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Anthropocene

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von Ariane Tanner

1. What is the Anthropocene?

Is the Anthropocene a scientific problem of how to determine when it began, is it a cultural metaphor, or is it a political concept? Is it a new epoch, an equivalent to contemporary history, or possibly even all of the above? This history of the term and concept is typically traced back to Dutch atmospheric chemist Paul Crutzen and his sudden outburst at a conference of the International Geosphere-Biosphere Programme (IGBP) in Mexico in the year 2000.[1] Crutzen, by his own account, was tired of always hearing about the "Holocene" and asserted that we are living in the Anthropocene, the Age of Man. This was new.[2] Because up until then geologists had considered the human influence on the planet negligible in comparison with the phenomena they were studying, measured in millions of years – continental drift, ocean formation and the impact of meteorites.[3]

The idea of an Anthropocene, of course, did not catch the scientific community off guard after decades of researching the anthropogenic causes of climate change. Given the irreversible changes in the geophysical parameters on planet Earth due to global warming, the designation for a new epoch which cites the main culprit in the word itself was very well received. As paleobiologist Jan Zalasiewicz noted: "The timing was perfect, as it had been becoming clear that human impact on the Earth might be geologically short-lived, but it was not trivial."[4]

Human activity since the Industrial Revolution, in particular the extraction and burning of fossil fuels, but also changes in the chemical composition of the oceans (over-acidification) and soils (fertilizers and chemicals), radical topographic changes through resource extraction and sediment transport (coal mines, sand mining for concrete production, fracking, etc.), the military and civil use of nuclear technology, the mass extinction of species and habitat loss (deforestation, intensive agriculture), interference with the water cycle, etc. – all of these and other measurable factors,[5] according to Crutzen, justify calling the Anthropocene the "Geology of Mankind."[6]

Scientists have since been investigating the possible existence of stratigraphic markers to justify the establishment of a new geological epoch. In 2008, Zalasiewicz and numerous geologists addressing the issue posed the question: "Are We Now Living in the Anthropocene?"[7] One year later, the interdisciplinary Anthropocene Working Group (AWG), which Zalasiewicz headed until 2020, was founded as a subgroup of the Subcommission on Quaternary Stratigraphy. One of its aims was to clarify whether it was justified and necessary from a geological standpoint to speak of a new epoch with reference to human impact on the planet. Another was to broaden our

perspective of the Earth system and its transformation.[8] The fact that two historians, Naomi Oreskes and John McNeill, are part of the Anthropocene Working Group is a testimony of this.

In 2016, British geologists reported that there was sufficient evidence for a new epoch after the Holocene – which for its part began when the last great ice age subsided about 11,000 years ago – but that it still formed part of the Quaternary period (starting around 2.4 million years ago).[9]

The last fifteen to twenty years have shown that, independent of any stratigraphic-geological evidence, the concept of the Anthropocene has rapidly made its way into various fields of study and museums. At inter- and transdisciplinary research institutes such as the Rachel Carson Center for Environment and Society in Munich and the KTH Environmental Humanities Laboratory in Stockholm teaching and research in the environmental humanities are closely intertwined and cooperation is actively sought with the arts and public history.[10] The Haus der Kulturen der Welt (House of World Cultures) in Berlin has hosted an Anthropocene project since 2013, and the Deutsches Museum (German Museum) collaborated with the Rachel Carson Center in running a highly acclaimed special exhibit called "Welcome to the Anthropocene: The Earth in Our Hands" from 2014 to 2016 in Munich.[11] In 2021, the Department of History at the University of Zurich appointed Debjani Bhattacharyya as its first Professor for the "History of the Anthropocene" – a clear indication of its institutional footing in European society as well.

The term has meanwhile established itself in a wide range of academic, public, media and artistic discourses. The Anthropocene, as Helmuth Trischler points out, has "great heuristic and analytical power," not only as a geological term but also as a cultural concept that challenges the narratives of the history of science as well as technological and environmental history.[12]

Traces of human activity can be found in the highest heights of the atmosphere and the deepest depths of the oceans. The notions of nature behaving as a backdrop or a resource reservoir for civilization have long since become obsolete. Even the French *Annales* historians considered factors such as climate, flora, fauna and topography essential aspects in an interdisciplinary effort to make historiography more comprehensive.[13] Since the 1960s, environmental studies has added the "observational dimension" of the environment to the historical "realm of experience," thus making "an issue of the interaction between nature and society in the past," as environmental historians Verena Winiwarter and Martin Knoll noted in 2007.[14] These interactions and relations are meanwhile so ubiquitous that, in the words of historians Sverker Sörlin and Paul Warde, we can speak of "nature's end." No concept of the environment can fail to take humans into account; nature is inherently alloyed, a historical category by dint of human influence.[15]

The history of environments or surroundings[16] is currently experiencing an abrupt shift, however. The Anthropocene marks this caesura in geological time. It is an "ecological threshold" and

"intellectual break," according to literary scholars Eva Horn und Hannes Bergthaller.[17] Concealed behind the prosaic geological term, Horn argues, is an "unprecedented ecological metacrisis," and it is "likewise unprecedented" to conceive this ecological crisis as a new geological epoch.[18] With the concept of the Anthropocene, the history of the environment, which includes humanity, has culminated in a planet-changing "diagnosis of the present."[19]

This inevitably lends the Anthropocene a pragmatic dimension, as noted by Horn and Bergthaller: "The sciences have to accept and embrace the fact that their findings – as in the case of climate science – can become eminently contentious, and thus political. The humanities, meanwhile, need to acknowledge the ecological and material foundations of cultures, societies and cultural artifacts."[20] Historian Dipesh Chakrabarty, who has played a key role in the historical debate around the Anthropocene, is a good example of an intellectual who was drawn to the subject because of its timeliness.[21] As informed contemporaries of the Anthropocene, however, it is not just the historians among us who need to address the issue – though admittedly it is a matter of debate just who the rest of "us" are.[22]

It is precisely this combination of scientific measurements or modeling and the social implications that make a closer examination of the concept so urgent. Literary scholar Gabriele Dürbeck states quite plainly: "The broad response in the media and public sphere shows that an originally geological concept can also function as a 'cultural concept' …"[23] This brings the natural sciences into a renewed dialogue with the humanities and the arts, with the hope of finally bridging the gap between these "two cultures"[24] (the sciences and humanities) with the aid of "environmental humanities,"[25] a relatively young field of study representing a transdisciplinary approach. It is meanwhile undisputed that the Anthropocene has upset the rigid order between nature and culture. Donna Haraway has coined the term "natureculture" to capture this inevitable intertwining[26] that needs to be more thoroughly investigated.

This article consists of four parts. The first reconstructs the "genealogy of a spontaneous idea" and outlines a conceptual history of the Anthropocene from a scientific and humanities perspective, showing which historical sources need to be taken into account in order to break away from a literal conceptual history. The second part, "narratives of dating and their historiographical significance," combines various suggested starting dates from a geological perspective with arguments from historical scholarship. Possible starting dates include the Big Bang, the beginning of the Holocene with the retreat of the great ice sheets about 11,000 years ago, the Industrial Revolution, the first detonation of an atomic bomb by human beings in 1945, and the so-called Great Acceleration, the general increase in resource consumption since World War II. Each starting date not only stakes out different geographical areas but also assigns different responsibilities or implies a different underlying ideology. Colonial, Eurocentric or technocratic approaches are

problematic in this context, suggesting as they do certain interpretations of the concept of the Anthropocene.

The third part will discuss the concept of the Anthropocene with reference to three particular historical debates. “Temporality and periodization” inquires into how historiography deals with the entanglement of planetary and historical time in the Anthropocene. This question was posed by Dipesh Chakrabarty in his thought-provoking 2009 essay “The Climate of History: Four Theses.”[27] Various thoughts on sediments of time and caesuras will be presented as well as discussing the problem of historiography’s position between processual experience and tipping points.

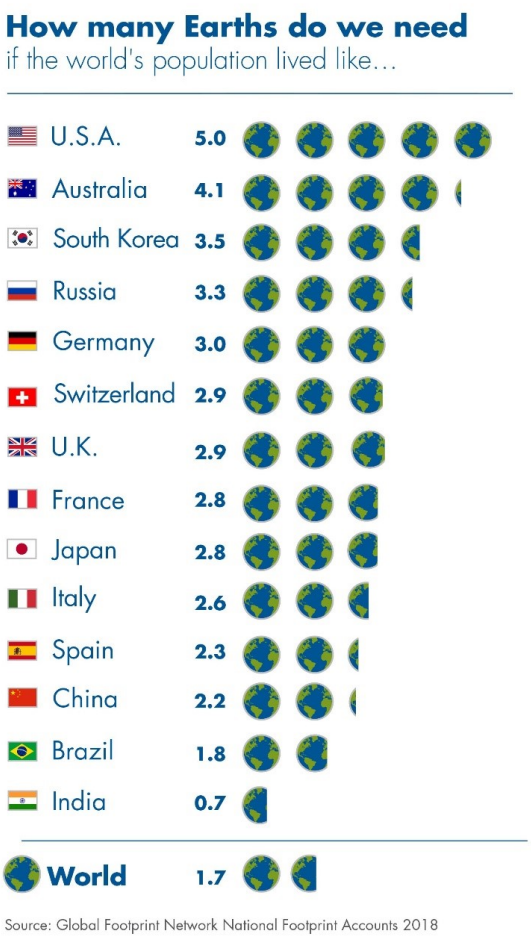
The second debate on “political responsibility” looks at why many scholars of history and the humanities insist on a more recent dating of the Anthropocene. Suggested alternative concepts such as “Capitalocene” or “Technocene” will also be explained, as well as investigating different implications of the concept of the Anthropocene. Political responsibility also includes dealing with climate-change denial and the Eurocentric dream of a “technological solution.” The first two debates are linked to the third concerning the “role of the humanities.” The latter can juxtapose tipping points in the Earth system with turning points in society by reflecting on and elaborating where and how humanity can take action.

The last part of this essay presents several recent examples from the field of history, demonstrating what it means to “write history in the Anthropocene.”[28] The stories that emerge in the process deal with new perspectivisations between micro- and macrohistory (“scales”), revealing “entanglements” and “structures” with a wide variety of actors ranging from mushrooms to jurisprudence. What becomes apparent here is that historians in the Anthropocene need to adopt a particular attitude and display a capacity for imaginative curiosity.

2. Genealogy of a Spontaneous Idea

“Anthropos” comes from the Greek and means “the one turned against”, which in antiquity referred to the upright, striding human being whose upright posture clearly distinguished him from the animal kingdom.[29] Man, however, has left his mark in the Anthropocene not by virtue of his intellectual abilities or social achievements but in the form of his ecological footprint,[30] the cumulative pressure on natural resources caused by human consumption.[31] Since 2003, the Global Footprint Network has created an accounting system for the level of strain on the planet, gaining public recognition in the form of *Earth Overshoot Day*. The latter calculates the calendar date on which humanity’s annual resource consumption exceeds the planet’s regenerative capacity that year.

Image



"How many Earths do we need if the world's population lived like ..." Diagram showing the amount of natural resources used by different countries based on Global Footprint Network data for 2018. Author: Footprint123, June 17, 2018. Source: Wikimedia Commons, License: CC BY-SA 4.0

Another powerful quantification tool, the planetary-boundaries system, was developed by Swedish scientist Johan Rockström. A color-coded system (green and red) indicates which areas (e.g., deforestation, ocean acidification, atmospheric particle pollution) have reached or exceeded the breaking point and thus moved beyond what Rockström and others have referred to as a "safe operating space for humanity."[32]

The so-called eureka moment in 2000 with the "spontaneous" coining of the concept by Dutch atmospheric scientist Crutzen provided a good "founding myth," as noted critically by Helmuth Trischler.[33] But even Crutzen himself had been studying the effects of cultural products (industrial fumes) on the Earth system since the 1970s,[34] just as limnologist Eugene Stoermer had

been using the term since the 1980s, albeit not systematically.[35]

The question as to whether and how much influence human beings have on their natural environment is also much older, dating as far back as the late eighteenth century when it spawned a body of literature in science and natural philosophy that is now being repeatedly cited in connection with the Anthropocene. Particularly noteworthy here is French naturalist Georges-Louis Leclerc, Comte de Buffon. As Anglicist Noah Heringman points out, Buffon's *Epochs of Nature* from 1778 highlights several elements that resonate in the concept of the Anthropocene. Buffon, for example, viewed the climate and energy consumption as interrelated; he spoke of humanity as a species in natural history[36] and distinguished between geologic and "human time."[37] Other seminal works from the nineteenth and twentieth centuries were penned by Italian priest and geologist Antonio Stoppani, who talked about an *antropozoico* in 1873,[38] and Russian-Ukrainian geologist Vladimir Vernadsky, who interpreted life in general – and the energy conversion rates of the biosphere – as a "geological force."[39]

In her "Genealogy of the Anthropocene,"[40] Eva Horn illustrates that what matters is not the literal history of the concept but the questions preoccupying human beings. The period around 1800 has thus come into focus, a time when, in Horn's depiction, "... naturalists, travelers and philosophers began to understand nature as something historical: as a place of severe upheavals and transformations affecting atmospheres, landscapes and life forms ..."[41] Natural surroundings were perceived afresh, not only in travelogues from the colonies, which told of a wilderness in need of taming, but also in works of natural philosophy and taxonomy and, increasingly in the nineteenth century, through tourism and popular hobbies such as collecting fossils on the coasts of Europe.

By observing rock formations and fossils, humans zoomed in on the history of the Earth. It soon became clear that the Earth's topography, with its folds, faults, moraines and erosion, could not be explained through a biblical timeframe of 6,000 years. New discoveries revealed the existence of "deep time."[42] This is evident even in the writings of Charles Darwin, whose account of evolution, published in 1859 and still valid today, only works over a very long time horizon.[43] The discovery of deep time was incompatible with historical, biblical time.[44] Hence new narratives about the origin of life on Earth were needed, as the Genesis story of Christian tradition could not explain these phenomena.

Another noteworthy moment in the conceptual history of the Anthropocene were the nineteenth-century debates of the British Geological Society over whether the immediate present was indicative of a new geological epoch. One proposed epoch for the Quaternary period/system[45] was "Recent." Geologist Charles Lyell wanted to distinguish between the Pleistocene and what is now known as the Holocene, when conditions emerged for human settlement about 11,000 years

ago as reflected in the composition of fossils.[46] Holocene, meaning “wholly recent” or “entirely new,” was officially adopted in 1885 by the International Geological Congress as a designation for the second epoch of the Quaternary period, whereas American scientists sometimes used the term “Recent” for the same geochronological epoch.

The Anthropocene as a figure of thought therefore has a deep time of its own, having more to do with the natural philosophy of the seventeenth century than with the more recent project of the natural sciences.[47] And yet the narrative in the natural sciences has a much longer history than the recent eureka moment would suggest.

3. Narratives of Dating and their Historiographical Significance

It would be wrong, however, to conclude that the technical-stratigraphic definition of the Anthropocene is of no particular interest to the humanities. Different historical developments with different geographical frameworks can be emphasized, depending on the starting point chosen. “The question of when the Anthropocene begins is also a question of what it is; of what it is the effect of …”[48] The question of geological dating therefore requires a twofold answer: Which stratigraphic evidence is there for a new phase in the history of the Earth? And when did this phase begin?

Justifying the end of the Holocene requires geologically relevant indicators, so-called golden spikes, i.e., globally distributed, relatively simultaneous changes that are reflected in the sediments and are of a recurring nature.[49] “The trick,” according to Zalasiewicz, who played a leading role in the discussion, “is to define the boundaries in such a way that the units of time structure (a human construct) coincide as closely as possible with the key episodes of the Earth’s history …”[50] On May 21, 2019, the Anthropocene Working Group, a component body of the Subcommission on Quaternary Stratigraphic, concluded following an internal vote (29 in favor, 4 against, and 1 abstention) that there is sufficient evidence, including golden spikes, to talk about a new geochronological epoch beginning in the mid-twentieth century.[51] The International Union of Geological Sciences is responsible for ratifying a geological epoch.[52]

For contemporary history the dating question means that it is dealing with various period overlaps, depending on the geochronological starting point for the Anthropocene. The following will present four suggestions for dating this new geological epoch and discuss the implications for the respective historical narratives.

3.1 The Steam Engine

Crutzen and Stoermer see significant changes in the phase around 1800, with the onset of the Industrial Revolution and the concomitant increase in CO2 emissions. More specifically, they've dated the marker of the new epoch back to the year 1784 with the invention of the steam engine by James Watt, a point in time corresponding to changes in the carbon-dioxide concentrations found in ice sheets.[53]

Choosing this as the starting point automatically puts us in the classic European history of industrialization, the Enlightenment, urbanization and scientific specialization. This means opting for a Western, technocratic perspective – as reflected, for example, in the cover image of *Anthropocene Review*, published since 2014, which shows a satellite image of North America, emphasizing the latter's pioneering role in researching the Anthropocene.[54] The danger of this dating approach, according to philosopher Jason Read, is that it places humans outside nature and views them primarily as a destructive force, whereas in fact it merely describes a certain appropriation of nature by capitalism.[55] It is therefore less about inquiring into the essence of being human or into a very natural process, as the term Anthropocene might suggest, than it is about the history and specific institutions of capitalism, industrial production and the use of fossil fuels.[56] In this context Read talks about the metabolic rift, meaning the social and economic processes that set the material cycle of capitalism in motion.

Political scientist Jeremy Baskin is similarly critical in his article "Paradigm Dressed as Epoch,"[57] arguing that the Anthropocene is less about scientific dating than ideological camouflage. The concept, he argues, is tantamount to a Western, colonial appropriation of nature, reflected in the present-day notions of "planetary management" and geoengineering.[58] In this sense it runs the risk of losing its cultural impact through the reconceptualization of man and nature, as it is ultimately just a reconfirmation of the global distribution of power and access to resources in the tradition of colonialism.

3.2 Sedentism and Agriculture

Another suggested start date attempts to emphasize the civilizational aspect. The question here is whether general "interventions in nature" can count as the start of the Anthropocene. This would push back the beginning even farther, as urban development, irrigation, agriculture and land clearing have existed since the first Mesopotamian settlements, commonly considered the cradle of civilization, the end of the last great ice age having created the necessary climatic conditions.

Marine biologist William Ruddiman spent a decade working on the hypothesis that the Anthropocene began about 11,000 years ago with the end of the Holocene.[59] However, while ice-

core drillings for the middle period of the Holocene (about 7,000 years ago) did reveal changes in the composition of the atmosphere, it is hard to link this to human activities (e.g., wood clearing for agriculture). According to Zalasiewicz, who was involved in the debates as a member of the advisory committee, this dating variant of the Anthropocene is hard to defend from a practical standpoint; moreover, interventions in the ecosystem are not synonymous with interventions in the Earth system.[60]

From a historian's perspective, too, this starting date is also problematic. The gradual process of human beings becoming sedentary as the "indicator of a new epoch" is overly simplistic. Though anthropological constants of this sort might have an appeal to the general public,[61] it is too vague a category for professional historians.

3.3 The Big Bang

Still, there have been suggestions to wind the timeline back even further. These have come from representatives of so-called Big History, an educational project of historian David Christian that emerged in the 1980s and has recently gained in popularity.[62] His arguments are based on a certain perception of historiography – which to his mind has increasingly isolated itself with its empirical specialization but that could once again reach a wider audience through the art of storytelling.[63] He attempts this himself in a TED Talk, in which he offers a synthesis of physics, chemistry, biology, evolution and history, tracing the history of the world from the Big Bang to his own grandchild – 13.8 billion years, no less – in a mere 18 minutes.[64] His narrative is intended to create an emotional bond with the cosmos and a new self-understanding as global citizens in lieu of the feeling of solidarity previously engendered by the nation state. This, according to Christian, would lay the foundation for a positive change of behavior in the present.[65]

Historian Ian Hesketh sees Big History as fulfilling the age-old dream of a "theory of everything" in the spirit of a mathematical aesthetic.[66] From the perspective of Fernand Braudel's levels of time, the narrative has perhaps briefly succeeded in outlining the *longue durée* (topography, climate), whereas the medium term (economic cycles) and the short term (events) are lacking entirely.[67] In Big History, historical time and the Anthropocene are not shaped by the actions of people and societies; rather, they are understood as the inevitable development of human nature, whose patterns are now revealed by the evolutionary epic.[68]

A concept of this sort not only romanticizes humanity but is also a gross generalization in its universalization of human beings. Human ecologists Andreas Malm and Alf Hornborg have offered a trenchant critique of this. The term Anthropocene, they argue, denaturalizes the climate by portraying it as something manmade, a product of culture, while in the same breath renaturalizing humanity by presenting it as unavoidable evolutionary history. The first narrative lumps together

all societies, whereas the second is a biological determinism. Malm and Hornborg, on the other hand, emphasize that the Anthropocene is a good opportunity to address global inequalities that the concept itself obscures. To be sure, this sidelines the cultural aspect, but allows "participation" in the global market and the access to resources to take center stage. The result is to highlight inequalities resulting from the current ecological crisis.[69] These differences, ignored by civilizational or planetary grand narratives, become the authors' focus of attention, not with the intention of retelling the story of capitalism but to grapple with the history of global inequalities.

3.4 Radioactivity and the Great Acceleration

The last proposed start date for a new epoch on the geological timescale references the accumulation of uranium and the first atomic-bomb test (New Mexico, July 16, 1945) as well as the military use of radioactivity (Hiroshima and Nagasaki, August 6 and 9, 1945) resulting in the unprecedented occurrence of radioisotopes on planet Earth.[70] Radioactivity is the marker in this case, evidenced in a golden spike and coinciding with a second phenomenon, the Great Acceleration.[71]

The latter refers to the exponential increase in natural-resource consumption since World War II. Every associated graph indicates the same pattern. Since 1800 (when the first measurements were made) the curve runs at a relatively low level until the benchmark year of 1950, at which point it rapidly rises – regardless of the indicator: whether demand for paper, CO2 emissions or fishing, whether surface temperatures, urban population, telecommunications or water consumption, methane emissions (cattle breeding) or transport volumes, etc.[72] The pattern of these graphs coincides with the so-called hockey-stick curve showing the average change in global temperature over the last 1,000 years. It rises rapidly in parallel with the Great Acceleration, substantiating the correlation between climate change and the history of culture and technology.[73]

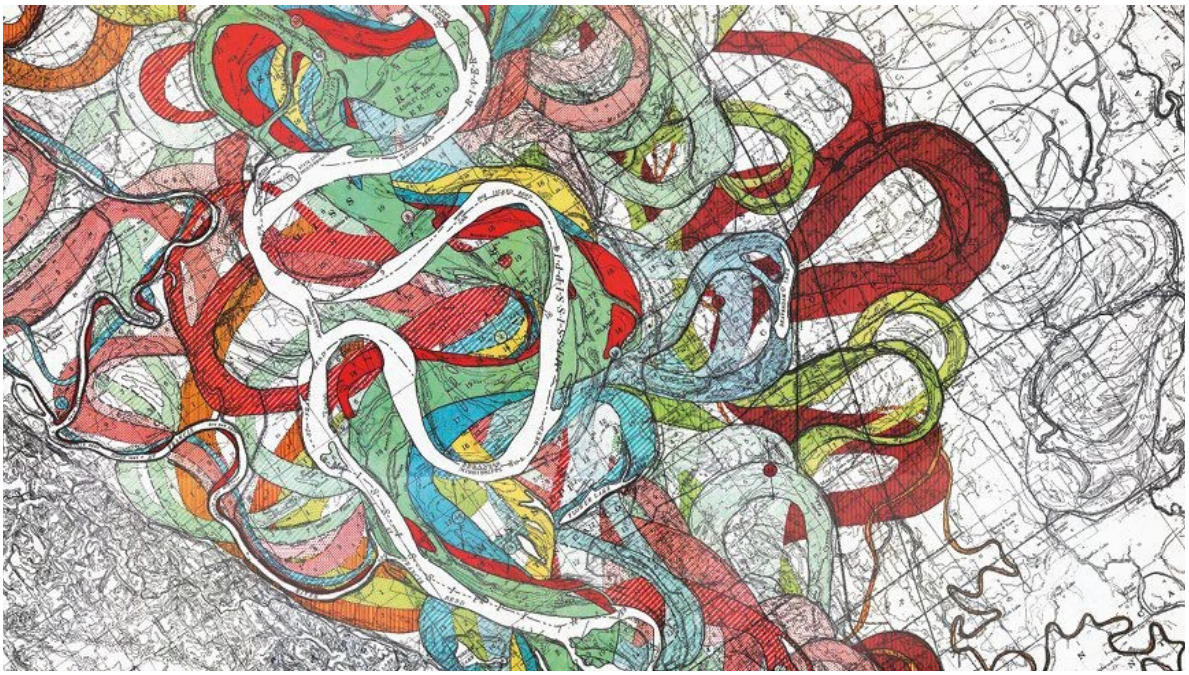
General resource consumption by highly industrialized societies is reflected, for example, in poorly degradable plastic products and concrete structures, prompting Zalasiewicz and others to speak – in a futuristic thought experiment – of so-called technofossils, which even in a hundred thousand years will be traceable to the present day.[74] Dating the start of the Anthropocene around the year 1950, writes Zalasiewicz elsewhere, offers a pragmatic solution and a workable hypothesis.[75]

Not all geologists have been on board with this. They not only find the manner of dating unusual, compared with traditional methods, but see their field being used for political purposes: "The Anthropocene, as currently popularized, is fundamentally different from the chronostratigraphic units that are the charge of the ICS [International Commission on Stratigraphy]. It is the present and future versus the past."[76] Climate scientist Will Steffen, who for years headed the International Geosphere-Biosphere Programme and published numerous articles in collaboration

with members of the Anthropocene Working Group, has emphasized on the other hand that the Anthropocene is precisely about linking classical geology or stratigraphy with Earth system science in order to be able to make predictions about the future at all.[77] An “Earth system point of view” allows us to consider the entire living parts of the Earth (including the atmosphere, cycles, humans), he has argued.[78]

Independent of these discussions among geologists, a consensus has formed in the last decades placing the start of the Anthropocene in the middle of the previous century. It is indeed a remarkable irony that the history of the planet began about 4.5 billion years ago with an overheated globe, that the genus *Homo* appeared about 2 to 3 million years ago, and that the start of a new geological epoch has been dated to exactly 70 years ago. “Coining the term ‘Anthropocene’ for a new epoch,” concludes Eva Horn, “means ending the Holocene *now*, an epoch that began about 11,000 years ago and that marks the start of human civilization.”[79] The post-glacial Holocene epoch, whose climatic characteristics, its so-called Goldilocks conditions,[80] enabled modern civilization in the first place, is over.

Image



“Meandering Mississippi.” Geological Study of the Alluvial Valley of the Lower Mississippi River, USA 1944. Map drawn by Harold N. Fisk, U.S. Army Corps of Engineers. Source: US Army Corps of Engineers [April 10, 2022], public domain. See also “Mississippi: An Anthropocene River,” a project developed and organized by Haus der Kulturen der Welt (HKW) and the Max Planck Institute for the History of Science (MPIWG) with the aim of exploring the vast region encompassed by the world’s fourth largest river, making this landscape legible as a critical zone of habitation and long term human-environment interaction by analyzing the Anthropocene on the ground and in the field. https://www.mpiwg-berlin.mpg.de/research/projects/mississippi-anthropocene-river [April 10, 2022].

Historians Debate the Term

The question, dealt with above, of setting an approximate start date for the geological epoch of the Anthropocene foregrounds various “drivers of history.” If the history of civilization with the start of sedentarization is the starting point, global inequalities fall by the wayside; choosing the Big Bang results in biological determinisms; industrialization as the starting point potentially favors a Western view; and opting for the Great Acceleration in the mid-twentieth century, while explaining many phenomena (with regard to consumer societies and the increase in measurable radioactivity in the environment), only marginally reflects the factors that historians are most interested in: societies and their transformation over time. Whereas this essay has thus far concerned itself with a technical-stratigraphic description of geologically verifiable effects in various epochs, it will now discuss what the concept of the Anthropocene can contribute to historiography.[81] Three debates will be addressed below: temporality, political responsibility and the role of the humanities.[82]

4.1 Temporality and Periodization

The Anthropocene means that geological time has caught up with a present hitherto experienced as a more or less random series of "futures past."[83] The "deep time" of our planet has effectively entered current events, as the previously known physical, chemical and biological parameters necessary for human life are measurably and perceptibly shifting. Our present, at the same time, is linked to the "deep future," since these changes in the biosphere are irreversible and will last for hundreds of thousands of years. Braudel's *longue durée* – the, for all intents and purposes, eventless background time, the geological, topographic, climatic and vegetative conditions for what we historians call historical transformation[84] – has collapsed into the present moment. The once profoundly slow pace of change in deep time is currently undergoing a process of acceleration and upheaval, heading toward so-called tipping points where previously independent and linear processes are now systemically and synergetically gathering momentum, with unpredictable, irreversible results.[85] The "long term" has given way to events.

What does this mean for the levels of time in historiography, in particular contemporary history, when planetary history extends into the present and our "realm of experience" is a CO_2 mortgage for our "horizon of expectation"?[86] Chakrabarty introduced this historians' dilemma into the Anthropocene discourse in 2009: namely, that history works on the assumption of a certain continuity in human experience, whereas the Anthropocene posits that we have never experienced anything like the current state of the world.[87] The "planetary crisis of climate change" affects not only us as humans but also the discipline of history: "How does the crisis of climate change appeal to our sense of human universals while challenging at the same time our capacity for historical understanding?"[88] In his essay "The Climate of History: Four Thesis," Chakrabarty sounded out, as it were, his own scientific reading with a view to the "current planetary crisis"[89] of global warming and came back empty-handed: "I realized that all my readings in theories of globalization, Marxist analysis of capital, subaltern studies, and postcolonial criticism over the last twenty-five years … had not really prepared me for making sense of this planetary conjuncture within which humanity finds itself today."[90]

The main conflict identified by Chakrabarty can be described as follows. The grand narrative of modernity, the unfolding story of emancipation, liberation and freedom, is becoming problematic, as this progress appears to have been built on a profound dependence on fossil fuels.[91] Chakrabarty makes his case that what made us prosperous in the first place is now depriving us of the very basis of our existence.[92] Capitalism has made the invisible visible: planetary history. But the latter has no meaning without life (or something capable of describing this life).[93] We should therefore bear in mind that we have to think in planetary timeframes, when in fact we are very much anchored in the present. The result is a cognitive incommensurability that ultimately brings

us to the “limits of historical understanding.”[94] Given the unprecedented nature of the Anthropocene, new information technologies being one reflection of this, historian of science Zoltán B. Simon points out that historiography with its processual thinking is actually a hindrance.[95]

Contemporary historian Martin Sabrow notes that “historiography cannot make do without some kind of watershed concept,” however “subjective, sectoral and perspective-bound” it may be.[96] In general the term “caesura” – watershed, inflection point – always needs to be understood in its context. Accordingly, economic, social, scientific and cultural caesuras in the modern era do not run parallel but “follow other logics and rhythms of change.”[97] The historical caesura does not hold up as a characteristic of the past, but it is a good heuristic tool with analytical costs and benefits.

Sabrow subsequently makes a distinction between a “retrospective interpretive caesura” and a “contemporary experiential or structural caesura.” The former is the “subsequent determination of a watershed moment by posterity,” the latter the contemporary designation of a caesura that is tangibly experienced in the “world of meaning.”[98] In this regard, the Anthropocene could be read as a prominent experiential and structural turning point. It is unique, first of all, because the Anthropocene affects all the foundations of our existence on the planet at the same time, making it an existential threat to the whole of humanity; secondly, and this is what makes it truly special, it is humanity that is causing these changes.

4.2 Political Responsibility

A variety of historians agree that it is crucial to date the beginning of the new epoch in the recent past. In his essay “Why the Anthropocene Has No History,”[99] Zoltán B. Simon argues for the above-mentioned “unprecedented” nature of the Anthropocene. It is unprecedented in his view because it is not the result of a gradual, incremental development.

He spells this out with a double line of reasoning. If we do not describe the Anthropocene as unprecedented, we would have to view it as an intermediate state in an ongoing process, in which case “Anthropocene” would be the wrong name and we should refer to it instead as the “Capitalocene” or the “Technocene.” The latter two designations would better capture the causes than the universalizing notion of the Anthropocene, which negates social, political and cultural differences.[100] Another alternative, the “Cosmopolocene,” amounts to the same as the Capitalocene/Technocene, the only difference being a desire to dress it up in more worldly garb.[101] But if, according to the second part of his line of reasoning, the current situation is understood as the tentative result of a gradual development (e.g., of technology or capitalism) this

obviates the need to take action right now. Only by recognizing the singularity of demonstrably manmade changes will a proactive stance be encouraged, leading to a genuine blueprint for the future on a planet that is still inhabitable.[102] It is therefore better if the Anthropocene does not have a long history.

A young epoch is needed in order to be able to investigate in concrete and systematic terms the historical distinctions and the "simultaneity of the non-simultaneous." In classic terms, following Reinhart Koselleck, it is a plea against the linearity of time and for the complexity of multiple chronologies: "The advantage of a theory of sedimentations of time lies in its ability to measure different velocities – accelerations or decelerations – and to thereby reveal different modes of historical change that indicate great temporal complexity."[103] Only with this complexity can we capture the political dimension of the concept, which goes hand in hand with responsibility.

Not all the countries on Earth have been equally responsible for the exponential increase in resource consumption reflected in the curve of the Great Acceleration. In this regard demographic growth is a poor indicator, since the places where population has grown the most have the lowest CO2 emissions, and vice versa.[104]

This "simultaneous non-simultaneity" has been countered at the international level since the Rio Earth Summit of 1992 and the Kyoto Protocol of 1997 with the notion of "common but differentiated responsibilities," meaning some countries and individuals bear more of the brunt for a joint problem. Chakrabarty has applied the same principle to the Anthropocene, asking who exactly the "we" is.[105] The history of humanity is also part of the history of our planet, or to put it another way: given our planetary crisis, it is necessary to think of ourselves in planetary terms. This does not, however, render the concept of humanity irrelevant, since the "starting point of our actions" is still the human lifespan.[106]

The biological concept of species hidden within the concept of humanity is therefore not very helpful, since – as Chakrabarty says, referencing Bruno Latour's "parliament of things" – it doesn't make sense, as people rather than species are sitting in the parliaments.[107] If a universalism is to be used, then not a biological (*Homo*)[108] but a social concept of humanity.[109] This would be the true measure of our actions. Reactions to the planetary crisis, according to Chakrabarty, are situational and necessary at all levels – individual, institutional, political – with every conceivable orientation. "The current planetary crisis of climate change or global warming elicits a variety of responses in individuals, groups, and governments, ranging from denial, disconnect, and indifference to a spirit of engagement and activism of varying kinds and degrees."[110] In order to understand this or make it comprehensible, however, a "new political anthropology" is needed.[111]

Chakrabarty assumes that the crisis of our planet has to do with global inequalities and should therefore be of particular interest to historians. This involves a double dissociation or positioning. The first concerns climate-change denial, which is counteracted by defining the Anthropocene as a young and unprecedented epoch. Even if, according to environmental historian Libby Robin, the climate-human relationship is much older than geologists and natural scientists have been able to measure, dating the Anthropocene further back would relativize its meaning.[112] Whereas economists have increasingly come to acknowledge that humans have been living at the expense of, i.e., "discounting the future," markets having not shown any willingness to bear the ecological costs, the majority of historians still believe they "can 'discount the present' by providing a deep past."[113] Malm and Hornborg argue in a similar vein: "If global warming is the outcome of the knowledge of how to light a fire, or some other property of the human species acquired in some distant stage of its evolution, how can we even imagine a dismantling of the fossil economy?"[114]

Second, this definition of the Anthropocene contains an inherent demand for political action and is therefore skeptical of an unalloyed belief in technological progress. The latter includes geoengineering proposals to combat global warming with large-scale technological interventions in environmental systems. Examples here are putting sulfur or mirrors in the outer layers of the atmosphere to reflect sunlight away from the Earth's surface, as well as encouraging plankton growth in the oceans, since algae use CO2 to grow and might hence provide a natural form of carbon capture and storage.[115] These and similar ideas are not new,[116] but are gaining new impetus in times of crisis. In 2006, Paul Crutzen referred to this approach as "Plan B," "Plan A" (government policy) having failed, and asked whether stratospheric sulfur injections would really be a "contribution to resolve a policy dilemma."[117]

The signatories of the "Ecomodernist Manifesto" of 2015, on the other hand, place their full trust in technological solutions.[118] Proceeding from a neoliberal-type cost-benefit analysis, the consequences of global warming are viewed as a problem of optimization best solved by means of engineering, more specifically by a select circle of technocrats. The authors coin the term "good Anthropocene," pointing to the opportunity they see rather than the problem.

Their recommendations to avert global warming are purely technological and technocratic in nature, and hence very much in the Western colonial tradition. Jeremy Baskin makes this clear in his essay on the Anthropocene, "Paradigm Dressed as Epoch." The narrative of the colonial settler subjugating nature and expanding in North America has seamlessly merged with the mentality that "the white man" can now, for the good of humanity, put right the damage he has done.[119] With a view to the above-mentioned deliberations allowing for a common but shared responsibility, this approach does not at all support a democratic, locally rooted process. Quite to the contrary, geographer Kathleen McAfee argues that this technocratic discourse runs the risk of reviving a

social Darwinist mode of thinking: “The notion of scarcity itself is a political concoction that masks immense waste, obscene concentrations of wealth, and the self-defeating pursuit of endless economic growth.”[120] An unbridled faith in progress and the omnipotent idea of feasibility could, according to Eva Horn, potentially lead to “the discovery of the Anthropocene initially fulfilling the age-old desire to shape, change and control nature.”[121]

Image

Road to the exploration field of a gold, copper and silver mine in Nusa Tenggara Barat, Indonesia, May 28, 2009. The original mountain had a height of 400 meters above sea level, with a planned excavation of 600 meters below sea level. Photo: Randi Ang, source: Flickr, License: CC BY 2.0

4. 3 The Role of the Humanities

“I find it strange,” wrote a befuddled human ecologist Alf Hornborg, “that, at the very moment when we seem to be realizing how significantly human culture and social organization can transform the biophysical conditions of human existence, it is being suggested that ‘society’ is an

obsolete concept and that the social sciences have nothing to offer."[122] The concept of the Anthropocene was devised by the natural sciences, relegating the social sciences and humanities to a reactive role from the start, as it were.[123] His colleague Andreas Malm even talks about the "unique agency" needed on the part of humans to deal with the situation at all.[124] Literary scholar Hannes Bajohr argues in a similar albeit more programmatic vein when he stresses that "as the addressee of ethical demands, as a political actor, or as the instigator and the thing responsible for climate change … the concept of 'the human,' while still perhaps operational, is a rather precarious term."[125]

In the introduction to their book *The Shock of the Anthropocene*,[126] historians Christophe Bonneuil and Jean-Baptiste Fressoz broaden the tasks and role of the humanities to prevent the Anthropocene from becoming just another element on a simple number line. They attempt to repoliticize the debate with the image of a "culminating point of a history of destructions."[127] They demonstrate that the drastically increasing energy flows since the dawn of the Industrial Revolution have always been bound up with social and economic realities, and criticize the humanities for having jumped with alarming speed onto the bandwagon of an "Anthropocene" discourse dominated by measurements and numbers, forgetting their own, much more essential contribution in the process. "The Anthropocene does not need to be an object of scientific inquiry by geologists and stratigraphers, or even a formally recognized geological epoch, in order to have an impact."[128]

The notion of a "turning point" as a complementary element to the "tipping point," as put forth by technological historian Sabine Höhler, underscores the importance of the social sciences and humanities.[129] The internationally recognized "two-degree target" of the Paris Climate Accords of 2015 and the 1.5-degree target adopted by the IPCC Special Report three years later in 2018 both contain the notion of a tipping point, because passing this global temperature threshold would have uncontrollable consequences. But they also convey the notion of a turning point, as the numbers are a path to global understanding and a prerequisite for "environmental governance." Averting the catastrophe inherent in the Earth-system tipping point requires a turning point, in other words, which can only be brought about by society.

But the task is (also) anchored at a local level, as 1.5 degrees Celsius does not mean the same thing for different places. The concept of a turning point encompasses what societies, institutions, individuals and states can do in the face of climate crisis. It opens up possibilities to act and spaces to imagine a different future, or as Jason Kelly put it: "It is a thing both manifested in the physical world and manifested in our imaginations. As such, it is a fractured thing, or things – Anthropocenes. This realization can be very useful for researchers and can help us create more nuanced research and policy."[130]

The social sciences and humanities can also provide needed answers to the Anthropocene.[131] They make distinctions that are necessary for describing the past and present, and capture the complexity of society. The biosphere has existed for eons without human beings, but analytical categories such as the biosphere, technology and society are needed to describe the (history of the) current situation.[132] The scientific facts are given, but in argumentative terms the scientific basis is a comprehensive understanding of culture with all of its interconnectedness: the most disparate areas of society and their interactions and interdependencies with the natural environment, down through the ages. The humanities, historians included, have by no means exhausted the possibilities of bringing these perspectives into a wider discussion.[133]

Contemporary history is called upon to forge the link between history and the Anthropocene as a new geological epoch. "Thresholds," "discontinuities," tipping points[134] and abrupt shifts in time bring new temporal structures and a new kind of politicization to historiography, linked to questions of responsibility and ethics as well as global governance and local, community-supported action. This becomes all the more relevant as global warming puts a spotlight on social non-synchronicities and social differences.

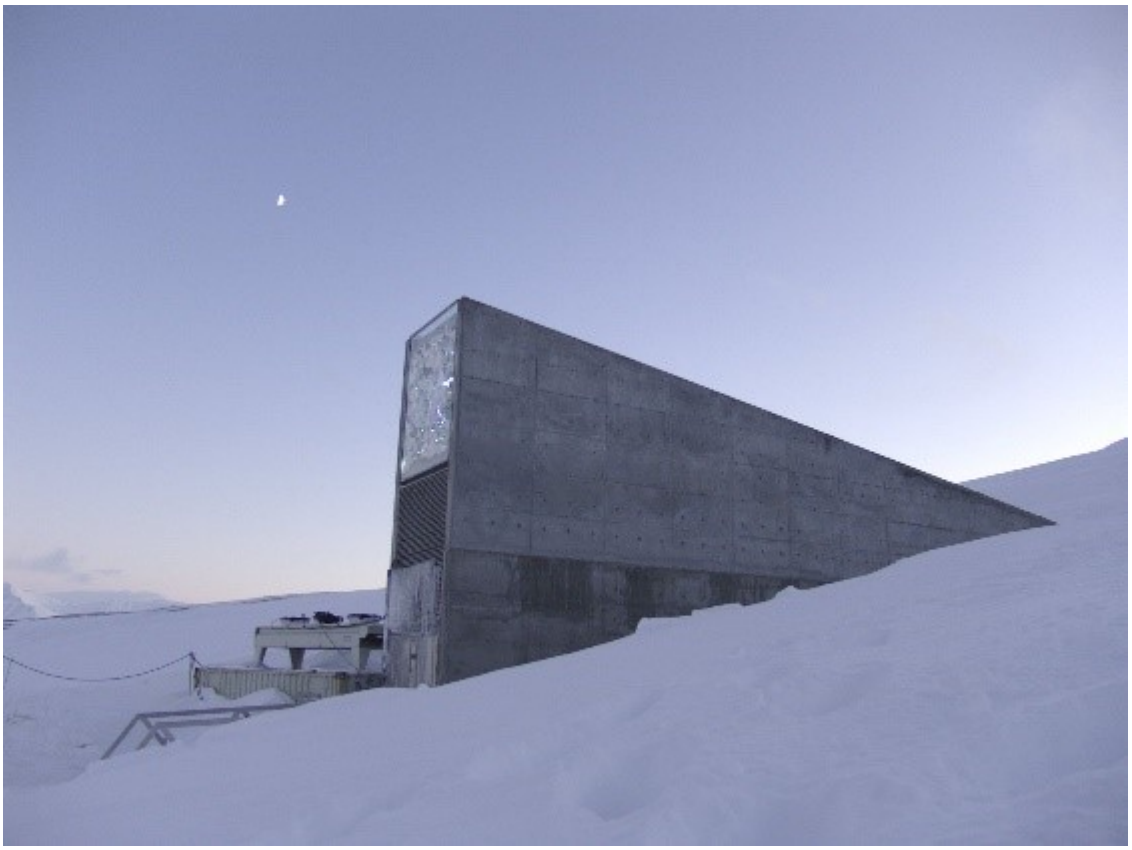
"How can we connect our stories about deep pasts and deep futures with historical pasts and futures?"[135] ask historians Andrea Westermann and Sabine Höhler. They advocate an ontological and epistemological expansion of histories in the Anthropocene across time, space and species, making sure that the human dimension and political inequalities remain visible.[136] At the same time, the Anthropocene is about a conflict-ridden temporality whose future is uncertain and marked by narratives of catastrophe and the end of humanity.[137] The Anthropocene is therefore not a universal and inevitable history, and won't be one for everyone (at the same time). Historiography, in the future, will thus need to make an imaginative leap.

5. Writing History in the Anthropocene

The COVID-19 pandemic made clear that global crises do not have the same effect in different parts of the world[138] but are always linked to the biological and material environment. This insight is hardly new[139] but has taken on a new urgency in light of global markets, global mobility, present-day means of communication, as well as the current use of resources and global supply chains. In this regard the Anthropocene is a condensed analysis of contemporary Earth system science and climate research that bears in mind the scale and complexity of human-induced transformation as well as its long-term effects.[140] It provides a new perspective on the material foundations of modern societies and their dependence on a human-friendly climate. New actors emerge that need to be integrated into our historical accounts: plants, animals, microbes, oceans, sand, lichens and plankton, as well as the physical and chemical conditions of natural and human-modified

environments and their interrelation with human behaviors and activities.

Image



Svalbard Globale frøhvelv / Svalbard Global Seed Vault. The largest seed vault in the world is located in permafrost, 1,300 kilometers north of the Arctic Circle. It was opened in 2008 by the Norwegian government with the aim of preserving the great genetic diversity of the world's food crops. See the website of the Norwegian government[April 10, 2022] Photo: Svalbard Globale Seed Vault/Mari Tefre, Norway, February 14, 2008. Source: Landbruks- og matdepartementet/Flickr, License: CC BY-ND 2.0

This opens up potentially new narratives for contemporary history if it increasingly joins forces with intellectual history, environmental studies, energy history, the history of science and historical climatology.[141] One innovative field for historiography is the study of new forms of (transformational) knowledge and action. Environmental humanities encourage transdisciplinary work as a mutual learning process, using participative processes to achieve problem-centered, practical and local approaches and incorporating various forms of knowledge, whether chemistry, indigenous knowledge or even the visual and fine arts.[142]

How can historians take into account these diverse contexts and interactions? The following will offer one methodological and a selection of substantive answers from historiography.

Historian of science Deborah R. Coen begins her argumentation with the topic of complexity.[143] The frequently used argument that the current ecological crisis is unfolding on a superhuman scale[144] has a story of its own when seen from the perspective of the history of ideas. It suggests that global warming and its consequences are simply too complex for humans to understand. From a historical perspective, however, this argument is untenable. Coen writes: "However, the spatial and temporal dimensions of human life are historically and culturally contingent … There is therefore no fixed 'human scale' that could be set in opposition to 'the planetary.'"[145]

Human behavior has always been related to the environment in specific ways, she says, so that the one cannot be seen in isolation from the other. Coen is inspired by an ecological model, as ecology demonstrates that climate change is both a global and a local phenomenon. These relationships can be understood historically, too, by using the method of scaling, i.e., "mediating between different systems of measurement."[146] Scaling is not a classic linking of object with context or macro- and microhistory. Nor is the aim to contrast universalism ("superhuman scale") with pluralism (the specific and incomparable). "Scaling," according to Coen, "is the process of situating the known world in relation to times or places that are distant or otherwise inaccessible to direct experience." It is the amplification of perspectives, in a precise rather than a relative sense.[147]

Daniel deB. Richter illustrates this approach in an article about the Cotton Belt region in the United States, concluding that its history can be described as a "narrative of decline" or a "narrative of creativity," depending on the manner of scaling.[148] The cognitive incommensurability between planetary and historical time as described by Chakrabarty is not a logical conclusion, according to Coen. Similarly, fears expressed by representatives of postcolonial studies that a planetary perspective of environmental catastrophe would result in a pluralist representation of history disallowing the portrayal of imbalances of power is likewise unfounded. The claim of incommensurability is more of a technical issue than an insurmountable methodological problem.[149]

The works of historian Andrea Westermann show one way of dealing simultaneously with the presence of different scales and sediments of time. She calls this an "earth-centered approach," combining long geological time frames with material concerns of the day. The example she chooses is the Atacama Desert on the Pacific coast of South America, a strip of land stretching over 1,600 kilometers (990 miles) that has both a colonial and multinational history as well as a geological one, given the mineral deposits there and associated mining activities.[150] Westermann uses this mining to show that not only minerals are being dug up but also a complex picture of the past, spanning millions of years geologically and comprising labor, global markets and visions of the future as well as waste products. The latter are sometimes dumped nearby, which is bad for the topographical dynamics of this desert landscape. Westermann's investigation combines

mineral dependencies with social interactions as well as with varied imaginary forms and competing consequences on a spatial and temporal scale: “Taking such an earth-centered approach, or *erdzugewandter Ansatz*, enables a more accurate depiction of social reality, its complexities, and ambivalences.”[151]

Making complexities and especially discontinuities more visible is a topic of anthropologist Anna Lowenhaupt Tsing’s *The Mushroom at the End of the World*.[152] The author sets out to explore a wild mushroom called the matsutake, which has the characteristic feature of growing where capitalism has devastated the natural landscape or where industrialization has caused the greatest environmental degradation. At the same time, the mushroom is an edible delicacy in Japan, where it commands a lucrative trade. It is often collected by displaced minorities and refugees to guarantee their survival.[153] The subtitle of Tsing’s book is *On the Possibility of Life in Capitalist Ruins*, and that’s exactly what she means: a biological survival artist, the matsutake, living in these depleted swaths of land enters into a temporary symbiotic relationship with the economic precariat, before the latter moves on in search of other sources of income.

In an ethnographically inspired, collective anthropology, she vividly illustrates how any linear narrative of this mushroom would fall short. To truly understand its history one has to correlate the entanglements of soil, trees, climate and water with the movement of refugees and other disenfranchised peoples, their economic hopes, as well as with their capitalist exploitation and the cultural reshaping of dietary habits. For this reason she adapts the narrative form of her book to the object of her research and the (collective) inquiry she undertakes: “I find myself surrounded by patchiness, that is, a mosaic of open-ended assemblages of entangled ways of life, with each further opening into a mosaic of temporal rhythms and spatial arcs.”[154]

The metaphor of “entanglement” belongs to the terminology of a multispecies perspective. The present-day situation with its interlinked global crises – global warming, biodiversity loss, pandemics – makes plain that it is not sufficient to merely talk about the impact of technological, biological, economic or health-related factors alone. We have to think in terms of myriad human-animal relations, not least of all our coexistence with viruses and bacteria, which can easily become a threat to humans, albeit with a very different impact depending on one’s socioeconomic and geographical situation. In the words of Donna Haraway, we should “make kin” with these species,[155] since we share a social space with all these other beings. Sociologist Bruno Latour would add: there is no outside, “no distant place anymore.”[156] We have always been entangled in various relationships to the world, what he calls the “complex workings of many enmeshed living organisms, the whole of which is either called ‘Earth system science,’ or more radically, Gaia.”[157]

Narratives like this go beyond animal studies, environmental history or science and technology studies by formulating and theoretically testing a new ontology[158] that is supposed to influence

our thinking and behavior. It is thus about the attitude we have as scholars and researchers towards ourselves and our so-called objects of study.[159]

When we historians begin to think more ecologically, seeing things as interrelated, the questions we ask will be more profound, our perspective broader. A case in point is historian Nils Güttler and his work on the Frankfurt airport. A technological history of the latter could be told by describing the first runway and the increasing number of passengers, by discussing transport logistics and security measures in response to the growth of tourism, the global exchange of goods and threats of terrorism. But *Everything About Flying*,[160] the title of Güttler's book, tells the story of the human infrastructure created in a biodiverse municipal forest. The author takes into account a wide array of knowledge concerning such diverse things as citizens' initiatives and individual beetle species, all of which in one way or another has influenced the history of the airport. The infrastructure itself has been formed through decades of interaction between politics and science, technology and infrastructure, zoology and botany, all very much intertwined.[161] Only in the form of a "political history of knowledge," as Güttler calls it, do concepts such as "environment," "region," and "resource" begin to acquire meaning for a particular place.

What is striking about these histories – whether dealing with the Atacama Desert, Japan or Frankfurt – is their historical dynamic. They focus on human behavior and explain it as being in a permanent exchange with the surroundings of humans, whether material, biological, ideational, etc. At the same time we are conscious of timeframes that we have no influence over (deep time, deep future) but that still concern us from a resource or sustainability perspective.

It is important to bear in mind as well that narratives of this sort, intended to reveal the complexity of relationships, will by necessity leave out something, as there is always a part we don't (yet) see, don't (yet) know or have already forgotten. The latter, forgetting, plays a pivotal role in Debjani Bhattacharyya's *Empire and Ecology in the Bengal Delta*.[162] His book tells the intricate history of the biggest delta on the planet, of its rivers and tides, where since the eighteenth century only the special interplay of imperialism, jurisprudence, land clearing, speculation and, especially, forgetfulness could result in the modern-day metropolis of Kolkata existing today on these "soaking ecologies." Basically, according Bhattacharyya, the city only came into existence because people repeatedly forgot about the dynamic, shifting ground it was built on.[163]

The future will see increasing importance attached to historical investigations that occasionally reach back further than the consensual starting date of the Anthropocene in order to help us better grasp the historically evolving relations between societies and their environments in their spatial three-dimensionality[164] and dynamics. Giving free rein to the powers of the imagination will play a decisive role here.[165] We historians have our work cut out for us if we choose to expand our perspective and try to reimagine temporality, humanity, culture and epochs in light of

the Anthropocene.

Translated from the German by David Burnett.

German Version: Ariane Tanner, Anthropozän, Version 1.0, in Docupedia-Zeitgeschichte, 03.05.2022

[1] Crutzen subsequently searched for previous uses of the term and came across limnologist Eugene F. Stoermer, who had talked about the Anthropocene in another context in the 1980s. This led to their coauthoring an article, see Paul J. Crutzen/Eugene F. Stoermer, "The 'Anthropocene,'" in: *Global Change Newsletter International Geosphere-Biosphere Programme (IGBP)* 41 (2000), 17-18, online at http://www.igbp.net/download/18.316f18321323470177580001401/1376383088452/NL41.pdf [10.04.2022]. See also Jane Carruthers, "The Anthropocene," in: *South African Journal of Science* 115 (2019), nos. 7/8, https://sajs.co.za/article/download/6428/7952 [10.04.2022].

[2] Christian Schwägerl, "'We aren't doomed. An Interview with Paul J. Crutzen,'" in: Nina Möllers/Christian Schwägerl/Helmuth Trischler (eds.), *Willkommen im Anthropozän. Unsere Verantwortung für die Zukunft der Erde*, Munich 2015, 30-36, here 32.

[3] See Jan Zalasiewicz, "Die menschliche Dimension in geologischer Zeit," in: Möllers/Schwägerl/Trischler (eds.), *Willkommen im Anthropozän*, 13-18, here 14.

[4] Zalasiewicz, "Die menschliche Dimension," 14.

[5] More than half of the earth's fresh water, for example, is used by humans, half of coastal mangrove forests have vanished, the fishing industry harvests 25 to 35 percent of the oceans' primary production, there are 800,000 dams around the world. For some of these statistics, see Will Steffen, "Commentary. Paul J. Crutzen and Eugene F. Stoermer, The 'Anthropocene,'" in: Libby Robin/Sverker Sörlin/Paul Warde (eds.), *The Future of Nature*, New Haven/London 2013, 483-490, here 483f.

[6] Paul J. Crutzen, "Geology of Mankind," in: *Nature* 415 (2002), no. 3, 23, https://www.nature.com/articles/415023a.pdf [10.04.2022].

[7] Jan Zalasiewicz et al., "Are We Now Living in the Anthropocene?," in: *GSA Today* 18 (2008), no. 2, 4-8, online at https://www.geosociety.org/gsatoday/archive/18/2/pdf/i1052-5173-18-2-4.pdf [10.04.2022].

[8] See Helmuth Trischler, “The Anthropocene. A Challenge for the History of Science, Technology, and the Environment,” in: *N.T.M. Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin* 24 (2016), 309-335, here 315-317.

[9] See Colin N. Waters et al., “The Anthropocene is Functionally and Stratigraphically Distinct from the Holocene,” in: *Science* 351 (6269), 137, online at https://www.science.org/doi/10.1126/science.aad2622

[10.04.2022]; for the publications of the Anthropocene Working Group, see http://quaternary.stratigraphy.org/working-groups/anthropocene/ [10.04.2022]; for an overview of the epochs and periods of the geological era as well as the Quaternary, see Erle C. Ellis, *Anthropocene. A Very Short Introduction*, Oxford 2018, 40f., 45-48.

[10] The Carnegie Museum of Natural History in Pittsburgh has its own Curator of Anthropocene Studies in the person of Nicole Heller, see https://carnegiemnh.org/research/nicole-heller/ [10.04.2022]; the University of Wisconsin-Madison held an “Anthropecene Slam” with performative and cinematic categories, https://www.solidfluids.org/the-anthropocene-slam [10.04.2022]; for an overview of Anthropocene-related institutes, see Uwe Lübken, “Umweltgeschichte,” in: *Clio Guide – Ein Handbuch zu digitalen Ressourcen für die Geschichtswissenschaften*, eds. Laura Busse/Wilfried Enderle/Rüdiger Hohls/Gregor Horstkemper/Thomas Meyer/Jens Prellwitz/Annette Schuhmann, Berlin 2016, https://guides.clio-online.de/guides/themen/umweltgeschichte/2016 [10.04.2022]; another valuable resource is the European Society for Environmental History (ESEH) and its biannual conference, https://www.environmentandsociety.org/mml/european-society-environmental-history-eseh [10.04.2022].

[11] On the Anthropocene project at Haus der Kulturen der Welt, see the website https://hkw.de/de/programm/themen/das_anthropozaen_am_hkw/das_anthropozaen_am_hkw_start.php [10.04.2022]; on the exhibit in Munich, see Nina Möllers, “Welcome to the Anthropocene. The Earth in Our Hands,” in: Environment & Society Portal, *Virtual Exhibitions*, https://www.environmentandsociety.org/sites/default/files/moellers_anthropocene_virtualexhibition.pdf [10.04.2022].

[12] Trischler, “Anthropocene Challenge,” 309 and 312.

[13] See Lucien Febvre, *La terre et l‘évolution humaine. Introduction géographique à l’histoire*, Paris 1949; Marc Bloch, *Apologie der Geschichtswissenschaft oder Der Beruf des Historikers*, Stuttgart 2002 (edited by Peter Schöttle, based on the French edition edited by Étienne Bloch and first published in 1949 under the title *Apologie pour l’histoire ou métier d’historien*); Emmanuel Le Roy Ladurie, *Histoire du climat depuis l’an mil*, Paris 1967.

[14] Verena Winiwarter/Martin Knoll, *Umweltgeschichte. Eine Einführung*, Cologne 2007, 20, 32, they use the term "nature" here, albeit in a heuristic rather than an essentialist sense. The history of environmental studies begins in the 1960s in the United States, see ibid., 30-35. For a classic of environmental history of the twentieth century, see John McNeill, *Something New under the Sun: An Environmental History of the Twentieth-Century World*, London 2000.

[15] Sverker Sörlin/Paul Warde, "Making the Environmental Historical – An Introduction," in: idem (eds.), *Nature's End. History and the Environment*, Basingstoke 2009, 1-19, here 3.

[16] On the history and critique of the term "environment," which has always been slightly problematic because of the implied separation of organisms from their environment, and the concept of "surroundings," see Etienne Benson, *Surroundings: A History of Environments and Environmentalisms*, Chicago 2020.

[17] Eva Horn/Hannes Bergthaller, *The Anthropocene: Key Issues for the Humanities*, London/New York 2020, 1f., 19; see also Timothy Clark, *Ecocriticism on the Edge: The Anthropocene as a Threshold Concept*, London 2016. The question was raised during the COVID-19 pandemic whether the global virus was tantamount to a "zero hour" or a "caesura," see René Schlott, "Corona-Pandemie: Todeszeit und Weltzeit," in: *Frankfurter Allgemeine Zeitung*, 14.10.2020, https://www.faz.net/aktuell/wissen/geist-soziales/corona-pandemie-als-historische-zaesur-in-der-geschichte-16987877.html [10.04.2022].

[18] Eva Horn, "Jenseits der Kindeskinder. Nachhaltigkeit im Anthropozän," in: *Merkur* 71 (23.02.2017), no. 814, 5-17, here 5, online at https://www.umkehr-zum-leben.de/fileadmin/Downloads_OeP/Vortraege/Horn_Anthropozaen_Februar_2017.pdf [10.04.2022].

[19] Eva Horn/Hannes Bergthaller, *Anthropozän zur Einführung*, Hamburg 2019, 12.

[20] Horn/Bergthaller, *Anthropocene. Key Issues for Humanities,* 6f.

[21] See Ariane Tanner/Gesine Krüger, interview with Dipesh Chakrabarty, *cliocast #2: Dipesh Chakrabarty*, 22.11.2018; https://infoclio.ch/de/cliocast-2-dipesh-chakrabarty [10.04.2022].

[22] An earlier article appeared in 2011 in *The Economist*, "The Geology of the Planet: Welcome to the Anthropocene," 28.05.2011, formulating the question of our relationship to the world. See also Rüdiger Kruse, „Was ist politisch an der Frage, ob es das Anthropozän gibt?," in: Jürgen Renn/Bernd Scherer (eds.), *Das Anthropozän. Zum Stand der Dinge*, Berlin 2015, 256-260.

[23] Gabriele Dürbeck, "Das Anthropozän erzählen: fünf Narrative," in: *Aus Politik und Zeitgeschichte/bpb.de*, 18.05.2018, https://www.bpb.de/apuz/269298/das-anthropozaen-erzaehlen-fuenf-narrative [10.04.2022].

[24] C. P. Snow, *The Two Cultures*, Cambridge 1998 [1959].

[25] See Bird Deborah Rose et al., "Thinking through the Environment, Unsettling the Humanities," in: *Environmental Humanities* 1 (2012), no. 1, 1-5, online at https://www.researchgate.net/publication/282266389_Thinking_Through_the_Environment_Unsettling_the_Humanities/fulltext/5723e92a08aee491cb377d46/Thinking-Through-the-Environment-Unsettling-the-Humanities.pdf?origin=publication_detail [10.04.2022]; Elizabeth DeLoughrey/Jill Didur/Anthony Carrigan (eds.), *Global Ecologies and the Environmental Humanities: Postcolonial Approaches*, New York/London 2015; Serpil Oppermann/Serenella Iovino, *Environmental Humanities. Voices from the Anthropocene*, London/New York 2017; Robert S. Emmett/David E. Nye, *The Environmental Humanities. A Critical Introduction*, Cambridge 2017.

[26] Donna Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness*, Chicago 2003, online at http://www.xenopraxis.net/readings/haraway_companion.pdf [10.04.2022].

[27] Dipesh Chakrabarty, "The Climate of History: Four Theses," in: *Critical Inquiry* 35 (2009), no. 2, 197-222.

[28] "Writing History in the Anthropocene" is the title of a special issue of *Geschichte und Gesellschaft* 46 (2020), edited by Andrea Westermann and Sabine Höhler.

[29] See the lemmas "anthropos" in AnthroWiki, 02.05.2019, https://en.anthro.wiki/Anthropos [10.04.2022].

[30] Global Footprint Network, https://www.footprintnetwork.org/ [10.04.2022].

[31] The carbon footprint, or the CO2 emissions caused by certain activities, is derived from the ecological footprint, see the Wikipedia: https://en.wikipedia.org/wiki/Carbon_footprint#Origin_of_the_concept [10.04.2022].

[32] See the "Planetary boundaries" website, Stockholm Resilience Centre, https://www.stockholmresilience.org/research/planetary-boundaries.html [10.04.2022]; Johan Rockström et al., "Planetary Boundaries: Exploring the Safe Operating Space for Humanity," in: *Ecology and Society* 14 (2009), no. 2, https://www.ecologyandsociety.org/vol14/iss2/art32/ [10.04.2022]. In January 2022, the Stockholm Resilience Centre concluded that a new boundary had been exceeded: chemical pollution or "novel entities." This particular boundary is not defined by the Earth system but created entirely by human activity; see Linn Persson et al., "Outside the Safe Operating Space of the Planetary Boundary for Novel Entities," in: *Environmental Science & Technology* 56 (2022), no. 3, 1510-1521, online at https://pubs.acs.org/doi/10.1021/acs.est.1c04158 [10.04.2022].

[33] Trischler, “Anthropocene Challenge,” 310; on the narrative, see Steffen, “Commentary. Crutzen, Stoermer, Anthropocene,” 486.

[34] In 1995 he received the Nobel Prize for demonstrating the ozone-depleting effects of these gases, see https://www.nobelprize.org/prizes/chemistry/1995/crutzen/facts/ [10.04.2022].

[35] See Will Steffen et al., The Anthropocene: Conceptual and Historical Perspectives, in: *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, vol. 369, no. 1938, 842-867, here 843, https://royalsocietypublishing.org/doi/10.1098/rsta.2010.0327 [10.04.2022]; Crutzen and Stoermer never met in person (see Schwägerl, “An Interview with Crutzen,” 32).

[36] Noah Heringman, “Buffons Époques de la Nature (1778) und die Tiefenzeit im Anthropozän,” in: *Zeitschrift für Kulturwissenschaften* 10 (2016), no. 1, 73-85, here 75, online at https://mediarep.org/bitstream/handle/doc/14914/ZFK_2016_1_73-85_Heringman_EPOQUES_DE_LA_NATURE_.pdf?sequence=4 [10.04.2022].

[37] Heringman, “Buffons Époques,” 77.

[38] For other source references, see Christian Schwägerl, “A Concept with a Past,” in: Möllers/Schwägerl/Trischler (eds.), *Welcome to the Anthropocene*, 128f.

[39] Vladimir Vernadsky, *La biosphère*, Paris 1929 [1926].

[40] Eva Horn, “Klimatologie um 1800. Zur Genealogie des Anthropozäns,” in: *Zeitschrift für Kulturwissenschaften* 10 (2016), no. 1, 87-102, online at https://www.uni-muenster.de/Ejournals/index.php/ZfK/article/download/1714/1649 [10.04.2022].

[41] Horn, “Genealogie des Anthropozäns,” 88.

[42] Stephen Jay Gould, *Time’s Arrow, Time’s Cycle: Myth and Metaphor in the Discovery of Geological Time, Cambridge*, 1987.

[43] Charles Darwin, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*, London 1859.

[44] See Noah Heringman, “Deep Time at the Dawn of the Anthropocene,” in: *Representations* 129 (2015), no. 1, 56-85.

[45] See the Interactive International Chronostratigraphic Chart of the International Commission on Stratigraphy (ICS), https://stratigraphy.org/timescale/ [10.04.2022].

[46] Charles Lyell, *Principles of Geology; Being an Attempt to Explain the Former Changes of the Earth's Surface, by Reference to Causes Now in Operation, Vol. III*, London 1833 (first edition), 52; see also Subcommission on Quarternary Stratgraphy, *History of the Stratigraphical Nomenclature of the Glacial Period*, (http://quaternary.stratigraphy.org/definitions/history-chronostratigraphy/ [10.04.2022]); William R. Farrand, "Origin of Quarternary-Pleistocene-Holocene Stratigraphic Terminology," in: Léo F. Laporte, *Establishment of a Geologic Framework for Paleoanthropology*, Boulder: Geological Society of America 1990, 15-22.

[47] Horn, "Genealogie des Anthropozäns," 95.

[48] Jason Read, "Anthropocene and Anthropogenesis: Philosophical Anthropology and the Ends of Man," in: *South Atlantic Quarterly* 116 (2017), no. 2, 257-273, here 258.

[49] The technical term for golden spike is Global Boundary Stratotype Section and Point (GSSP) and refers to the drill core containing the primary marker. There is also a second type of dating, the so-called Global Standard Stratigraphic Age (GSSA), if markers are scarce. See Jan Zalasiewicz, "Die Einstiegsfrage: Wann hat das Anthropozän begonnen?," in: Renn/Scherer (eds.), *Anthropozän. Zum Stand der Dinge*, 160-180, here 165; on *Golden Spikes*: Ellis, *Anthropocene*, 42-45.

[50] Zalasiewicz, "Die Einstiegsfrage," 164.

[51] See Subcommission on Quaternary Stratigraphy, *Anthropocene Working Group*, http://quaternary.stratigraphy.org/working-groups/anthropocene/ [10.04.2022].

[52] There are four coordination committees in ascending hierarchical order: the Anthropocene Working Group (AWG) is a component group of the Subcommission on Quarternary Stratigraphy (SQS), a constituent body of the International Commission on Stratigraphy (ICS), which in turn is the oldest scientific association of the International Union of Geological Sciences (IUGS).

[53] On the steam engine, see Crutzen/Stoermer, "The Anthropocene," 17; on the reception of this as the "origin story," see the literature compiled by Malm/Hornborg: Andreas Malm/Alf Hornborg, "The Geology of Mankind? A Critique of the Anthropocene Narrative," in: *The Anthropocene Review* 1 (2014), no. 1, 62-69, here 65; on the ice-core-drilling argument, see Crutzen, "Geology of Mankind."

[54] See Frank Oldfield et al., "Editorial: The Anthropocene Review: Its Significance, Implications and the Rationale for a new Transdisciplinary Journal," in: *The Anthropocene Review* 1 (2014), no. 1, 3-7, here 5, online at https://web.archive.org/web/20150406144321/http://anr.sagepub.com/content/1/1/3.full.pdf [10.04.2022].

[55] See Read, "Anthropocene and Anthropogenesis," 260.

[56] Ibid.; on metabolic rift, see McKenzie Wark, *Molecular Red. Theory for the Anthropocene*, London 2015, as cited by Read.

[57] Jeremy Baskin, "Paradigm Dressed as Epoch: The Ideology of the Anthropocene," in: *Environmental Values* 24 (2015), 9-29, online at https://law.unimelb.edu.au/__data/assets/pdf_file/0006/3118236/2-Baskin,-Jeremy,-Paradigm-Dressed-as-Epoch-The-Ideology-of-the-Anthropocene.pdf [10.04.2022].

[58] Ibid., 10f.

[59] See William F. Ruddiman: "The Anthropocene," in: *Annual Review of Earth and Planetary Sciences* 41 (2013), 45-68. On Bill Ruddiman and his hypothesis, see Richard J. Blaustein, "William Ruddiman and the Ruddiman Hypothesis," in: *Minding Nature* 8 (2015), 44-49, https://www.humansandnature.org/filebin/pdf/minding_nature/january_2015/William_Ruddiman_and_The_Rudiman_Hypothesis.pdf [10.04.2022].

[60] See Zalasiewicz, "Die Einstiegsfrage," 169-171; for a detailed critique of the Holocene dating theory, see Clive Hamilton, "The Anthropocene as Rupture," in: *The Anthropocene Review* 3 (2016), no. 2, 93-106.

[61] Historian Yuval Noah Harari, for example, views "storytelling" as the start of human civilization, see idem, *Sapiens: A Brief History of Mankind*, 2014 [2011 in Hebrew].

[62] David Christian, *Maps of Time. An Introduction to Big History*, Berkeley 2004, online at https://www.tsu.ge/data/file_db/faculty_humanities/Christian%20-%20Maps%20of%20Time.%20An%20Introduction%20to%20Big%20History,%20I%20ed..pdf [10.04.2022]; see also Cynthia Stokes Brown, *Big History: From the Big Bang to the Present*, New York 2007; Andrew Shryock/Daniel Lord Smail (eds.), *Deep History. The Architecture of Past and Present*, Berkeley 2011; Christian Geulen, "Das große Ganze – und seine Didaktik. Über Big History," in: *Zeithistorische Forschungen/Studies in Contemporary History* 17 (2020), no. 3, https://zeithistorische-forschungen.de/3-2020/5886 [10.04.2022].

[63] David Christian, "What Is Big History?," in: *Journal of Big History* 1 (2018), no. 1, 4-19, here 8 and 12.

[64] David Christian, *The History of Our World in 18 Minutes*, YouTube, April 11, 2011, https://www.youtube.com/watch?v=yqc9zX04DXs [10.04.2022].

[65] David Christian, "The Return of Universal History," in: *History and Theory* 49 (2010), no. 4, 6-27, here 7.

[66] Ian Hesketh, "The Story of Big History," in: *History of the Present* 4 (2014), no. 2, 171-202, here 171.

[67] Fernand Braudel, "Geschichte und Sozialwissenschaften. Die *longue durée*," in: Claudia Honegger (ed.), *M. Bloch, F. Braudel, L. Febvre u.a. Schrift und Materie der Geschichte. Vorschläge zur systematischen Aneignung historischer Prozesse*, Frankfurt am Main 1977, 47-85.

[68] Christian, "Return of Universal History," 21. It is a matter of debate whether humanity is a good biological or a "degenerate" species that has not found its ecological niche and is therefore proliferating and destroying everything. In the latter reading of Big History mankind would be tantamount to a natural catastrophe, as shown by Read with reference to the movie *Matrix*, in which humans are portrayed as a "virus." See Read, "Anthropocene and Anthropogenesis," 258f.

[69] Malm/Hornborg, "The Geology of Mankind," 62.

[70] See Alexander P. Wolfe et al., "Stratigraphic Expressions of the Holocene-Anthropocene Transition Revealed in Sediments from Remote Lakes," in: *Earth-Science Reviews* 116 (2013), 17-34, esp. 31, online at https://people.earth.yale.edu/sites/default/files/files/Pagani/2013%20Wolfe_ESR.pdf [10.04.2022].

[71] Steffen et al., Conceptual and Historical Perspectives, 849.

[72] On some of these curves, see Steffen et al., Conceptual and Historical Perspectives, 851f.; Renn/Scherer (eds.), *Anthropozän. Zum Stand der Dinge*, 10f.

[73] On the hockey-stick curve in particular, see Birgit Schneider, *Klimabilder. Eine Genealogie globaler Bildpolitiken von Klima und Klimawandel*, Berlin 2018, 183-201.

[74] Jan Zalasiewicz, *The Earth after us. What Legacy Will Humans Leave in the Rocks?*, Oxford 2008; idem et al., "The Technofossil Record of Humans," in: *The Anthropocene Review* 1 (2014), no. 1, 34-43, online at https://www.researchgate.net/profile/Mark-Williams- 74/publication/264461538_The_technofossil_record_of_humans/links/53e63fb60cf21cc29fd12f81/The-technofossil-record-of-humans.pdf?origin=publication_detail [10.04.2022]; Colin N. Waters et al., "A Stratigraphical Basis for the Anthropocene?," London, The Geological Society 2014, 1-21, esp. Fig. 2 on p. 8, online at https://www.researchgate.net/profile/Mark-Williams-74/publication/264450783_A_Stratigraphical_Basis_for_the_Anthropocene/links/5467b49a0cf20dedafcf512b/A-Stratigraphical-Basis-for-the-Anthropocene.pdf?origin=publication_detail [10.04.2022]; Andrea Westermann, "A Technofossil of the Anthropocene: Sliding up and down Temporal Scales with Plastic," in: Dan Edelstein/Stefanos Geroulanos/Natasha Wheatley (eds.), *Power and Time Temporalities in Conflict and the Making of History*, Chicago 2020, 122-144, online at https://www.researchgate.net/profile/Andrea-Westermann-2/publication/

314119076_A_Technofossil_of_the_Anthropocene_Sliding_up_and_down_Temporal_Scales_with_Plas links/607c6c3b2fb9097c0cf364d4/A-Technofossil-of-the-Anthropocene-Sliding-up-and-down-Temporal-Scales-with-Plastic.pdf?origin=publication_detail [10.04.2022]. On the transformation of sandy beaches into concrete structures, see Ariane Tanner, "Der langsame Abschied vom Strand," in: *WOZ – Wochenzeitung,* 20.09.2018, no. 38, 23, online at https://www.woz.ch/-907f [10.04.2022].

[75] Zalasiewicz, "Die Einstiegsfrage," 178.

[76] Stanley C. Finney/Lucy E. Edwards, "The 'Anthropocene' Epoch: Scientific Decision or Political Statement?," in: *GSA – Geological Society of America* 26 (2016), no. 3, 4-10, here 8, online at https://www.geosociety.org/gsatoday/archive/26/3/pdf/i1052-5173-26-3-4.pdf [10.04.2022].

[77] See Will Steffen et al., "Stratigraphic and Earth System Approaches to Defining the Anthropocene," in: *Earth's Future* 4 (2016), 324-345, online at https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016EF000379 [10.04.2022].

[78] Interview with Will: KTH Environmental Humanities Laboratory, Intervention, ca. 1:45, https://www.kth.se/en/2.99698/about-the-ehl/media/podcasts/ehl-intervention-pod/episode-5-will-steffen-1.552805 [10.04.2022].

[79] Horn, "Jenseits der Kindeskinder," 5.

[80] An expression used in Big History, see David Christian, *The History of Our World in 18 Minutes, TED Talk*: https://www.youtube.com/watch?v=yqc9zX04DXs [10.04.2022].

[81] On the interdisciplinary debate about the term, see Fabienne Will, *Evidenz für das Anthropozän. Wissensbildung und Aushandlungsprozesse an der Schnittstelle von Natur-, Geistes- und Sozialwissenschaften*, Göttingen 2021.

[82] The choice of debates is arbitrary. I would like to take this opportunity to thank the participants in the master's seminar "Anthropocene and Deep History" during the fall semester of 2018 at the Department of History of the University of Zurich, along with tutor Hendrik Althoff and Professor Gesine Krüger for a wonderful co-teaching experience. This Docupedia article would not have been written without the many fruitful exchanges we had during the seminar.

[83] Reinhart Koselleck, Futures Past: *On the Semantics of Historical Time. Translated and with an introduction by Keith Tribe*, New York, 2004 [1985]. Originally published in German as *Vergangene Zukunft. Zur Semantik geschichtlicher Zeiten*, Frankfurt a.M. 1995 [1979]; for a recent discussion of Koselleck's "sediments of time" within the Anthropocene discourse, see Erik Isberg, "Multiple

Temporalities in a New Geological Age: Revisiting Reinhart Koselleck's Zeitschichten," in: *Geschichte und Gesellschaft* 46 (2020), 729-735.

[84] Fernand Braudel, *La Méditerranée et le monde méditerranéen à l'époque de Philippe II., 2 vols.*, Paris 1966 (revised and expanded new edition, first published in 1949).

[85] These are feedback effects. The year 2021 in particular evinced such tipping points: e.g., the accelerated melting of the Arctic, rain forests no longer absorbing CO2, the thawing of permafrost.

[86] Reinhart Koselleck, "'Erfahrungsraum' und 'Erwartungshorizont' – zwei historische Kategorien" (first published in 1977), in: *Vergangene Zukunft*, 349-375.

[87] Dipesh Chakrabarty, "The Climate of History: Four Theses," in: *Critical Inquiry* 35 (2009), no. 2, 197-222, 197, online at https://pcc.hypotheses.org/files/2012/03/Chakrabarty_2009.pdf [10.04.2022].

[88] Chakrabarty, "The Climate of History," 201.

[89] Ibid., 197.

[90] Ibid., 199.

[91] Depicted in Robert Emmett/Thomas Lekan, "Foreword and Introduction," in: idem (eds.), *Whose Anthropocene? Revisiting Dipesh Chakrabarty's „Four Theses"*, Munich: RCC Perspectives 2016, 5-11, esp. 7f., online at https://anthropocene.au.dk/uploads/media/rcc-whose-anthropocene.pdf [10.04.2022].

[92] Chakrabarty, "The Climate of History," 217.

[93] Ibid., 217.

[94] Ibid., 220.

[95] Zoltán Boldizsár Simon, "Why the Anthropocene Has No History: Facing the Unprecedented," in: *The Anthropocene Review* 4 (2017), no. 3, 239-245, here 243, online at https://pub.uni-bielefeld.de/record/2914878 [10.04.2022].

[96] Martin Sabrow, "Zäsuren in der Zeitgeschichte," Version: 1.0, in: *Docupedia-Zeitgeschichte*, June 3, 2013, http://docupedia.de/zg/sabrow_zaesuren_v1_de_2013 [10.04.2022].

[97] Michael Prinz/Matthias Frese, "Sozialer Wandel und politische Zäsuren seit der Zwischenkriegszeit. Methodische Probleme und Ereignisse," in: idem (eds.), *Politische Zäsuren und gesellschaftlicher Wandel im 20. Jahrhundert. Regionale und vergleichende Perspektiven*, Paderborn 1996, 1-31, here 4.

[98] Sabrow, “Zäsuren in der Zeitgeschichte.”

[99] Simon, “Why the Anthropocene Has No History.”

[100] Ibid., 240; see also Jason W. Moore, *Anthropocene or Capitalocene? Nature, History and the Crisis of Capitalism*, Binghamton 2016, online at https://orb.binghamton.edu/cgi/viewcontent.cgi?article=1002&context=sociology_fac [10.04.2022].

[101] Simon, “The Anthropocene Has No History,” 240.

[102] Ibid., 243.

[103] Reinhart Koselleck, *Sediments of Time: On Possible Histories. Translated and edited by Sean Franzel and Stefan-Ludwig Hoffmann*, Palo Alto, CA, 2018, 6 [originally published in German as *Zeitschichten. Studien zur Historik*, Frankfurt a.M. 2000, 22].

[104] Malm/Hornborg, “The Geology of Mankind?,” 63f.

[105] Dipesh Chakrabarty, *The Human Condition in the Anthropocene*, 18/19.02.2015 (The Tanner Lectures in Human Values Delivered at Yale University), 138-188, esp. 139f. and 180, online at https://www.umkehr-zum-leben.de/fileadmin/Downloads_OeP/Vortraege/Chakrabarty_2015.pdf [April 10, 2020]; on the reception and discussion of Chakrabarty’s “Four Theses,” see Emmett/Lekan, *Whose Anthropocene?*.

[106] Renn/Scherer (eds.), *Anthropozän. Zum Stand der Dinge*, 18.

[107] Dipesh Chakrabarty, “Eine gemeinsame, aber differenzierte Verantwortung. Gespräch mit Katrin Klingan,” in: Renn/Scherer (eds.), *Anthropozän. Zum Stand der Dinge*, 142-159, here 154-156.

[108] On the non-uniformity of the biological concept of species, see Julia Adeney Thomas, “AHR Roundtable. History and Biology in the Anthropocene: Problems of Scale, Problems of Value,” in: *The American Historical Review* 119 (2014), no. 5, 1587-1607.

[109] See also Horn/Bergthaller, *Anthropocene. Issues for Humanities*, 70.

[110] Chakrabarty, “The Climate of History,” 197.

[111] Dipesh Chakrabarty, *The Human in Natural and Humanist Histories: Towards a Fragile Rapprochement*, talk delivered at the Archive der Umwelt: Naturwissenschaften und Geschichte conference, infoclio, 23.11.2018, video at https://vimeo.com/305032467 [10.04.2022]. For a history of ideas in political anthropology, see Jens Kersten, “The Enjoyment of Complexity A New Political Anthropology for the Anthropocene?,” in: Helmuth Trischler (ed.), *Anthropocene: Exploring the Future of the Age of Humans*, RCC Perspectives 2013, no. 3, 39-55, online at https://

www.environmentandsociety.org/sites/default/files/seiten_aus_1303_anthro_web-3.pdf [10.04.2022].

[112] Libby Robin, "Histories for Changing Times: Entering the Anthropocene?," in: *Australian Historical Studies* 44 (2013), no. 3, 329-340. See also Clive Hamilton/Jacques Grinevald, "Was the Anthropocene anticipated?," in: *The Anthropocene Review* 2 (2015), no. 1, 59-72, online at https://wp.unil.ch/geoblog/files/2013/06/Hamilton-Grinevald2015.pdf [10.04.2022].

[113] Robin, "Histories for Changing Times," 336.

[114] Malm/Hornborg, "The Geology of Mankind?," 67.

[115] See Ariane Tanner, *Imaginations of the Perfect Human-Ocean Relation*, Lunchtime Colloquium at Rachel Carson Center, YouTube, July 4, 2019, https://www.youtube.com/watch?v=HvhqfUzGgao [10.04.2022].

[116] On the history of geoengineering, see Clive Hamilton, *Earthmasters. The Dawn of the Age of Climate Engineering*, New Haven/London 2013; Martin Meiske, *Die Geburt des Geoengineerings. Großbauprojekte in der Frühphase des Anthropozäns (1850-1950)*, Göttingen 2021.

[117] See Paul J. Crutzen, "Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma? An Editorial Essay," in: *Climatic Change* 77 (2006), 211-219, online at http://agriculturedefensecoalition.org/sites/default/files/file/geo_scheme_16/16YC_2006_Crutzen_SEPT_2_2006_Albedo_Enhancement_by_Stratospheric_Sulfur_Ir [10.04.2022]; on the discursive link between "crisis" and geoengineering and the resulting lack of democracy, see Ariane Tanner, "Reparatur des Planeten," in: *infosperber*, June 12, 2019, https://www.infosperber.ch/politik/welt/kontertext-reparatur-des-planeten/ [10.04.2022].

[118] John Asafu-Adjaye et al., *An Ecomodernist Manifesto*, 2015, http://www.ecomodernism.org/manifesto-english [10.04.2022].

[119] See Baskin, "Paradigm Dressed as Epoch;" idem, *Geoengineering, the Anthropocene and the End of Nature*, London 2019.

[120] Kathleen McAfee, "The Politics of Nature in the Anthropocene," in: *RCC Perspectives* 2 (2016), 65-72, here 68, online at https://www.academia.edu/es/15106705/The_politics_of_Nature_in_the_anthropocene [10.04.2022].

[121] Horn, "Genealogie des Anthropozäns," 88; a deliberation that she herself ironically subverts, as in his day did philosopher Johann Gottfried Herder, who referred to human beings as "little giants," see ibid.

[122] See Hornborg, “Does the Anthropocene Really Imply the End of Culture/Nature and Subject/Object Distinctions?,” in: *Os Mil Nomes de Gaia. Do Antropoceno à Idade de Terra*, Rio de Janeiro 2014, online at https://osmilnomesdegaia.files.wordpress.com/2014/11/alf-hornborg-does-the-anthropocene-really-imply-the-end-of-culturenature-and-subjectobject-distinctions.pdf [10.04.2022], 2f.

[123] Malm/Hornborg, “Geology of Mankind?,” 66.

[124] Andreas Malm, *The Progress of this Storm: Nature and Society in a Warming World*, London/New York 2018, 2.

[125] Hannes Bajohr, “Keine Quallen: Anthropozän und Negative Anthropologie,” in: idem (eds.), *Der Anthropos im Anthropozän. Die Wiederkehr des Menschen im Moment seiner vermeintlich endgültigen Verabschiedung*, Berlin/Boston 2020, 1-16, here 10; see also Horn/Bergthaller, “Anthropocene. Issues for Humanities,” 11.

[126] Christophe Bonneuil/Jean-Baptiste Fressoz, *L’événement anthropocène: la Terre, l’histoire et nous*, Paris 2013; idem, *The Shock of the Anthropocene: The Earth, History and Us*, London/New York 2016.

[127] Matthias Heymann, “Rezension: Christoph Bonneuil, Jean-Baptiste Fressoz, The Shock of the Anthropocene: The Earth, History and Us, London/New York 2016,” in: H-Soz-u-Kult, February 10, 2017, https://www.hsozkult.de/publicationreview/id/reb-24319 [10.04.2022].

[128] Baskin, Paradigm Dressed as Epoch, 12.

[129] Sabine Höhler, “Two Degrees: A Global Climate Accord and its Disparities,” lecture at the workshop *Creative Commensuration: Histories of Scaling in Science and Society*, Center History of Knowledge Zurich, 07.-08.07.2016; see http://kth.diva-portal.org/smash/record.jsf?pid=diva2%3A1062517&dswid=-5563 [10.04.2022].

[130] Jason M. Kelly, “Anthropocenes: A Fractured Picture,” in: idem et al. (eds.), *Rivers of the Anthropocene*, Oakland 2018, 1-18, here 17, online at https://www.researchgate.net/profile/Jason-Kelly-10/publication/321140296_Anthropocenes_A_Fractured_Picture/links/5a103a8a458515cc5aa6bdd0/Anthropocenes-A-Fractured-Picture.pdf?origin=publication_detail [10.04.2022].

[131] See McAfee, “The Politics of Nature,” 71f.

[132] See Alf Hornborg, Does the Anthropocene Really Imply the End of Culture/Nature and Subject/Object Distinctions?, in: *Os Mil Nomes de Gaia. Do Antropoceno à Idade de Terra*, Rio de

Janeiro 2014, online at https://osmilnomesdegaia.files.wordpress.com/2014/11/alf-hornborg-does-the-anthropocene-really-imply-the-end-of-culturenature-and-subjectobject-distinctions.pdf [10.04.2022].

[133] Sverker Sörlin, "Reform and Responsibility – The Climate of History in Times of Transformation;" in: *Historisk Tidsskrift* 97 (2018), no. 1, 7-23, online at https://www.semanticscholar.org/paper/Reform-and-responsibility-The-climate-of-history-in-S%C3%B6rlin/209b5672ff4f266dc2864dadf37789713d2b8aaa [10.04.2022].

[134] Boundaries are not the same as tipping points, which, having been exceeded, give way to a nonlinear and unpredictable development. Whereas tipping points are systematic, boundaries are the product of social-policy negotiations about the world we want to live in. See Rockström et al., "Planetary Boundaries," 2f., and idem at the website of the Stockholm Resilience Center: https://www.stockholmresilience.org/research/research-news/2017-11-20-a-fundamental-misrepresentation-of-the-planetary-boundaries-framework.html [10.04.2022].

[135] Westermann/Höhler, "Introduction to the special Issue: Writing History in the Anthropocene," 584.

[136] Ibid., 585.

[137] See idem, "Writing History in the Anthropocene. Scaling, Accountability, and Accumulation," in: idem (ed.), special issue *Writing History in the Anthropocene*, in: *Geschichte und Gesellschaft* 46 (2020), no. 4, 579-605, here 583.

[138] Marco Armiero, current president der European Society for Environmental History (ESEH), on having survived COVID-19: "Something I Have Learned from Covid-19," in: *Environment and History* 26 (2020), no. 3, 451-454, online at https://www.kth.se/blogs/hist/2021/02/something-i-have-learned-from-covid-19/ [10.04.2022].

[139] On transatlantic exchange processes in relation to infectious diseases, see Alfred Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492*, Westport 1972.

[140] Zalasiewicz, "Die menschliche Dimension," 13-18, here 14.

[141] See, e.g., the observations on historical paradigm shifts: Franz Mauelshagen, "'Anthropozän.' Plädoyer für eine Klimageschichte des 19. und 20. Jahrhunderts," in: *Zeithistorische Forschungen* 9 (2012), no. 1, 131-137, online at https://zeithistorische-forschungen.de/1-2012/4596 [10.04.2022]; Monika Dommann, "Alles fließt: Soll die Geschichte nomadischer werden?," in: *Geschichte und Gesellschaft* 42 (2016), no. 3, 516-534, online at https://www.academia.edu/28290583/Alles_fliesst_Soll_die_Geschichte_nomadischer_werden_in_Geschichte_und_Gesellschaft_42_2016_S

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[142] See Deborah Bird Rose et al., “Thinking Through the Environment, Unsettling the Humanities,” in: *Environmental Humanities* 1 (2012), no. 1, 1-5, online at https://read.dukeupress.edu/environmental-humanities/article/1/1/1/8085/Thinking-Through-the-Environment-Unsettling-the [10.04.2022]; Elizabeth DeLoughrey/Jill Didur/Anthony Carrigan (eds.), *Global Ecologies and the Environmental Humanities. Postcolonial Approaches*, New York/London 2015; Serpil Oppermann/Serenella Iovino, *Environmental Humanities. Voices from the Anthropocene*, London/New York 2017; Robert S. Emmett/David E. Nye, *The Environmental Humanities. A Critical Introduction*, Cambridge 2017.

[143] See Deborah R. Coen, “Big Is a Thing of the Past: Climate Change and Methodology in the History of Ideas,” in: *Journal of the History of Ideas* 77 (2016), no. 2, 305-321.

[144] Ibid.

[145] Coen, “Climate Change and Methodology,” 308.

[146] Ibid., 312.

[147] One’s own methodology has to be precise as well, Coen explains; the conditions of scaling itself (“commensuration”) are reflected upon in the process. See also the workshop she organized together with Andrea Westermann and Nils Güttler entitled “Creative Commensuration: Histories of Scaling in Science and Society,” which took place at the History of Knowledge Center in Zurich on 07.-08.07.2016.

[148] Daniel deB. Richter, “The Crisis of Environmental Narrative in the Anthropocene,” in: Emmett/Lekan, *Whose Anthropocene?*, 97-100.

[149] Coen, “Climate Change and Methodology,” 307f.

[150] Andrea Westermann, “Enrichment and Dilution in the Atacama Mining Desert: Writing History from an Earth-Centered Perspective,” in: *Geschichte und Gesellschaft* 46 (2020), 634-661, here 636, online at https://www.researchgate.net/publication/348364013_Enrichment_and_Dilution_in_the_Atacama_Mining_Desert_Writing_History_from_an_Ear Centered_Perspective/link/60c3375392851ca6f8dbeec4/download [10.04.2022].

[151] Ibid., 635.

[152] Anna Lowenhaupt Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*, Princeton 2015.

[153] Ibid., 4.

[154] Ibid., 4.

[155] Donna Haraway, "Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin," in: *Environmental Humanities* 6 (2015), 159-165, here 159, online at https://www.environmentandsociety.org/sites/default/files/key_docs/environmental_humanities-2015-haraway-159-65.pdf [10.04.2022].

[156] Bruno Latour, "Agency at the Time of the Anthropocene," in: *New Literary History* 45 (2014), no. 1, 1-18, here 2, online at http://www.bruno-latour.fr/sites/default/files/128-FELSKI-HOLBERG-NLH-FINAL.pdf [10.04.2022].

[157] Latour, "Agency at the Time of the Anthropocene," 3. Latour makes reference to the British scientist James Lovelock, who came up with the idea of "Gaia" in the 1960s. See J. E. Lovelock, *Gaia: A New Look at Life on Earth*, Oxford 1979. Further elaborations of his thoughts in: Bruno Latour, *Das terrestrische Manifest*, Berlin 2018.

[158] See, e.g., Timothy Morton, *Humankind: Solidarity with Nonhuman People*, London 2017.

[159] Donna Haraway & Anna Tsing, "Reflections on the Plantationocene (moderated by Gregg Mitman)," in: *Edge Effects Magazine*, 2019, 1-20, here 13, online at https://edgeeffects.net/wp-content/uploads/2019/06/PlantationoceneReflections_Haraway_Tsing.pdf [10.04.2022]. Capitalism plays a crucial role for Donna Haraway in terms of its grip on people, animals and environments. The term "Plantationocene" reflects these utterly exploitative practices that give organisms almost no refuge or hiding places anymore. More on the multispecies perspective: S. Eben Kirksey/Stefan Helmreich, "The Emergence of Multispecies Ethnography," in: *Cultural Anthropology* 25 (2010), no. 4, 545-576, online at https://anthropology.mit.edu/sites/default/files/documents/helmreich_multispecies_ethnography.pdf [10.04.2022].

[160] Nils Güttler, *Alles über das Fliegen. Zur politischen Wissensgeschichte des Frankfurter Flughafens*, Vienna/Berlin 2020.

[161] Güttler, *Alles über das Fliegen*, 107.

[162] Debjani Bhattacharyya, *Empire and Ecology in the Bengal Delta: The Making of Calcutta*, Cambridge 2018.

[163] See Bhattacharyya, *Empire and Ecology*, 1-15.

[164] See Philip E. Steinberg/Kimberley Peters, “Wet Ontologies, Fluid Spaces: Giving Depth to Volume through Oceanic Thinking,” in: *Environment and Planning D: Society and Space* 33 (2015), 247-264, online at https://livrepository.liverpool.ac.uk/3000928/1/Environment%20and%20Planning%20D_final_version_pure.pdf [10.04.2022].

[165] See Clark, *Ecocriticism on the Edge*, 18f.; for a critical look at the “crisis of the imagination” see Alexa Weik von Mossner, “Storytelling in the Anthropocene,” in: Emmett/Lekan (eds.), *Whose Anthropocene?*, 83-88, online at https://www.environmentandsociety.org/sites/default/files/2016_2_weik_von_mossner.pdf [10.04.2022].

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