the dark night in the tunnels and passages had something ineffably attractive. However, in the darkness, in the sparse light from the mining lamps, we really had to struggle to make out the walls of the tunnels and the fossils that gave shape to them, covered in moisture and mud. Even more difficult, in the beginning quite impossible, was the task of following the directions of the tunnels, which we navigated by use of a compass, and to understand how they clustered, crossed and trailed each other. As we descended the horizontal ladders, as the sight of the blue sky through the opening

24 Steffens 1801, 34–35.

gradually disappeared, as the large wheel that put the water from the surface into motion made a turn, at the signal of a bell, while all around us drops were constantly falling quietly, I initially found myself in a strange and uncanny mood.²⁵

The world that Steffens discovered under the surface was not dead, but very much alive, dynamic, and full of movement. In this sense, his discovery of chemistry and his descent into the mines had a similar effect: to redirect his focus from the immutable, dead external surfaces of mountains and rocks on the outside to the incessantly moving, changing, transforming, rich life on the inside. Thus, *die innere Naturgeschichte*, “the inner natural history”, can be taken to refer both to the inside of rocks, to the chemical processes of mineral composition and decomposition, and to the inside of the earth, which Steffens got to visit during his stay at a student in Freiberg.

Looking back at the Anthropocene

In his autobiography *Was ich erlebte*, published forty years later in the 1840s, Steffens looks back at this moment in his coming-of-age, as a man, a mineralogist, and a natural philosopher. He tells the story of his own transformation, from natural historian and rock collector to famous *Naturphilosoph* almost like a Christian conversion narrative, emphasized even more by the vertical movement that the narrator experienced, from below to above, from death to life,

25 Steffens 1841, 135: “Die unterirdische Welt, die dunkle Nacht in den Stollen und Zeuggestrecken hatten für mich etwas unbeschreiblich Anziehendes. Allerdings kostete es uns nicht geringe Mühe, in der Dunkelheit, von den Gruben-Lampen spärlich erleuchtet, die Gangmasse und die Fossilien, aus welcher sie zusammengesetzt war, durch Feuchtigkeit und Schmutz bedeckt, zu unterscheiden. Schwieriger noch war es uns, ja im Anfange schien es fast unmöglich, die Richtung der Gänge, in denen wir uns durch den Kompaß orientirten, zu verfolgen, und es uns klar zu machen, wie sie sich durchkreuzten, schaarnten und schlepten. Wenn wir die senkrechte Leiter herunterstiegen, wenn das Blau des Himmels durch die Oeffnung allmähig verschwand, wenn das große Rad, durch welches das Tageswasser in Bewegung gesetzt wurde, in dem engen Eisenraume neben uns seinen Umschwung machte, das Anschlagen der Glocke einen jeden Umschwung bezeichnete, während um uns herum und über uns die Tropfen still rauschend, unablässig herunterfielen, so war uns im Anfange seltsam und wunderbarlich zu Muth.”

in all its dynamic and diverse forms, nature's *rastloses, thatenvolles Leben*. Of course, Steffens was another man then, not the hungry, curious young mineralogist, but a celebrated professor, member of both the Prussian and the Bavarian academy of sciences, and a staunch confessional Lutheran. He obviously saw the earlier part of his life in a somewhat different light. But for my purposes here, this retrospective narrative brings out a methodological point that I do not want to let go amiss. In this chapter, I look back at the moment when Steffens came into his own as *Naturphilosoph* from the present, a site of climate and nature emergency, shaped by the concept of the Anthropocene. For this purpose, Steffens' autobiographical retrospection, in which he distilled the most important insights and lessons from his years as an aspiring mineralogist and philosopher, is of particular interest.

In the passages in volume 4, where Steffens recounts his time in Freiberg, he also returns to his *Beyträge zur inneren Naturgeschichte der Erde*. This book, he writes, represents «the fundamental theme of my entire life», *das Grundthema meines ganzen Lebens*, and then, he suddenly leaves his scientific aspirations behind and ascends to lyrical heights:

In it was hidden the dark memories from my earliest childhood, from the dreamy activities of my youth, which were then violently suppressed by a moment of predominantly sensuous reflection.²⁶

Already we have seen that Steffens' *Beyträge zur inneren Naturgeschichte der Erde* contain his own reworkings of his experiences at the mining academy in Freiberg, in the lecture halls as well as in the mines. In retrospect, Steffens connects these experiences to his own personal *Bildung*, when he left his childhood and youth behind and became a mature man. His *Beyträge* represented the pivotal moment in this coming-of-age story. One set of lifetimes, which are human, personal, and existential are linked to another set, which are natural, chemical, and ontological – the life of man and the life of rocks come to overlap. In his autobiography, Steffens goes

26 Steffens 1841, 172: "Es lagen in ihr dunkle Erinnerungen aus meiner frühesten Kindheit, aus den träumerischen Beschäftigungen meiner Jugend, die durch einen überwiegend sinnlich reflectirenden Moment gewaltsam zurückgedrängt wurden, verborgen."

on to explain how he was influenced by Spinoza's idea of the unity of all existence, *Einheit des Daseins*, and then by Schelling, who helped him salvage the elements of physics for *eine höhere geistige Bedeutung*, "a higher spiritual meaning" – which they both, Spinoza – otherwise known as a radical pantheist – and Schelling found in God, according to Steffens.²⁷ Against this, he then pits what he calls *die empirische Wissenschaft*, "empirical science". "I owed Schelling a lot", he writes, "everything even". Still, his *Beyträge* brought something new into natural philosophy, he realizes, that he got from another teacher, Werner. From Schelling, Steffens writes more than forty years later, he got the fundamental figure, *den Grund-Typus*, but from Werner he got the movement, *eine Bewegung*, including a will and goal – in other words, a teleology, a direction. Then follows a passage that I reproduce in its entirety. He begins by explaining the title of the book:

All of existence was to become history, I called it the inner natural history of the earth. It did not only concern itself with the influence of natural objects on human events, through which they, as Schelling expressed, assumed a real historical character; even humans should entirely be a product of natural developments. [...] I became aware how the natural sciences themselves brought an absolutely new element into history, by which our time distinguished itself from the entirety of the past. [...] History itself had to become all nature, if it wanted to hold its own as history with nature, that is in all directions of its existence.²⁸

Looking back at himself as a young man, Steffens places himself at the intersection of two spheres of influence, Werner at the mining academy in Freiberg and Schelling in his circle of Romantics in Jena.

27 Steffens 1841, 173.

28 Steffens 1841, 173–174: "Das ganze Dasein sollte Geschichte werden, ich nannte sie die innere Natur-Geschichte der Erde. Es war nicht bloß von jenem Einflusse der Natur-Gegenstände auf menschliche Begebenheiten, durch welche sie, wie Schelling äußerte, einen ächt geschichtlichen Charakter annahmen, die Rede; der Mensch selbst sollte ganz und gar ein Product der Natur-Entwicklung sein. [...] Mir ward es immer klarer, daß die Natur-Wissenschaft selbst, wie sie ein durchaus neues Element in die Geschichte hineingebracht hatte, durch welches unsere Zeit sich von der ganzen Vergangenheit unterschied, [die wichtigste aller Wissenschaften, die Grundlage der ganzen geistigen Zukunft des Geschlechts werden mußte.] Die Geschichte selbst mußte ganz Natur werden, wenn sie mit der Natur, d. h. in allen Richtungen ihres Daseins sich als Geschichte behaupten wollte."

In other words, he found himself at the origin of two emerging intellectual traditions: modern scientific geology and German *Naturphilosophie*. Both would set European and global history of knowledge on a new track for centuries to come, although in opposite directions. Together with chemistry, biology, and physics, geology would form a new order of disciplines that would dominate modern universities. *Naturphilosophie*, on the other hand, would lose out as a philosophical genre, but live on as a driving force in continental philosophy, for example in the Frankfurt School. At the time of writing, Steffens had moved quite far from his youthful enthusiasm and radical worldviews and become an orthodox Lutheran, who tended to view “history” – which is the main topic of the passage – as something quite close to providence or at least a kind of Christian teleology. Nevertheless, in reminiscing about the literary and intellectual high point of his early career, he successfully manages to put his own youthful ideas into a broader and longer perspective – in which the competing forces that emerge, are nature and history.

To conclude, I will make a little return to where I started and remind us again that one of the most daunting intellectual challenges of the current moment, faced with the fact of anthropogenic planetary change and the attempt to historicize it by means of the concept of the Anthropocene, consists in changing our view of history to also include nature – from species going extinct at a staggering rate, to minerals, rare and not so rare, to carbondioxide stacking up in the atmosphere, to viruses and pandemics. From 17th- and 18th-century natural history, Steffens inherits the idea that “all of existence”, *das ganze Dasein*, can and should be part of the same field of knowledge. However, all-comprehensive “natural history” did not concern itself with history in terms of temporal movement, change, and transformation. Rather it adhered to the other originally Aristotelian meaning of *historia*, knowledge of particulars, distributed in an atemporal space. This can be the space of landscape, or as in the case of both Linnaeus and Werner, the space of a table. But this is not the concept of history that Steffens is evoking. As we have seen, his concept of history is one of movement, change, revolutions, and formations. In the second half of the 18th century, when knowledge was temporalized, to speak with Koselleck, that is, when historical time became part of knowledge, it caused the collapse of the field of natural history and the division into different disciplines. Faced

with this collapse of the unity of knowledge, Steffens makes his last-ditch attempt to keep empirical and speculative, human and natural sciences together, while at the same time investing them with temporality and historicity. If “all existence is to become history”, as he puts it in the first sentence, “history itself had to become nature”.

Rereading Steffens’ work today, and looking back at his historical moment, when the unity of knowledge produced by natural history was transformed into German *Naturphilosophie*, the most important intellectual heritage might be this concept of history, aptly summed up by an old man writing his life. Only history, Steffens seems to argue, can balance the worlds of human experience, consciousness, intentions, and actions, and the worlds of natural forces, sedimentation, eruptions, solidifications, fossilization and so on. Only history, in other words, make thinking with rocks possible and meaningful.

Again today, the “natural sciences themselves [have] brought an absolutely new element into history”, to reuse Steffens’s own words. To him this “new element” was the dynamic planet – that all parts of the Earth existed in a process of continuous change, caused by the same set of natural, mainly chemical and geological forces. More than two hundred years later, these changes are “anthropogenic”, in other words, they are caused by human actions. These anthropogenic changes are traced stratigraphically in geology and documented statistically in Earth System Science. They lead to climate emergency and nature crisis and, if left unchecked, to an uninhabitable planet. Rereading the works of an 18th-century Norwegian geologist and natural philosopher might not be of much help to prevent these changes. Nevertheless, if we can open up our concept of history to include more of the entanglements and exchanges between the human and the non-human we might be able to understand more of them.

Steffens’ contribution to reshaping in some small sense our ways of thinking about climate emergency and nature crisis could thus consist in a twofold movement: On the one hand, to bring rocks – as the most immutable element of natural history – into the dynamic, instable, ever-changing framework of human history, in order to question the anthropocentrism and the exclusion of nature from historical arguments and narratives. On the other hand – inversely – to bring human agency and intentionality into the history of rocks, in order to analyze how even the most immutable parts of nature

are subject to anthropogenic change, even long before the dawn of industrial mining and the fossil economy, because they share their history with humanity. By allowing for these kinds of back-and-forth movements, the Anthropocene could come into its own not as a geological epoch, but as a site for communication and entanglement between human and natural history.

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