**What is at Stake in the Formalization of a Chronostratigraphic Unit? A Case Study on the Anthropocene**

Abstract

The possibility of formalizing the Anthropocene as a chronostratigraphic unit by the International Commission on Stratigraphy (ICS) has been intensely debated. The aim of this paper is to explore and assess some of the stakes of this process from a philosophical point of view. In order to do this, I distinguish and explicate two senses of formalization, namely the descriptive and the evaluative senses. With this distinction at hand, I conclude the following. First, I submit that there are formalizations of the Anthropocene, in both descriptive and evaluative senses, beyond the confines of the ICS, which reveals a disunity of the sciences. Second, I suggest that some calls for rejecting the formalization of the Anthropocene in the context of the ICS are concerned with a lack of descriptive formality of the proposals in the form of incoherencies. I argue that these incoherencies are not a decisive reason for rejection. Third, I claim that the ICS could take a stance in terms of the evaluative formalization of the Anthropocene, given its orthogonality to its descriptive formalization and its potential political consequences.

1. Introduction

In 2000, Paul Crutzen and Eugene Stoermer proposed to use the term “Anthropocene” for the current geological epoch, to acknowledge the ongoing impact of human activities on the earth. This impact has been well-documented in a vast number of scientific publications. However, most of this impact is reported at the critical zone, i.e. the interface between atmosphere, hydrosphere, biosphere, cryosphere and pedosphere. There is less compelling evidence about the impact of humans on the lithosphere. This is the predicament: It is in the lithospheric domain that geological epochs have been traditionally formalized, based on stratigraphic evidence.

The Anthropocene Working Group (AWG) is preparing a proposal to formalize the status of the Anthropocene as a new geological epoch. The AWG is part of the Subcommission on Quaternary Stratigraphy (SQS) of the International Commission on Stratigraphy (ICS). In the website of the SQS, the AWG declares its official stance: i) the Anthropocene should be treated as a formal chronostratigraphic unit; and ii) its base should be established based on a stratigraphic signal around the mid-twentieth century. In order to be accepted, the AWG’s proposal must meet the guidelines established by the ICS. Rejection remains a realistic scenario.

In his persuasive 2019’s paper, Carlos Santana argues that formal recognition of the Anthropocene by the ICS should be indefinitely deferred by challenging two arguments in favour of its formalization. The first one is referred to as the “future geologist perspective” argument. According to it, formalizing the Anthropocene is justified based on what future geologists will recognize as significant markers in the stratigraphy to establish the lower boundary of the Anthropocene roughly in our present time. This argument relies on a projection into future millennia concerning the stratigraphy, which is controversial given the traditionally empirical approach of the ICS. The second argument is referred to as the “synchronic perspective” argument. According to it, formalizing the Anthropocene is justified based on the synchronic consequences of its formalization, above all its political effects. In particular, formalizing the Anthropocene may convince climate change skeptics about the human impact on the environment, which would significantly reconfigure the political space. Nonetheless, Santana argues that this expectation is not warranted.

In this paper, I explore and assess some of the stakes of the formalization of the Anthropocene. To begin with, I distinguish two senses of “formalization”, namely the descriptive and the evaluative. This distinction allows me to assess the formal status of the term “Anthropocene” in the literature. I submit that “Anthropocene” is a formal notion relative to specific disciplines and research contexts, thus making a case for the disunity of the sciences. Having made this point, I proceed to focus on the predicaments of formalizing the Anthropocene in the context of the ICS, as schematized by Santana. First, I rephrase his “future geologist perspective” counterargument as a matter of descriptive formalization. I submit that Santana’s criticism amounts to pointing at shortcomings in coherence between proposals for formalizing the Anthropocene and the ICS guidelines and commitments. In response, I argue that i) if the value of coherence is central, sacrifices to immediate coherence may be justified with the promise of future coherence; and ii) the value of coherence does not need to be central, i.e. trade-offs with other concerns may be tolerated. Second, I rephrase his “synchronic perspective” counterargument as a matter of evaluative formalization. I submit that the political consequences of formalizing the Anthropocene go well beyond the conversion of skeptics.

1. Descriptive and Evaluative Formalizations

There are two senses in which the term “formalization” is used: the descriptive and the evaluative.[[1]](#footnote-1) In the descriptive sense, formalization amounts to providing an explicit and rigorous articulation. In the context of science, the objects of descriptive formalizations are mainly scientific concepts, methods, and theories. The articulations used for formalization may be cast mathematically, as it is typically the case in the so-called exact or quantitative sciences. However, formalizations may also occur in the form of explicit and rigorous definitions of concepts, principled classification schemes, and explications of theories. This is how formalization is typically conceived in the so-called inexact or qualitative sciences. In particular, this is how formalization of the Anthropocene should be understood: as an explicit definition and/or classification rigorously based on a principled scheme.

In the descriptive sense, formalization is a means for clarity (cf. Suppes 1968, 653). This aim may be construed as a non-epistemic desideratum (e.g. aesthetical). However, its main import in science is epistemic: Formalization is a strategy to avoid ambiguities and errors in communication and thus promote efficient and accurate scientific research. Having said this, there is no single, objective metric to measure the clarity of a concept, method, or theory. Because of this, formalizations could be achieved by alternative articulations, making the choice a contextual matter.

In the evaluative sense, formalizing means giving approval to or endorsing of a concept, method, or theory by relevant institutions or groups. In this evaluative sense, formalization is contextually decided, given that different institutions and groups may endorse different concepts, methods, and theories. There are various reasons that prompt institutional endorsement. Typically, epistemic reasons play a central role in the endorsement of concepts, methods, and theories. For example, rigorous demonstrations and robust evidence often prompt approval and endorsement of the involved concepts, methods, and theories. However, other kinds of reasons play a role too, such as instrumental, aesthetical, ethical and political reasons.

In the evaluative sense, formalization leads to standardization (cf. Suppes 1968, 654). That is, the institutional endorsement of concepts, methods, and theories affords common terminology and practices for the endorsing institutions. Standardization may be construed as a non-epistemic aim, but it is its epistemic import which plays a major role in justifying it in the context of science. Standardization improves communication among scientists by means of affording common terminology and practices, making scientific research more efficient and accurate. Still, it is worth mentioning that standardization may at times function as an impediment for innovation and adaptation. In this sense, scientists should also be cautious about procedures of standardization and remain vigilant of the established standards.

These two senses of formalization are conceptually distinct and, in principle, independent. That is, institutional endorsement of X does not imply that X has an explicit and rigorous articulation, and X having an explicit and rigorous articulation does not imply its endorsement by relevant institutions. Nonetheless, these two senses of formalization tend to cooccur, often causally so. On the one hand, explicit and rigorous articulations tend to motivate institutional recognition and endorsement, due to the valuable opportunities for efficient sharing and reusing of content. On the other hand, institutional recognition may come first and motivate elucidatory efforts later. In this case, an institution first endorse X for purposes of standardization in accordance to what the institution has reason to value. But X itself need not be fully articulated in an explicit and rigorous fashion for this to occur.

Given the analysis above, I propose that the adjective “formal”, without qualifications, should be conceived as a thick concept. On the one hand, it is descriptive: It means that X is articulated explicitly and rigorously. On the other hand, it is evaluative: It means that X is deemed acceptable and endorsed by relevant institutions. In this sense, formalizing the Anthropocene involves i) providing an explicit and rigorous definition of this temporal unit, based on a principled scheme of classification; and ii) deeming the general (if vague) notion of a present human-driven time as acceptable for institutional endorsement. The AWG vote for the formalization of the Anthropocene covers these two aspects. The first vote was “Should the Anthropocene be treated as a formal chrono-stratigraphic unit defined by a GSSP?”, i.e. a matter of evaluative formalization.[[2]](#footnote-2) The second vote was “Should the primary guide for the base of the Anthropocene be one of the stratigraphic signals around the mid-twentieth century of the Common Era?”, i.e. a matter of descriptive formalization.

1. Formalizations of the Anthropocene: A Case for the Disunity of the Sciences

The Anthropocene remains an informal notion, in both the descriptive and evaluative senses, in the context of the ICS. Indeed, the ICS has not been able to provide an explicit and rigorous definition of the unit based on a principled scheme of classification. Nor has the ICS officially endorsed the employment of the Anthropocene as a chronostratigraphic unit (although the AWG already did). Santana goes further and claims that the Anthropocene *should not* be formalized by the ICS.

In spite of this, in the roughly twenty years since its proposal, “Anthropocene” has become a widely used term among working scientists from different disciplines, such as meteorology, atmospheric chemistry, biology, ecology, economy, and anthropology, to name a few. A quick search in Google Scholar returns about 262.000 entries with the term Anthropocene, including several peer-reviewed articles. In fact, two of the most prestigious scientific journals – Nature and Science – have published articles endorsing it (e.g. Lewis and Maslin, 2015; Waters et al. 2016, respectively). And there are journals and research centres dedicated to study the Anthropocene and named after it (e.g. Elsevier’s “Anthropocene” or the Vienna Anthropocene Network). With this evidence, it becomes difficult to make a case for the lack of institutional endorsement *tout court* of the term “Anthropocene”. Thus, in the evaluative sense, the Anthropocene is a formal notion in several domains.

To be clear, what is deemed acceptable is not a single, explicit, and rigorous articulation of the Anthropocene. Rather, what is being endorsed is a general notion that is common to all employments of the term, rooted in its etymology. The shared notion is that the present time is human-driven; that human activities are affecting the dynamics and constitution of the planet in an unprecedented fashion. This general notion is not controversial. In fact, most geologists at the ICS and Santana himself agree with this claim. The controversial part is how to formalize the Anthropocene descriptively, i.e. how to articulate this general notion explicitly and rigorously. But, as I have argued above, descriptive formalization is orthogonal to evaluative formalization. The Anthropocene case illustrates this orthogonality. Conceding that the general notion of the Anthropocene is formal, in the evaluative sense, in multiple contexts, I proceed to focus on the issue of its descriptive formality.

The case for the descriptive formality of the Anthropocene is more nuanced. As a matter of fact, there have been attempts to explicitly and rigorously articulate the Anthropocene. In practice, this involves stating a date of beginning of the Anthropocene (i.e. explicitness) based on empirical evidence (i.e. rigorosity). Admittedly, the proposals are dissimilar. They range in the nature of the employed empirical evidence, e.g. changes in climate records, chemical composition of the atmosphere and oceans, and extinction rates of species (see e.g. Lewis and Maslin, 172). They also range in the recommended date of beginning, e.g. arrival of Europeans in the Americas (1492-1650), the industrial revolution (1760-1880), and the Great-Acceleration (second half of the 20th century) (ibid, 177).

This plurality of articulations is often regarded as a manifestation of the informal character of the Anthropocene. I suggest this is a mistake. Such judgement conflates the lack of a standardized description with the lack of descriptive formality. X does not need to have a standardized definition to be explicitly and rigorously articulated, even if this allows for multiple articulations. I suggest that the conflation between standardized description and descriptive formality is, at least partly, a side-effect of the often implicit but nonetheless influential thesis of the “unity of science”.

This thesis is complex enough to be discussed in several papers (for an overview, see Cat 2021). Still, its main import for my argument is that – in some versions of it – the unity of science calls for standardized practices and terminology. Typically, this is expressed as a call for better communication among scientists, which improves the efficiency of scientific production. So expressed, the call seems justified. However, in practice, the unity of science often means modelling scientific disciplines after the practices and terminology of one discipline. This is the core of the problem. Standardization may improve communication and efficiency of interactions among scientists. But in a space in which scientific disciplines have different commitments – epistemic and non-epistemic – standardization should emerge (if at all) from the free interactions, democratic procedures, and collective negotiations in which scientists engage. In other words, the problem is not standardization *simpliciter* but “centralized” standardization, conducted in a reductionistic and monolithic fashion, with a lack of due process.

The thesis of the unity of science has influenced the formalization of geological time units. The development of a geological time scale is an endeavour as old as modern geology and it has gone through different paradigms in its history. However, since 1961, the ICS has become the “official” body in charge of formalizations related to geological time. In its website, the ICS declares that the purposes of its stratigraphic guide are “to promote international agreement on principles of stratigraphic classification and to develop an internationally acceptable stratigraphic terminology and rules of stratigraphic procedure – all in the interest of improved accuracy and precision in international communication, coordination, and understanding.” These purposes are laudable goals which prompt efforts for formalization. However, it is worth noting that the emphasis is on international communication, as opposed to interdisciplinary communication.[[3]](#footnote-3)

A significant limitation for the ICS to engage in interdisciplinary communication about geological time is to assume that the stratigraphic record is the best or even only source to study geological time. Other disciplines may require alternative partitions of geological time based on other kinds of markers depending on their research interests. That is, chronological units of geological time need not be restricted to chronostratigraphic ones. Evidence such as changes in chemical composition of the atmosphere and oceans, biodiversity metrics, or climate regimes are, at least in principle, reasonable empirical markers to parcel recent geological time. The problem for the ICS with these forms of evidence is that they do not have a straightforward correlative marker in the stratigraphy. But why should that be a constraint for scientific disciplines that study earth processes with a faster “kinetics” than lithospheric processes? Is it reasonable to propose divisions of geological time that “are not written in stone” but rather registered in markers of the critical zone, written in the soil, the water, or the air, so to speak? I think it is. And Earth System scientists working on atmospheric chemistry, meteorology, climate studies, ecology, palaeobiology, oceanography, and other “faster” endeavours may well agree.

The unity of science thesis is recognizable in a recent document of the AWG (Zalasiewicz et al. 2019). Their approach is pluralist in the sense of admitting that the social sciences, humanities and arts may develop their own concepts of the Anthropocene (3). However, their pluralism does not extend to science. They equalize scientific evidence for the Anthropocene with stratigraphic evidence, neglecting other markers of the critical zone for its formalization: “As the history of the Earth prior to human documentation can *only* be inferred from the rock record, this focus on material, stratal evidence is critical to comparing the modern and ancient histories of this planet and therefore to gauging the relative scale and rate of human-driven perturbation. The geological Anthropocene, therefore, has to be considered within the established rules and guidelines that apply to all other units of the Geological Time Scale” (ibid).

As a matter of fact, formalization by the ICS has not been needed for scientists in different disciplines to endorse the Anthropocene and deliver explicit and rigorous articulations of it. In this sense, the state of affairs should discourage us from projecting the unity of science picture. Instead, we should embrace a disunity of the sciences. This certainly does not mean that scientists working in different disciplines should be purists about their own endeavours and protective of their own practices. The disunity of the sciences allows for a cohesive interdisciplinary scientific community, which can be assembled through communication, cooperation, and complementation. And it is worth emphasising that the disunity of the sciences is not antithetic to formalization. It only makes it operate differently: Formalization of the Anthropocene can only be assessed contextually because the clarity and approval required for descriptive and evaluative formalizations are relative to practices and institutions.

In sum, questioning the formal status of the Anthropocene across the board seems unprompted: i) there are explicit and rigorous articulations of the Anthropocene, even if dissimilar, and ii) several disciplines and institutions endorse the general notion of a human-driven time. In the next section, I focus on the internalist problem of the Anthropocene in the context of the ICS. That is, if the purpose of the ICS is to establish agreement in matters of principles and classification for accuracy and precision in communication among stratigraphers, then the question is whether the formalization of the Anthropocene helps to that purpose.

1. Descriptive Formalization of the Anthropocene and the Problem of Incoherence

I suggest that Santana’s “future geologist perspective” counterargument is an argument about the lack of descriptive formality in the proposals for the formalization of the Anthropocene. More explicitly, Santana surveys several of these proposals and claims that they fall into one of three problems. Two problems are concerned with failed prediction. In one case, the prediction of a human-driven geological epoch recognized by the future geologist may be wrong because humans may be able to mitigate their impact. In the other case, the prediction of a human-driven geological epoch recognized by the future geologist may be wrong because the effects of humans may only be local, i.e. not significant enough to declare an epoch. The third problem concerns how to fit the Anthropocene with existent chronostratigraphic units. The future geologist may see evidence in the stratigraphy of the impact of humans, but this evidence may not be straightforwardly distinguishable from that of processes starting in the Holocene.

These problems are problems of descriptive formality in the following sense. The two problems of prediction are concerned with the lack of compelling empirical evidence to *classify* the Anthropocene as a geological epoch, in accordance to the classification schemes held by the ICS. The third problem amounts to obstacles to an explicit *definition* of the Anthropocene.

I suggest that these problems of descriptive formalization may be expressed as problems of coherence. On the one hand, there is the incoherence of using predictive criteria for establishing a chronostratigraphic unit with the official historical and empirical approach. Furthermore, if predictions regarding the impact of human behaviour are wrong, then a formal Anthropocene epoch would not cohere with the properties of other geological epochs in terms of their standard duration and global scope. On the other hand, proposed markers for the beginning of the Anthropocene seem to blend with processes that commenced during the Holocene. Thus, formalizing the Anthropocene would be incoherent with the current formalization of the Holocene.

In most scientific endeavours, coherence across a constellation of scientific commitments is a central value. Rejection of the Anthropocene seems to safeguard the coherence achieved between the ICS guidelines and currently formal chronostratigraphic units. However, I articulate two responses that keep the formalization of the Anthropocene as a viable option in spite of its putative incoherent import.

First, the centrality of coherence as a value is compatible with the acceptance of immediate incoherence as a path towards prospective coherence. I illustrate this using an argument by Oreskes (2019). She argues that epistemic strength is gained through diversity in scientific practice and representation. Opening scientific debates to a diversity of perspectives and communities of practice often has an immediate negative effect in the overall coherence of the endeavour at hand. But the thesis is that immediate incoherence pays off in the long term by enabling the exploration of unprecedented configurations and, through processes of reflective equilibrium, settling for more robust states of coherence.

Formalization of the Anthropocene may be seen under this light. In order to gain epistemic strength, the ICS needs to open the debate to the various proposals for formalization of the Anthropocene that do not cohere with its current guidelines and formal units. By broadening the scope of assessment, what used to be coherent within the narrow scope of the ICS is now incoherent in the context of the plethora of perspectives of the interdisciplinary community. But, as the thesis goes, this incoherence may only be temporary. The prospect is that all agents involved in the debate of the Anthropocene – including the ICS – may be able to find a new configuration that is robustly coherent, even if this involves the readjustment of chronostratigraphic units and guidelines of the ICS.

The second response to the problem of incoherence is that the centrality of coherence may be questioned. In particular, geologists tend to navigate the overlaps and mismatches of schemes of classification without much anguish. Chronostratigraphy is not the exception. As Lucas (2018) points out, the ICS has been inconsistent in the past in its GSSP approach and overall schemes of classification. For example, he reports that different subcommissions adopt different protocols for naming chronostratigraphic units and request exceptional ranks, such as “subsystem” for the Carboniferous and “subseries” for the Paleogene (9). To be sure, it remains a possibility that the ICS has tolerated these inconsistencies with the expectation of finding future coherence.

In sum, Santana’s criticism of the future geologist perspective argument rests on the value of coherence. In a historical and inexact discipline such as stratigraphy, a fixation with coherence seems artificial. It does not reflect practices of accommodation and transient incoherence. And even if the value of coherence reigns supreme, immediate incoherence may be accepted in the name of future coherence.

1. Evaluative Formalization of the Anthropocene and its Inherently Political Dimension

The fact that GSSPs are decided by vote makes the formalization of chronostratigraphic units inherently political. This is especially so in the case for the formalization of the Anthropocene, given that its formalization may change the relationship that humans have with the earth. The “synchronic perspective” argument submits that formalization of the Anthropocene should be decided based on these sorts of political consequences. Santana explores this argument, focusing on one consequence, namely the potential conversion of climate change skeptics due to the formalization of the Anthropocene. He suggests that this expectation is unwarranted given that skeptics do not necessarily convert in light of scientific consensus. Furthermore, Santana argues that scientific consensus may even work against conversion of the skeptics, polarizing the factions even more.

I have two reactions to Santana’s views. First, given that formalization of the Anthropocene is a political issue, its approval has less to do with the promise of converting skeptics than signalling a political stance. Our political decisions should stand for what we have reason to value. If you are, say, a left-winger, you should not stop proposing socialist policies, just because the right-wingers refuse your propositions. This would not be a sustainable strategy for the Left. In this sense, the diversity of political views, even the rivalry among them, should not be regarded as intrinsically undesirable, surmountable at all costs. Instead, the different propositions of the political space should be ecologically managed through due process (*à la* Latour 2004). To put it differently, converting adversaries should not be the main goal of political decisions because it presumes that one has the right stance. This is a way of doing politics that assumes that we are already polarized.

A second reaction is that political decisions are adopted to make one’s propositions more persuasive in the political space. The goal is to reconfigure the political space with one’s own political stance. But this is not tantamount to the conversion of adversaries. If the skeptics are a lost cause, the political space may still be reconfigured by the force of the undecided, the unmotivated, and the new generations. The formalization of the Anthropocene should be seen under this light, as a political signal that may be ignored by the skeptics, but one that may well attract the attention of those who need guidance.

Given these two reactions, I think that the debate cannot be reduced to whether the ICS should formalize the Anthropocene to convert climate change skeptics. The first concern should be where the ICS stands in terms of the politics of the Anthropocene, orthogonally to the issue of its descriptive formalization. And the second concern should be how the formalization of the Anthropocene reconfigures the political space beyond the conversion of skeptics. The AWG vote illustrates both issues. The fact that the AWG already endorses the Anthropocene as a formal unit sends a strong political signal which reverberates across the political space, notwithstanding the skeptics.

In this sense, I have reservations about Santana’s claim that “treating the Anthropocene as if it were figuratively set in stone [i.e. formalizing it] makes it appear inevitable, and thus not worth the effort to try to prevent” (1091). I suggest the opposite: *By formalizing the Anthropocene as an epoch, we anticipate its ending*. Recall that the formalization of the Anthropocene works as a thick concept. We can treat the Anthropocene as descriptive of a human-driven time *and* as a time that calls for deep changes in human behaviour.

1. Conclusions

Before restating the main points of this paper, it is worth being explicit about what I have *not* attempted. I do *not* claim that the ICS should formalize the Anthropocene. I also have *not* analysed the merits of particular proposals for formalizing the Anthropocene in the context of the ICS. Rather, my only claims have been: i) the decision made by the ICS should not be binding for other scientific disciplines, which may formalize the Anthropocene differently through specific articulations based on different forms of evidence; ii) the incoherence of “Anthropocene” proposals with the guidelines and formal units of the ICS is a weak reason for their rejection, given their potential for future coherence and the ICS’s record of inconsistencies; and iii) regardless of what the ICS does in terms of descriptive formalization, they could orthogonally decide a stance in terms of the evaluative formalization of the Anthropocene, which would have significant political consequences.

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1. The Merriam-Webster dictionary defines “formalize” as: 1) to give a certain or *definite form* to; 2a) to make formal; and 2b) to give formal status or *approval* to (retrieved online on 21st July 2021; my emphasis). [↑](#footnote-ref-1)
2. GSSP stands for “Global Boundary Stratotype Section and Point”, which define the lower boundary of chronostratigraphic units (Murphy and Salvador 1999, 269). [↑](#footnote-ref-2)
3. Arguably, the ICS also falls short of its “international communication” project. In their website, the ICS declares: “Over the years, the number of members has ranged from 75 to 130 representing 30 to 45 countries.” If the central goal of the ICS is international communication, global international representation should be part of the process. This is even more salient as “voting” is an established mechanism for formalization. Cope (1996) notes that “in the final analysis decisions may depend upon which country has the greatest number of titular (voting) members of the relevant subcommission” (109). This bias can be recognized in the distribution of GSSPs. It can hardly be an accident that all GSSPs are located in the northern hemisphere, with the only exception being the GSSP of the Ediacaran period in Australia. [↑](#footnote-ref-3)