

The Geo-Politics of the Anthropocene: Using Stratigraphy to Naturalize the Anthropocene as a Formal Geological Unit

Jeni Barton

Preview

In humanities disciplines, ever more metaphorical ink is being spilled on conceptualizing the Anthropocene. Given the numerous articles, books, and edited volumes (this one included) theorizing and retheorizing the Anthropocene, it's little wonder that there is no agreement about precisely what it is or what it means. There is no single Anthropocene narrative to be told. Rather, there are, as scholars have noted, a plurality of Anthropocenes. There are a plurality of interpretations of the Anthropocene concept and an abundance of proposed uses for it. Among the various narratives, differences often lie in who or what is blamed (humanity; capitalism; fossil fuels), when it began (the Neolithic Revolution; the Industrial Revolution; the post-WWII "Great Acceleration"), and what is to be done (alter human activities to reduce the negative effects; embrace and expand the human potential to better manage and control the planet). A common thread running through the many disparate Anthropocene stories is the very general point that at least some human activities have effects on the planet that are both large-scale and deleterious. The list of offending human activities is probably familiar: greenhouse gas emissions from fossil fuel burning, altering of land-cover, fertilizer runoff, overfishing, garbage production, natural resource extraction, to name just a few. The undesirable effects include climate change, ocean acidification, sea level rise, lack of potable water, eutrophication, acid rain, ozone depletion, biodiversity loss, the Great Pacific garbage patch, and rivers that catch on fire.

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Introduction

In humanities disciplines, ever more metaphorical ink is being spilled on conceptualizing the Anthropocene. Given the numerous articles, books, and edited volumes (this one included) theorizing and retheorizing the Anthropocene, it's little wonder that there is no agreement about precisely what it is or what it means.¹ There is no single Anthropocene narrative to be told. Rather, there are, as scholars have noted, a plurality of Anthropocenes.² There are a plurality of interpretations of the Anthropocene concept and an abundance of proposed uses for it. Among the various narratives, differences often lie in who or what is blamed (humanity; capitalism; fossil fuels), when it began (the Neolithic Revolution; the Industrial Revolution; the post-WWII "Great Acceleration"), and what is to be done (alter human activities to reduce the

¹ A cursory search of the University of Toronto's library catalogue returns 246 unique hits. The majority of these (232) have been published since 2010, while only 14 were published between 2000 and 2009. Zalasiewicz et al. (2017) note that since 2000, the term "Anthropocene" has been used in more than 1,300 scientific papers. See, Jan Zalasiewicz et al., "Making the Case for a Formal Anthropocene Epoch: An Analysis of Ongoing Critiques," *Newsletters on Stratigraphy* 50, No. 2 (2017), 208-209.

² Jedediah Purdy, *After Nature: A Politics for the Anthropocene* (Cambridge, MA: Harvard University Press, 2015); Christophe Bonneuil and Jean-Baptiste Fressoz, *The Shock of the Anthropocene: The Earth, History and Us*, trans. David Fernbach (Verso: New York, 2016); Christophe Bonneuil, "The Geological Turn: Narratives of the Anthropocene," in *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, eds. Clive Hamilton et al. (New York: Routledge, 2015), 17-31; Amelia Moore, "The Anthropocene: A Critical Exploration," *Environment and Society: Advances in Research* 6, No. 1 (2015), 1-3.

negative effects; embrace and expand the human potential to better manage and control the planet).³ A common thread running through the many disparate Anthropocene stories is the very general point that at least some human activities have effects on the planet that are both large-scale and deleterious. The list of offending human activities is probably familiar: greenhouse gas emissions from fossil fuel burning, altering of land-cover, fertilizer runoff, overfishing, garbage production, natural resource extraction, to name just a few. The undesirable effects include climate change, ocean acidification, sea level rise, lack of potable water, eutrophication, acid rain, ozone depletion, biodiversity loss, the Great Pacific garbage patch, and rivers that catch on fire.

But the Anthropocene concept is not limited to the humanities. Its reach crosses the boundary of the so-called two cultures. Many in the sciences have also adopted the concept even if only tentatively. And its modern origins⁴ are typically traced to an article published in 2000 in the *International Geosphere Biosphere Program Newsletter* by Paul Crutzen and Eugene Stoermer, an atmospheric chemist and biologist respectively. Crutzen and Stoermer argued that, due to the many effects of human activity observable around the planet, we have entered a new “geological epoch” dominated by humans.⁵ Sometimes the beginnings of the Anthropocene are traced to Crutzen’s 2002 concepts piece in *Nature* titled “Geology of Mankind,” where Crutzen again argued that the Holocene (the current geological epoch) had ended and we were now living in the Anthropocene, the “human-dominated” geological epoch.⁶ Though not geologists themselves, Crutzen and Stoermer used geological nomenclature to propose a new span of geological time. But for geologists, as we shall see, a new span of geological time corresponds

³ Bonneuil and Fressoz, 65-96.

⁴ There have been some precursors to the term “Anthropocene.” It should be distinguished from the term “Anthropogene,” which was another, informal, name for the Quaternary Period (the current geological period), but has fallen out of use. See, Subcommission on Quaternary Stratigraphy, International Commission on Stratigraphy, “Anthropocene,” accessed 18 April 2017, <https://quaternary.stratigraphy.org/majordivisions/anthropocene/>; Hollis D. Hedberg, ed., *International Stratigraphic Guide: A Guide to Classification, Terminology, and Procedure* (Toronto: John Wiley and Sons, 1976), 79. Also, in the nineteenth century, Italian geologist Antonio Stoppani coined the phrase “anthropozoic era” to refer to humanity’s increased capacity to effect changes on the planet. See, Paul J. Crutzen, “Geology of Mankind,” *Nature* 415, No. 3 (3 Jan. 2002), 23.

⁵ Paul J. Crutzen and Eugene F. Stoermer, “The ‘Anthropocene,’” *IGBP Newsletter* 41 (May 2000), 17-18.

⁶ Paul J. Crutzen, “Geology of Mankind,” *Nature* 415, No. 3 (3 Jan. 2002), 23.

with a specific segment of rock strata and so Crutzen and Stoermer were also making implicit claims about the stratigraphic record.

For most proponents of the Anthropocene, what is crucial is not the specifics of the geological record but rather the ways the concept might be used to reframe environmental politics. With a single a word, “Anthropocene,” we can now refer to the extensive effects of human activities on the Earth’s lands, oceans, and air. A single evocative term can now gesture towards the whole gamut of human effects on the planet. For many, this new framing is an important first step in attempting to solve the many of environmental problems that human activities are creating or to which human activities are contributing.⁷ That humans are having an effect on planetary systems is no long a “subject” of academic inquiry and public debate. There is now an “object”⁸ that has been identified, the Anthropocene, and it can be further studied and known, thus facilitating discussion and debate about how to best respond to anthropogenic environmental problems. Reframing the problems as “the Anthropocene” is, in this line of thinking, the first step in tackling these problems.

In some respects, using the Anthropocene to re-frame environmental politics maps on to how scholars have interpreted and applied Michel Foucault’s concept of problematization. For Foucault, this meant studying, “how and why certain things (behavior, phenomena, processes) became a problem.”⁹ It meant asking the question: how did something become an object of attention that could be known and therefore capable of eliciting concern? This is not to deny the reality or diminish the significance of the things that are problematized, but simply to recognize that problems are not self-evident. Problems have histories. Those histories may be traced genealogically by tracking the particular practices, processes, beliefs, regulations, knowledge, and actors that played roles in making something into a problem.¹⁰ Scholars taking up Foucault’s study of governmentality further note the importance of

⁷ Purdy, 1-6; Nature, “Editorial: The Human Epoch,” *Nature* 473, No. 7347 (19 May 2011), 254.

⁸ This paper will use the term “object” not in a Fregean sense in which it is distinguished from “concept.” Rather, “object” here simply refers to something that can be the focus of attention.

⁹ Michel Foucault, “Discourse and Truth: The Problematization of Parrhesia: Six Lectures Given by Michel Foucault at the University of California at Berkeley, Oct-Nov. 1983,” accessed 14 April 2017, https://foucault.info/system/files/pdf/DiscourseAndTruth_MichelFoucault_1983_0.pdf.

¹⁰ Foucault, “Discourse and Truth”; Carol Bacchi, “Why Study Problematizations? Making Politics Visible,” *Open Journal of Political Science* 2, No. 1 (2012), 1-4.

problematization in regulation and governance. Problematization can help with understanding how certain kinds of objects, certain kinds of relations, become objects of concern since governments and other regulatory bodies require, among other things, problems that they can then attempt to solve. They need problems to be made visible that can, once identified, then be tackled using a variety of methods.¹¹ Scientists (with the particular kinds of expertise they can offer) and scientific knowledge can play a crucial role in formulating “calculable” problems onto which governments and institutions can focus their regulatory attention.¹² So, following this line of argument, if the Anthropocene can be framed as a scientific concept, which is to say something considered scientifically real in the world,¹³ it can then serve as a problem that can be addressed by regulatory bodies. The problems that the Anthropocene refers to can now be addressed and perhaps solved.

This paper will not grapple with whether or not “the problem” of the Anthropocene might be an effective instrument to address environmental issues.¹⁴ Instead, it focuses on a single attempt to problematize the Anthropocene by transforming it into a formal scientific category. This attempt to make the Anthropocene a natural category arises from the Anthropocene’s modern genesis as a geological concept, rather than as an approach to environmental politics. It involves the Anthropocene Working Group (AWG),¹⁵ formed in 2009 by the

¹¹ For examples of this scholarship see, Peter Miller and Nikolas Rose, *Governing the Present: Administering Economic, Social and Personal Life* (Malden, MA: Polity Press, 2008); Bacchi, 1-8; Mitchell Dean, *Governmentality: Power and Rule in Modern Society* (Thousand Oaks, CA: Sage Publications, 1999); Mark Whitehead, *State, Science, and the Skies: Governmentalities of the British Atmosphere* (Malden, MA: Wiley-Blackwell, 2009).

¹² Ola Uhrqvist, “Seeing and Knowing the Earth as a System: An Effective History of Global Environmental Change Research as Scientific and Political Practice” (PhD diss., Linköping University, 2014), 19-31.

¹³ The use of “real” here simply refers to facts about the world that are currently accepted in the scientific community.

¹⁴ Some argue that the idea that words affect the world is erroneous, or at least not a necessary connection. For instance, as James Westcott notes, Timothy Morton suggests that, “The idea that a view can change the world is deeply rooted in the Romantic period[.]” See, Timothy Morton, *Ecology Without Nature: Rethinking Environmental Aesthetics* (Cambridge, MA: Harvard University Press, 2007), 2; James Westcott, “Is Rushing to Declare the Anthropocene Also Human Error?” *Aeon*, accessed 22 February 2017, <https://aeon.co/essays/is-rushing-to-declare-the-anthropocene-also-human-error>. For a contrasting view see, Purdy, 1-10.

¹⁵ The Anthropocene Working Group (AWG) is sometimes referred to as the Working Group on the Anthropocene, with the abbreviation WGA. This paper will use the

Subcommission on Quaternary Stratigraphy (SQS) of the International Commission on Stratigraphy (ICS). The working group's members, drawn from both the sciences and the humanities,¹⁶ were tasked with studying available evidence and recommending whether or not the Anthropocene should formally be labeled a new geological epoch. The question here is whether, geologically-speaking, the Earth had passed from the Holocene epoch into a new Anthropocene epoch that should be added to the ICS's International Chronostratigraphic Chart.¹⁷ It is the ICS (and its coordinating body, the International Union of Geological Societies [IUGS]) that is responsible for maintaining the global standards for geological units, and thus it is the ICS (through its various subcommissions and working groups) that proposes and adjudicates any new units.

While the question of whether or not the Anthropocene is a new *geological epoch* certainly falls under the purview of the ICS, this may not be the best way of framing of the question. The Anthropocene might not be, or at least need not be, a geological category at all, despite its original introduction as one. The effects of human activities on the planet go beyond possible traces in the geological record, affecting many, if not all, aspects of the Earth system to varying degrees.¹⁸ So calling the Anthropocene a “geological epoch” might in fact limit attention to the vast scope of human effects.¹⁹ As the AWG's chair, geologist Jan Zalasiewicz, has informally suggested, “The Anthropocene is not about being able to

abbreviation AWG, since this is how it appears in the ICS's Annual Report for 2009. See, “ICS Annual Report 2009,” International Commission on Stratigraphy, accessed 7 March 2017, http://www.stratigraphy.org/images/Archive/ICS_AnnReport2009.pdf.

¹⁶ The AWG was convened by geologist Jan Zalasiewicz. The AWG website lists 37 members from a variety of disciplines, including geology, archaeology, history, soil science, ecology, oceanography, polar science, atmospheric chemistry, and international law. See, Jan Zalasiewicz, et al., “Anthropocene: Its Stratigraphic Basis,” *Nature* 541 (19 Jan. 2017), 289; Subcommission on Quaternary Stratigraphy, “Working Group on the ‘Anthropocene,’” accessed 7 March 2017, <https://quaternary.stratigraphy.org/workinggroups/anthropocene/>. Unfortunately, this list appears to be out of date, since the name of at least one current member (Martin Head) is missing. See, Zalasiewicz et al., “Making the Case,” 221.

¹⁷ “ICS Subcommission Annual Report 2009,” International Commission on Stratigraphy.

¹⁸ Even Crutzen and Stoermer's original Anthropocene proposal focused, albeit briefly, on a variety of data and observations well beyond that observable in the rock record. See, Crutzen and Stoermer, 17-18.

¹⁹ James Westcott, “Is Rushing to Declare the Anthropocene Also Human Error?” *Aeon*, accessed 22 February 2017, <https://aeon.co/essays/is-rushing-to-declare-the-anthropocene-also-human-error>.

detect human influence in stratigraphy, but reflects a change in the Earth system (of which the most important and long-lasting is the change to the biological system).”²⁰ In a different vein, Nigel Clark and Dipesh Chakrabarty argue that much Anthropocene “talk” gives too much centrality and agency to humans. They argue that there are many Earth system processes, geological and otherwise, to which human activities may contribute but do not direct.²¹ Thus, the Anthropocene need not be linked to a formal geological unit in order for it to have conceptual utility. Jedediah Purdy and Noel Castree, among others, maintain that the Anthropocene need not be linked to *any* scientific concept in order for it to prove a useful tool to effect change.²²

What I want to explore in this paper is not the geological strengths and weakness of attempting to formalize the Anthropocene epoch as a new geological unit. Rather, this paper will focus on how the attempt to problematize the Anthropocene by making it a natural, or scientific, category through the institutional mechanisms of the ICS and IUGS presents the ICS and IUGS with a tough choice. This choice can be simply summed up: should the Anthropocene be formally ratified as a new geological unit or not? The question is simple enough and it admits of a simple “yes” or “no” answer. But I wish to suggest that either way the ICS and IUGS answers will potentially provide grounds to doubt the reality of the Anthropocene as scientifically real. In turn, this runs the risk of providing fuel to those wishing to undercut environmental action by fomenting skepticism about the scientific basis of the Anthropocene. Paradoxically, this was the precise thing that the Anthropocene Working

²⁰ Quoted in Adrian J. Ivakhiv, “Anthropocene Debate Continues,” accessed 22 February 2017, <http://blog.uvm.edu/aivakhiv/2014/08/05/anthropocene-debate-continues> Zalasiewicz’s quotation comes from his response to a blogpost by Kieran Suckling titled “Against the Anthropocene.” This blogpost elicited response emails from Zalasiewicz and paleobiologist Anthony Barnosky, which were shared with their permissions.

²¹ Dipesh Chakrabarty, “The Anthropocene and the Convergence of Histories,” in *The Anthropocene and the Global Environmental Crisis: Rethinking Modernity in a New Epoch*, eds. Clive Hamilton et al. (New York: Routledge, 2015), 54-55; Nigel Clark, “Anthropocene Incitements: Toward a Politics and Ethics of Ex-Orbitant Planetarity,” in *The Politics of Globality: Assembling the Planet*, eds. Rens van Munster and Casper Sylvest (New York: Routledge, 2016), 137.

²² Purdy, 16-17; Noel Castree, “Anthropocene: Social Science Misconstrued,” *Nature* 541 (19 Jan. 2017), 289; Noel Castree, “An Official Welcome to the Anthropocene Epoch—But Who Gets to Decide It’s Here?” *The Conversation*, accessed 7 March 2017, <https://theconversation.com/an-official-welcome-to-the-anthropocene-epoch-but-who-gets-to-decide-its-here-57113>.

Group was attempting to avoid by making the Anthropocene a natural category underwritten by appropriate scientific evidence.

This paper will first provide a brief background on how the international stratigraphic community developed international standards for the classification of geological units and then briefly discuss the current standards. It will then turn to the stratigraphic consideration of the Anthropocene as a new geological unit. Next, it will highlight how some of the evidence being mustered to characterize the Anthropocene epoch might be unusual by the current standards stratigraphic classification. Some members of the stratigraphic community maintain that ratifying the Anthropocene would require changes to the kinds of evidence normally used to support a recommendation to alter the ICS's International Chronostratigraphic Chart and, thus the official Geological Time Scale. Lastly, the paper will discuss how, as a result, the choice to either ratify or reject the Anthropocene as a new geological epoch has the potential to fuel scepticism about the Anthropocene as a scientific category.

Building Up International Stratigraphic Standards

Up to the middle of the twentieth century, the stratigraphic community had no international standards by which to label geological units. According to Stephen Walsh et al., different stratigraphers from different parts of the world conceptualized and applied geological time units (periods, epochs, ages) and stratigraphic units (systems, series, stages) in a variety of different ways, using a variety of different nomenclature practices and supporting evidence. Not only was there no international coordination, there were also gaps and overlaps between these units that diminished their scientific utility. Considerable credit for the move towards creating international standards should be given to Hollis D. Hedberg, though of course there were predecessors in the stratigraphic community. In 1952, at the International Geological Congress in Algiers, Hedberg called for the establishment of the International Subcommittee on Stratigraphic Terminology (ISST) in order to set international standards for the demarcation of geological units. Hedberg's call was heeded and the ISST was established in 1952, with a name change in 1965 to the International Subcommittee on Stratigraphic Classification (ISSC). The ISSC worked under the aegis of the International Geological Congress until 1965, when

it moved under the purview of the International Union of Geological Sciences (IUGS).²³

It was not until 1976 that the first collection of international stratigraphic standards was published in the *International Stratigraphic Guide*.²⁴ During the intervening 25 years, from when Hedberg first made his proposal in 1952 until 1976, Hedberg and the other members of the ISSC were not idle. In the preface to the *Guide*, Hedberg describes, “the thorny path along which it [the ISSC] has had to make its way, contending first with apathy and then at times with fierce opposition, and continually being forced to pick its way through thickets of nationalism, regionalism, traditionalism, conservatism, and radicalism, in trying to arrive at the best majority consensus.”²⁵ As part of their process, the ISSC sent stratigraphers a series of circulars and questionnaires to “explore and evaluate existing stratigraphic principles, procedures, and terminology worldwide, and to determine to what extent there could be general agreement, or possibilities of obtaining general agreement, leading to an optimum and universally acceptable working basis in the field of stratigraphy.”²⁶ Many hundreds of pages of responses ensued, as did “open discussion meetings” held at International Geological Congress meetings in 1956 (Mexico), 1960 (Copenhagen), 1964 (India), 1968 (Czechoslovakia), and 1972 (Canada). The ISSC also published a number of early reports that presented some of their initial findings, in order to receive further feedback.²⁷ After a number of drafts of the guide were prepared and revised, a final draft was presented to members of the ISSC. Of the 88 members that voted, 85 approved the publication of the guide, though approval did not indicate full agreement with every aspect of the text.²⁸

With the *International Stratigraphic Guide* of 1976, stratigraphers from around the world now had one single text to consult regarding the standards for demarcating geological units. But this *Guide* was never

²³ Stephen L. Walsh, et al., “History, Philosophy, and Application of the Global Stratotype Section and Point (GSSP),” *Lethaia* 37, No. 2 (2004), 201-202. The ISSC is one of the ICS’s current 16 subcommissions.

²⁴ Hollis D. Hedberg, ed., *International Stratigraphic Guide: A Guide to Classification, Terminology, and Procedure* (Toronto: John Wiley and Sons, 1976).

²⁵ Hedberg, vi.

²⁶ Hedberg, 3.

²⁷ Hedberg, 102.

²⁸ Hedberg, vi-vii.

formally adopted by the ICS as a “statutory policy document”²⁹ and there have been subsequent reworkings, as finer points are elaborated and new techniques for identification and dating of geological units are introduced. In a forward to the second edition of the *Guide* published in 1994, Jürgen Remane, then chairman of the ICS, noted that 32 additional circulars (consisting of over a thousand pages of material) were distributed to stratigraphers from 1977 to 1993 to solicit suggestions for a new guide.³⁰ This new edition provides some reworkings of the 1976 *Guide* as well as additional information on, for instance, the classification of igneous and metamorphic rocks, and magnetostratigraphy.³¹

But these guides were intended to be just that, *guidelines* for classifying geological units in rocks and in time, rather than rigid, unchanging, eternal codes. Hedberg himself notes that his 1976 guide was only meant as a “step” in the direction of standardization, not a final, static product.³² However, in addition to these guides the ICS, as the institution responsible for coordinating international stratigraphy, has also produced its own procedural guidelines and statutes (and revised guidelines and statutes) that further detail the general international standards and ratification procedures to be followed for the introduction of new geological units into the ICS’s International Chronostratigraphic Chart.³³ In the most recent iteration, Jürgen Remane *et al.* note that the full ICS voted overwhelmingly in favour of the revised guidelines, and they are, “thus a *formal and mandatory* document regulating the procedure to be followed in the definition of chronostratigraphic boundaries.”³⁴ So while the *International Stratigraphic Guides* provide general guidelines for working stratigraphers, when it comes to adjudicating new geological units, it is the ICS’s guidelines for ratification (or rejection) that are “formal and mandatory.”

²⁹ John W. Cowie, et al., “Guidelines and Statutes of the International Commission on Stratigraphy (ICS),” *Courier Forschungsinstitut Senckenberg* 83 (Mar. 1986), 1.

³⁰ Jürgen Remane, “Foreword,” in *International Stratigraphic Guide: A Guide to Stratigraphic Classification, Terminology, and Procedure*, ed. Amos Salvador (Boulder, CO: The Geological Society of America, 1994), xi.

³¹ Amos Salvador, ed., *International Stratigraphic Guide: A Guide to Stratigraphic Classification, Terminology, and Procedure* (Boulder, CO: The Geological Society of America, 1994).

³² Hedberg, vi.

³³ Cowie, et al., 1-14; Jürgen Remane, et al., “Revised Guidelines for the Establishment of Global Chronostratigraphic Standards by the International Commission on Stratigraphy (ICS),” *Episodes* 19, No. 3 (Sep. 1996), 77-81.

³⁴ Remane, et al., 77 [emphasis added].

For this paper, the minutiae of how these standards were initially conceived by various stratigraphers and then transformed over time are not particularly germane. The significant point is that it took many years and much consultation and consensus-building to construct the standards to which the international stratigraphy community now adheres. These standards were carefully considered and hard-won. Although they can be revised, they are not altered without serious consideration and extensive deliberation in the stratigraphic community. What is more relevant here is the current state and shape of these standards, in the early twenty-first century, as a working group of the ICS considers whether or not to recommend the formalization of the Anthropocene epoch as a new geological unit.

These stratigraphic standards, as mentioned, center around the International Commission on Stratigraphy (ICS), which is the largest scientific body of the International Union of Geological Sciences (IUGS). The ICS has a three-person executive board, with the rest of the membership comprised of the heads of the 16 subcommissions³⁵ of the ICS that each have around 20 voting members from over 50 countries.³⁶ In its mission to define and maintain global standards for geological units, the ICS employs the concept of the Global Standard Stratotype Section and Point (GSSP).³⁷ A GSSP is a physical point located in a particular strata of rock that best identifies a particular geological unit from its predecessor. It demarcates a unit's lower boundary (and thus the upper boundary of the underlying unit).³⁸ Stratigraphers identify GSSPs using a number of evidentiary criteria that have been developed over the years, including biostratigraphy (fossils), magnetostratigraphy (magnetic pole reversals), chemostratigraphy (chemical signatures in the rock layers), and

³⁵ In addition to the Subcommittee on Quaternary Stratigraphy, there are subcommissions for the following 15 areas: Precambrian Stratigraphy, Cryogenian Stratigraphy, Ediacaran Stratigraphy, Cambrian Stratigraphy, Ordovician Stratigraphy, Silurian Stratigraphy, Devonian Stratigraphy, Carboniferous Stratigraphy, Permian Stratigraphy, Triassic Stratigraphy, Jurassic Stratigraphy, Cretaceous Stratigraphy, Paleogene Stratigraphy, Neogene Stratigraphy, and Stratigraphic Classification. See, "Subcommissions," International Commission on Stratigraphy, accessed 22 April 2017, <http://www.stratigraphy.org/index.php/ics-subcommissions>.

³⁶ Stanley C. Finney and Lucy E. Edwards, "The 'Anthropocene' Epoch: Scientific Decision or Political Statement," *GSA Today* 26, No. 3-4 (Mar./Apr. 2016), 4.

³⁷ There are 75 ratified GSSPs. See, "Global Boundary Stratotype Section and Point (GSSP) of the International Commission on Stratigraphy," International Commission on Stratigraphy, accessed 22 April 2017, <http://www.stratigraphy.org/GSSP/GSSPTable2015-01.pdf>.

³⁸ Remane, et al., 77.

cyclostratigraphy (solar- or orbit-forced climate cycles). Though it is difficult (read: impossible) to find an “ideal” or perfect boundary point, a GSSP is identified based on the best available evidence and its ability to facilitate broad correlation around the world by having many “stratigraphic signals” that serve as reference points.³⁹

Formal ratification of a new geological unit proceeds in stages. First, a working group within a particular subcommission of the ICS is formed. This working group studies all available evidence of candidate GSSPs worldwide and prepares a written proposal recommending a single GSSP to demarcate the geological unit, based on voting by members of the working group. If this proposal achieves consensual agreement by the members, the proposal is voted on by members of the subcommission to which the working group belongs. If it is approved by greater than 60 percent of the votes at the subcommission, the proposal is forwarded to the ICS, where its three-person executive and the heads of the 16 subcommissions vote. If again the proposal receives at least a 60 percent “yes” vote, the proposal is sent to the IUGS for final ratification.⁴⁰ At any stage in this process, a proposal can be sent back to a previous stage for revision, and sometimes proposals die altogether.⁴¹ This is, according to the current head of the Quaternary subcommission (and member of the AWG)⁴² Martin Head, an inherently conservative process: “You are messing around with a timescale that is used by millions of people around the world. So if you’re making changes, they have to be made on the basis of something for which there is overwhelming support.”⁴³ Jan Zalasiewicz et al. note that the International Chronostratigraphic Chart, “may be considered the backbone of geology; consequently, the process of adding to it, or amending existing units, is justly a slow, incremental and conservative process.”⁴⁴

After ratification, the ICS guidelines and statutes state that, “The GSSP should be indicated by a permanently fixed marker.”⁴⁵ This is what

³⁹ Finney and Edwards, 4-5; Jan Zalasiewicz, et al., “When Did the Anthropocene Begin? A Mid-Twentieth Century Boundary Level is Stratigraphically Optimal,” *Quaternary International* 383 (5 Oct. 2015), 197-198. Beyond these stratigraphic techniques, thought must also be given to the accessibility of the site. See, Remane, et al., 80.

⁴⁰ Remane, et al., 80; Finney and Edwards, 5-6.

⁴¹ Richard Monastersky, “Anthropocene: The Human Age,” *Nature* 519 (12 Mar. 2015),

⁴² Zalasiewicz et al., “Making the Case,” 221.

⁴³ Quoted in, Monastersky, 147.

⁴⁴ Zalasiewicz et al., “Making the Case,” 206.

⁴⁵ Remane, et al., 80.

is colloquially known as the “golden spike.”⁴⁶ In addition to the golden spike that is placed in a physical location, approved geological units are recorded in the ICS’s International Chronostratigraphic Chart. For geologist Michael Walker, this chart, “is one of the greatest achievements of humanity[.]”⁴⁷ As stratigraphers Stanley Finney and Lucy Edwards note, “The rigorous criteria on which a GSSP proposal is evaluated and the several levels of evaluation and consideration by which it is approved and ratified give validity and authority to ratified GSSPs as international geostandards.”⁴⁸ All of this illustrates that, for members of the stratigraphic community, the International Chronostratigraphic Chart represents a significant scientific achievement, and its status as well-founded science rests on the now well-established and formal process of geological standardization.

The Anthropocene as a Formal Geological Unit

While the modern origins of the Anthropocene concept can be traced back to articles by Crutzen (and Stoermer) in 2000 and 2002, its uptake in the institutional decision-making process of the ICS (and IUGS) emerged slightly later.⁴⁹ In 2008, members of the Stratigraphic Commission of the Geological Society of London posed a question in the Geological Society

⁴⁶ According to Walsh et al., there are at least origin stories for the “Golden Spike” nickname. One suggests that the phrase was taken from the ceremonial spikes that were placed to mark the completion of certain railway lines in North America. The other claims that it comes from the American stratigrapher W.C. Bell’s use of a “golden pick” to demarcate the lower base of a stratigraphic formation (which was then photographed). See, Walsh et al., 203-204.

⁴⁷ Quoted in, Monastersky, 145.

⁴⁸ Finney and Edwards, 6.

⁴⁹ The reasons, if any, for this time lag are not clear. The ICS’s Subcommittee Annual Report for 2009 simply states that the AWG, “was created in the summer of 2009, following the proposal of the term Anthropocene by Crutzen (2002), its subsequent analysis by the Stratigraphy Commission of the Geological Society of London (Zalasiewicz et al. 2008) and a session convened at the 2008 Fall Meeting of the American Geophysical Union on this theme.” See, “ICS Subcommittee Annual Report 2009,” International Commission on Stratigraphy. One possible reason for the 2008 “analysis” by the Geological Society of London may have been the December 2007 publication of an important article about the Anthropocene concept. See, Will Steffen, et al., “The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?” *Ambio* 36, No. 8 (Dec. 2007), 614-621. The first international meeting of the AWG did not take place until October 2014. See, “ICS Subcommittee Annual Reports for 2014,”

International Commission on Stratigraphy, accessed 7 March 2017, http://www.stratigraphy.org/images/Archive/ICS_SubcommReport2014.pdf.

of America's monthly news and science publication: "Are we now living in the Anthropocene?"⁵⁰ The 21 authors outlined the various human influences on the environment that are (or might in the future be) observable in the stratigraphic record. They note that human activity helped "characterize Holocene strata" but since the Industrial Revolution there has been "a fundamentally different stratigraphical signal."⁵¹ Notable signals included changes to physical sedimentation and carbon -cycle perturbation, as well as changes in global mean temperature, rates of biotic extinction, and ocean acidification.⁵² Their conclusion: "Sufficient evidence has emerged of stratigraphically significant change (both elapsed and imminent) for recognition of the Anthropocene—currently a vivid yet informal metaphor of global environmental change—as a new geological epoch to be considered for formalization by international discussion."⁵³ By 2009, the ICS's Subcommittee on Quaternary Stratigraphy (SQS) had formed the Anthropocene Working Group (AWG) to consider formalization of the concept of the Anthropocene through the ICS's ratification process.⁵⁴

As of mid-2017, the AWG has not submitted a formal proposal regarding the status of the Anthropocene as a formal geological unit. However, in the years since 2009, members of the working group (and other stratigraphers) have published a number of articles, and even a special publication of the Geological Society of London, that have examined the kinds of stratigraphic evidence that could support the formalization of the Anthropocene as a geological unit.⁵⁵ They have also

⁵⁰ Jan Zalasiewicz, et al., "Are We Now Living in the Anthropocene?" *GSA Today* 18, No. 2 (Feb. 2008), 4-8.

⁵¹ Zalasiewicz, et al., "Are We Now Living in the Anthropocene?" 5.

⁵² Zalasiewicz, et al., "Are We Now Living in the Anthropocene?" 5-6.

⁵³ Zalasiewicz, et al., "Are We Now Living in the Anthropocene?" 7.

⁵⁴ "ICS Subcommittee Annual Report 2009," International Commission on Stratigraphy.

⁵⁵ For examples see, Jan Zalasiewicz, et al., "The Anthropocene: A New Epoch of Geological Time?" *Philosophical Transactions of the Royal Society A* 369, No. 1938 (13 Mar. 2011), 835-841; Simon J. Price, et al., "Humans as Major Geological and Geomorphological Agents in the Anthropocene: The Significance of Artificial Ground in Great Britain," *Philosophical Transactions of the Royal Society A* 369, No. 1938 (13 Mar. 2011), 1056-1084; Roger LeB. Hooke, et al., "Land Transformation by Humans: A Review," *GSA Today* 22 No. 12 (Dec. 2012), 4-10; Colin N. Waters, et al., eds., *A Stratigraphical Basis for the Anthropocene* (London: The Geological Society, 2014); Jan Zalasiewicz and Mark Williams, "The Anthropocene: A Comparison with the Ordovician-Silurian Boundary," *Rendiconti Lincei* 25, No. 1 (Mar. 2014), 5-12; Jan Zalasiewicz, et al., "The Technofossil Record of Humans," *The Anthropocene Review* 1,

proposed various potential starting points that could serve as a GSSP. These potential points can be broadly split into three periods: the “pre-Industrial Revolution age” (e.g. signals from early agricultural practices around 8,000 years ago), the “Industrial Revolution age” (e.g. signals from increased CO₂ emissions beginning in the late eighteenth century), and the mid-twentieth century “Great Acceleration” (e.g. signals from nuclear weapons detonation).⁵⁶

Most recently, on 29 August 2016, Colin Waters, representing the AWG, announced some of the working group’s preliminary findings at the International Geological Congress in Cape Town, South Africa. Of the 35 current members of the AWG, 34 have voted “yes” to the question, “Is the Anthropocene stratigraphically real?” (with one member abstaining). A majority of the votes cast (28.3 percent) favoured demarcating the mid-twentieth century as the starting point (i.e. GSSP) of the Anthropocene, when human influences on the rock layers intensified in comparison to previous traces. However, this was not a formal proposal to the ICS, as the AWG still needs to determine where, precisely, the starting point of the Anthropocene should be located, a process that could take another three years.⁵⁷

Furthermore, not everyone in the stratigraphic community agrees that the Anthropocene should be formalized as a new geological unit (perhaps this is an obvious point, given that the AWG has not yet produced a formal written proposal after almost nine years of deliberations).⁵⁸ One persistent critic has been geologist Stanley Finney

No. 1 (2014), 34-43; Jan Zalasiewicz, et al., “Human Bioturbation, and the Subterranean Landscape of the Anthropocene,” *Anthropocene* 6 (Jun. 2014), 3-9; Colin N. Waters, et al., “Can Nuclear Weapons Fallout Mark the Beginning of the Anthropocene Epoch?” *Bulletin of the Atomic Scientists* 71, No. 3 (Jan. 2015), 46-57; Will Steffen, et al., “Stratigraphic and Earth System Approaches to Defining the Anthropocene,” *Earth’s Future* 4 (2016), 324-345; Jan Zalasiewicz, et al., “The Geological Cycle of Plastics and Their Use as a Stratigraphic Indicator of the Anthropocene,” *Anthropocene* 13 (2016), 4-17.

⁵⁶ Colin N. Waters, et al., “A Stratigraphical Basis for the Anthropocene?” in *A Stratigraphical Basis for the Anthropocene*, eds. Colin N. Waters, et al. (London: The Geological Society, 2014), 7-15.

⁵⁷ “Media note: Anthropocene Working Group (AWG),” University of Leicester, accessed 7 March 2017, <http://www2.le.ac.uk/offices/press/press-releases/2016/august/media-note-anthropocene-working-group-awg>.

⁵⁸ While reasons for it vary, a number of stratigraphic criticisms and issues regarding the formalization of the Anthropocene epoch have been raised by stratigraphers. For examples see, Mike Walker, et al., “Comment on ‘When Did the Anthropocene Begin? A Mid-Twentieth Century Boundary is Stratigraphically Optimal’ by Jan Zalasiewicz et al. (2015), *Quaternary International*, 383, 196-203,” *Quaternary International* 383 (5 Oct.

who, from 2008 to 2016, was chair of the ICS.⁵⁹ “Critic” might be too strong, at least until recently. In his contribution to the Geological Society of London’s Special Publication *A Stratigraphic Basis for the Anthropocene* (2014), Finney refrained from full-blown criticism of the Anthropocene concept as a potential formal geological unit.⁶⁰ Instead, he raised a number of key issues that needed to be addressed by the AWG before any formalization could take place. These included issues regarding the strength of the Anthropocene’s stratigraphic record and whether or not it was more of a projection into the future rather than a unit of Earth’s history like all other formal geological units.⁶¹ As noted above, Finney and Edwards stated in 2016 that it is the ICS’s established stratigraphic criteria and procedures that provide “validity and authority” to the GSSPs and the ICS’s chart containing “global geostandards[.]”⁶² Similarly in 2014, Finney maintained that, “Contentious issues, novel proposals, proposals with vocal proponents, and proposals that receive international media attention are best addressed by the ICS by following these well-established procedures.”⁶³

A crucial point in Finney’s critique is that the Anthropocene presents many unique features when compared to other already ratified geological units. These unique features arise from the proposed Anthropocene geological unit being very much a current and future projection, rather than a unit based on the past history of the Earth. If the Anthropocene is a “real” geological unit, then it is geologically recent (at

2015), 204-207; Whitney J. Autin and John M. Holbrook, “Is the Anthropocene an Issue of Stratigraphy or Pop Culture?” *GSA Today* 22, No. 7 (Jul. 2012), 60-61; S.J. Gale and P.J. Hoare, “The Stratigraphic Status of the Anthropocene,” *The Holocene* 22, No. 12 (2012), 1491-1494; P.L. Gibbard and M.J.C. Walker, “The Term ‘Anthropocene’ in the Context of Formal Geological Classification,” in *A Stratigraphical Basis for the Anthropocene*, eds. Colin N. Waters, et al. (London: The Geological Society, 2014), 29-37; E.W. Wolff, “Ice Sheets and the Anthropocene,” in *A Stratigraphical Basis for the Anthropocene*, eds. Colin N. Waters, et al. (London: The Geological Society, 2014), 255-263; Monastersky, 144-147; Guido Visconti, “Anthropocene: Another Academic Invention?” *Rendiconti Lincei* 25, No. 3 (2014), 381-392.

⁵⁹ “ICS Annual Report 2009,” International Commission on Stratigraphy; “ICS Annual Report 2015,” International Commission on Stratigraphy, accessed 7 March 2017, http://www.stratigraphy.org/images/Archive/ICS_AnnReport2015.pdf.

⁶⁰ Stanley C. Finney, “The ‘Anthropocene’ as a Ratified Unit in the ICS International Chronostratigraphic Chart: Fundamental Issues that Must be Addressed by the Task Group,” in *A Stratigraphical Basis for the Anthropocene*, eds. Colin N. Waters, et al. (London: The Geological Society, 2014), 23-28.

⁶¹ Finney, 24-27.

⁶² Finney and Edwards, 6.

⁶³ Finney, 23.

the very most only ~8,000 years old), we are currently living in it, and many of its stratigraphically defining characteristics (e.g. evidence of human activity) have not yet left significant physical traces in the rock record. A concern for Finney is that, given this recentness and the need to make future projections, there are not enough strong and widespread stratigraphical signals that can be amassed to provide evidence for a GSSP for the Anthropocene in the same way that GSSPs for previously proposed geological units have been established. The Anthropocene as a geological unit has been largely motivated by a wide variety of scientific observations as well as historical written records that go well beyond specifically *stratigraphic* evidence in the rocks.⁶⁴ As Finney notes, “All units presently on it [the ICS’s International Chronostratigraphic Chart] are based on rock records, generally stratigraphic, of events that occurred in the past, that is in deep time.”⁶⁵ The proposed Anthropocene epoch does not yet possess this kind of robust record. Further, when there are nascent signatures in the rocks, it’s not clear which of these signatures will actually persist hundreds or thousands or millions of years into the future. The upshot is that, in order to formally ratify it as a geological unit and designate a GSSP, the ICS (and therefore all the relevant subcommissions, working groups, and its governing body) would have to alter at least some of the evidentiary standards that stratigraphers have used up to now to identify and ratify new geological units. As Finney interprets the situation, if the ICS were to ratify the Anthropocene, it would have to use different standards of evidence than have been used to ratify all other formal geological units.

More recently, Finney and Edwards have gone further in critiquing the Anthropocene as a geological unit.⁶⁶ They do fully admit the potential utility of the Anthropocene concept to “raise awareness that...the human impact on the Earth system is global, and that human impact may have initiated a cascade of events that will greatly alter Earth’s surface, oceans,

⁶⁴ Finney, 24-27.

⁶⁵ Finney, 26.

⁶⁶ Finney was even on the program for the International Geological Congress held in Cape Town, South Africa in August 2016. His name was listed directly after Colin Waters, who made the AWG announcement that its members overwhelmingly believe that the Anthropocene is stratigraphically real, and that a majority of the members support a mid-twentieth century starting point. Finney’s talk was titled “The Mistaken Drive to Define the ‘Anthropocene’ as an Officially Recognized Unit of the Geologic Time Scale.” See, “35th International Geological Congress, 27 August - 2 September 2016, Cape Town, South Africa, Monday Program,” accessed 1 March 2017, http://www.35igc.org/Uploads/Conference/IGC_PROGRAMME_MONDAY_2016_WEB.pdf.

and atmosphere.”⁶⁷ However, Finney and Edwards emphasize that the Anthropocene concept, “as currently popularized, is fundamentally different from the chronostratigraphic units that are the charge of the ICS. It is the present and future versus the past.”⁶⁸ For them, important events and effects of the Anthropocene are observed by humans often in real-time, and are measured using the Gregorian calendar. This contrasts with how stratigraphers have traditionally defined geological units, by relying on the rock record as a way to interpret events in the past. Stratigraphic evidence for the Anthropocene using the beginning point of the mid-twentieth-century as proposed by the AWG is, according to Finney and Edwards, “negligible” in comparison to evidence used for the dating of other GSSPs.⁶⁹

Finney and Edwards go on to suggest that labeling the Anthropocene as a formal geological unit might be more of a “political statement” than a stratigraphically -defensible scientific decision. They note that proponents of formalizing the Anthropocene epoch, “often reply that the human impact on the Earth system must be officially recognized, if for no other reason than to make the public and governmental agencies aware of that impact.”⁷⁰ They also cite a 2011 *Nature* editorial that suggests that any concerns regarding the geological formalization of the Anthropocene should be “quashed” given the “scale of the changes already under way [from human actions] and the real value of a unified approach to studying human influences on the planet[.]”⁷¹ This line of argument, that there are important, though non-stratigraphic, reasons for formalizing the Anthropocene, is unsettling and illegitimate to Finney and Edwards. By making a distinction between a “political statement” and a “scientific decision,” Finney and Edwards should not be interpreted as implying that there is no “human” aspect to the work done under the purview of the ICS. In this wide sense of politics, the ICS is political “all the way down,” as clearly there are many consensus-building and ratification activities that must occur in order for the ICS to define new GSSPs and geological units. Rather, Finney and Edwards mean political in the narrow sense of the “political arena.” By “political statement” they mean that the labeling of the Anthropocene as a formal geological unit, if measured by the current standards of the international stratigraphic

⁶⁷ Finney and Edwards, 8.

⁶⁸ Finney and Edwards, 8.

⁶⁹ Finney and Edwards, 7.

⁷⁰ Finney and Edwards, 9.

⁷¹ Nature, “Editorial: The Human Epoch,” *Nature* 473, No. 7347 (19 May 2011), 254.

community, would be a statement for *political* institutions and actors rather than a scientifically defensible or useful category for stratigraphers. The introduction of non-stratigraphic concerns and standards into stratigraphic decisions could be interpreted as “bad” science. At the very least, introducing these “non-stratigraphic” concerns would require the alteration of the previous standards of the ICS.

Now not all stratigraphers agree with the assessment of Finney and Edwards. Clearly many, including members of the AWG, firmly support the formalization of the Anthropocene epoch. Most recently (2017), members of the AWG published a response to stratigraphic critiques raised against this formalization. Among their other responses, Zalasiewicz et al. note that, though often spatially thin, there are still recognizable signals in rocks and sediments that are indicative of human activities (e.g. microplastics and artificial radiation fallout in ocean sedimentation) and can, therefore, provide an evidentiary basis for the formalization of the Anthropocene epoch with a beginning in the mid-twentieth century.⁷² There is, for them, an already present and observable stratigraphic rupture with the conditions of the Holocene. Even for Anthropocene supporters, this epoch will differ in some ways from previously ratified geological units. For example, it will very likely be a geological unit that extends much further into the future than the past. Yet, supporters maintain there is still *enough* of a stratigraphic basis to support ratification, and these signals will almost certainly increase in intensity over time.⁷³

Zalasiewicz and his 26 co-authors maintain that critiques such as the ones they’re responding to, “are an essential part of the process of considering modification of the International Chronostratigraphic Chart and the Geological Time Scale upon which it is based.”⁷⁴ They welcome these critiques as both normal and important because this is how the science of stratigraphy proceeds. However, certain geologists have expressed concerns that seem to go beyond mere scientific disagreements. For example, Richard Monastersky’s *Nature* article “Anthropocene: The Human Age” (2015) presents some of these broader concerns and reactions. One geologist, “who asked not to be named,” compared Anthropocene supporters to religious adherents: “There’s a similarity to certain religious groups who are extremely keen on their religion—to the extent that they think everybody who doesn’t practise their religion is

⁷² Zalasiewicz et al., “Making the Case,” 213.

⁷³ Zalasiewicz et al., “Making the Case,” 214-215.

⁷⁴ Zalasiewicz et al., “Making the Case,” 206.

some kind of barbarian[.]”⁷⁵ Finney, not surprisingly, has also expressed frustration with the “push” to formalize the Anthropocene epoch: “I’m frustrated because any time they do anything, there are newspaper articles[.]...What you see here is, it’s become a political statement. That’s what so many people want.”⁷⁶ Geologist Michael Walker, who resigned from the AWG in 2014, claims that, though he respects the AWG members, “There’s a sense in some quarters that this is something of a juggernaut...Within the geologic community, particularly within the stratigraphic community, there is a sense of disquiet.”⁷⁷ For Monastersky, some stratigraphers are worried that criticisms of the Anthropocene epoch are being ignored due to a “popular enthusiasm, driven in part by environmentally minded researchers who want to highlight how destructive humans have become.”⁷⁸

Of course, scientific standards can and do change. (If they didn’t there would be much less to study for “science studiers.”)⁷⁹ Indeed, the brief history above shows that stratigraphic standards are not static entities. It takes work to achieve general consensus for these standards, but they are generally considered open to revision in light of new information or techniques that emerge. However, it should be emphasized again that, though revisable, these stratigraphic standards are not amended haphazardly or readily. In particular, those guidelines and statutes that have been voted on by the ICS are much more fixed, and would take further voting by members to amend. And as the above quotations show, there are some in the stratigraphic community who are uncomfortable, if not downright opposed, to making changes to stratigraphic standards in order to formalize the Anthropocene epoch.

Further, if the ICS standards need to be changed *specifically* to facilitate the adoption of the Anthropocene as a new formal geological unit, how might this change be perceived by those on the outside,

⁷⁵ Quoted in, Monastersky, 145.

⁷⁶ Quoted in, Monastersky, 147.

⁷⁷ Quoted in, Monastersky, 147.

⁷⁸ Monastersky, 145.

⁷⁹ In the history and philosophy of science and technology, there is a vast body of literature that examines (in some form or another) the development of and/or change in scientific standards and practices. For examples see, Martin J.S. Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: Chicago University Press, 2005); Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007); Lawrence Busch, *Standards: Recipes for Reality* (Cambridge, MA: MIT Press, 2011); Hasok Chang, *Inventing Temperature: Measurement and Scientific Progress* (New York: Oxford University Press, 2004).

particularly those with more skeptical attitudes towards the scale of human impacts on the planet and the need to alter human activities? Even if the changing of standards is perfectly acceptable within a particular scientific community (and arguably it is), it can still offer an avenue of critique to anyone looking for objections. And this critique can be draped with the veneer of “science.” It might, at least on the surface, seem unscientific to change standards, procedures, or whatever simply to achieve a desired outcome, in this case ratifying the Anthropocene as a new geological unit. To illustrate the potential problem, let’s turn now to the two basic scenarios facing the AWG, SQS, ICS, and IUGS: ratification or rejection.⁸⁰

Between Scylla and Charybdis

The international stratigraphic community has been placed in an unfamiliar and perhaps even uncomfortable situation. As geographer Jamie Lorimer describes it, “An eclectic working group (AWG) has found itself thrust into the scientific, political and popular limelight. In responding to the AWG proposal, the International Commission on Stratigraphy will be asked to pronounce with unaccustomed speed and with unfamiliar public attention on a new epoch whose evidentiary base is alien to the epistemic conventions of stratigraphy.”⁸¹ So, what if the Anthropocene is rejected as a formal geological unit? The AWG, SQS, ICS and IUGS could all defend a rejection of the Anthropocene as a new epoch on stratigraphic grounds. As already noted, the Anthropocene as a potential geological unit differs in many respects from all previously ratified units. The Anthropocene is more about the present and future conditions on the planet, rather than the past. Evidence for its existence comes from observations made by scientists in a variety of Earth sciences (e.g. climatology, meteorology, ecology, oceanography, limnology, pedology), and not simply from signals in the rock record identified by stratigraphers, the primary evidentiary basis for all previous geological unit ratifications. There are precise, Gregorian calendar dates for many of the important events in the Anthropocene (e.g. increased fossil fuel burning starting in about 1800 with the onset of the Industrial Revolution

⁸⁰ The ICS guidelines and statutes do stipulate that members may vote “yes,” “no,” or “abstain,” but for the purposes of this paper, if all members were to abstain, that would, in effect, be comparable to a vote of “no” in the sense that it would not represent an endorsement of the Anthropocene as a new formal geological unit. See, Remane, et al.,

80.

⁸¹ Lorimer, 121.

or the detonation of nuclear weapons beginning in 1945) and so it's not even necessary to use rock evidence for dating in the same way that it is for other geological units. Since the Anthropocene is so recent—it would be the current epoch and would quite probably stretch well into the future—any signals in the rocks are weak at best (certainly weaker than signals used to formalize other geological units), and it's not clear which potential signals (if any) will be most observable in the future. For at least these reasons, the international stratigraphic community could defend a rejection of the Anthropocene epoch, or leave formal ratification of the Anthropocene to some future time when perhaps there might be an unequivocal, observable stratigraphic signal.

But if the Anthropocene is rejected by the international stratigraphic community, what effect might this rejection have? What non-stratigraphic signal would this send, particularly to those writing and reading about it in mainstream media? The deliberations of the AWG have already received periodic attention there, so it seems not unfair to assume that this rejection would receive at least some kind of media treatment. Now, I don't want to speculate about what might happen in this possible future scenario (no doubt a foolhardy endeavour). But, I simply want to point out that there is a possibility that this rejection of the Anthropocene by a group of scientists could, if the details of the reasons for rejection are ignored or glossed over, be interpreted and presented as a wholesale scientific rejection of the Anthropocene.⁸² This rejection could be made to serve as evidence that *scientists* reject the Anthropocene for *scientific* reasons. Any way that the AWG, SQS, ICU, and/or IUGS justifies this rejection—no matter how vociferously they might choose to defend the broad concept of the Anthropocene while rejecting that it a new geological epoch, no matter how frequently they might reiterate that human activities have widespread and deleterious effects on the planet, no matter how strongly they might emphasize that the Anthropocene is real but not stratigraphically well-founded—there would be no way to fully prevent the possibility of skeptics taking this rejection as evidence that the Anthropocene concept is considered scientifically unsound by the scientific community.

In the scholarship on what might called “organized scepticism,” Robert Proctor coined the word “agnotology” to label the study of

⁸²This possibility, that a formal stratigraphic rejection of the Anthropocene epoch could provide support to Anthropocene skeptics, has been noted by other scholars. See, James Westcott, “Is Rushing to Declare the Anthropocene Also Human Error?” Aeon, accessed 22 February 2017, <https://aeon.co/essays/is-rushing-to-declare-the-anthropocene-also-human-error>.

ignorance. There are at least two kinds of ignorance. Ignorance is sometimes a simple lack of knowledge, sometimes a result of choosing to study one thing at the expense of something else, but at other times ignorance is the result of deliberate, strategic activities to actively produce ignorance.⁸³ It is this last flavour of ignorance that is most relevant here. Research by Proctor, as well as by Naomi Oreskes and Erik Conway among others, has shown that scientific consensus have been attacked by specific individuals and institutions in order to prevent government regulation or adverse consumer responses.⁸⁴ One of the most infamous examples comes from the tobacco industry, where some scientists and groups received payments in exchange for creating doubts about the hazards of smoking cigarettes despite ever increasing evidence supporting the dangers. As Proctor notes, their tactics included, “release of duplicitous press releases, publication of ‘nobody knows the answers’ white papers, and funding decoy or red herring research to distract from genuine hazards[.]”⁸⁵ All this was done to manufacture and promote doubt. Tobacco apologists argued that the scientific community was divided on the effects of cigarette smoking, that there was still a “controversy” among scientists that required “more research” before conclusions could be drawn or causes identified. These individuals and groups set impossibly high standards of certainty that no scientific result could ever meet, with the effect that the science surrounding tobacco smoke could never be “settled.”⁸⁶ Similar tactics, and shockingly even the same individuals, appear in a number of other controversial areas promoting doubt about ozone depletion, asbestos hazards, the Strategic Defense Initiative, DDT, and most germane here, climate change. These sophisticated “merchants of doubt” may or may not be driven by genuine convictions, but in almost all cases, they receive funding from large corporate interests, be it tobacco companies, military contractors, chemical manufacturers, or those in the fossil fuel industry.⁸⁷

⁸³ Robert N. Proctor, “Agnotology: A Missing Term to Describe the Cultural Production of Ignorance (and Its Study),” in *Agnotology: The Making and Unmaking of Ignorance*, eds. Robert N. Proctor and Londa Schiebinger (Stanford, CA: Stanford University Press, 2008), 3.

⁸⁴ Robert N. Proctor, *Cancer Wars: How Politics Shapes What We Know and Don't Know About Cancer* (New York: BasicBooks, 1995); Naomi Oreskes and Erik M. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury Press, 2010).

⁸⁵ Proctor, “Agnotology,” 15.

⁸⁶ Proctor, “Agnotology,” 12-18.

⁸⁷ Oreskes and Conway.

And so, as documented examples of “organized skepticism” suggest, there is ample evidence from controversial areas of science to suggest that individuals and groups have deliberately attempted to undermine scientific consensus through strategies that produce doubt, that “maintain the controversy” and “fight facts.” If the Anthropocene as a new geological epoch is rejected by the international stratigraphic community, this rejection could be used as evidence to suggest that there is no scientific consensus about the widespread effects of human activities on the planet. Those with vested interests in preventing increased environmental regulations (or those receiving financial compensation from these interests) could use this rejection of the Anthropocene as a formal geological unit as evidence that the Anthropocene as a whole is completely unscientific. At the very least, they might argue that the Anthropocene concept is still controversial and that more research is needed before the scientific community can make a warranted assertion about its existence. A rejection of the Anthropocene as a formal geological unit by stratigraphers, no matter how nuanced in detail, on the surface could appear to be a scientific rejection that would be ripe for use in the production of uncertainty and controversy for anyone who might care to do so. This rejection runs the risk, no matter how small, of undermining the scientific credibility of the entire Anthropocene concept, not just the geological features of the concept but also the ability of the concept to point to the entirety of human effects on the environment. Paradoxically, giving the Anthropocene concept scientific weight was the very reason that the international stratigraphic community formed the Anthropocene Working Group in the first place.

But what if the AWG, SQS, ICS, and the IUGS choose to ratify the Anthropocene as a formal geological unit? Again, though I want to avoid undue speculation, there is the possibility that, similar to the rejection scenario, a ratification of the Anthropocene epoch could also provide sceptics with a means to manufacture controversy about human activities and their effects on the planet. Recall that the Anthropocene is a unique geological unit, one that is more about present and future conditions than the past. Ratifying the Anthropocene epoch would probably require alterations to the standards of evidence for evaluating new candidates for geological units. As discussed above, according to the existing standards, the stratigraphic community examines evidence from the rock record in order to identify a GSSP for a new geological unit. This include rock signals like fossils, magnetic pole reversals, chemical signatures in rocks, and solar- or orbit-forced climate cycles. These are the types of evidence that stratigraphers have used up until now. Some stratigraphers, Finney

and Edwards among them, maintain that these types of signatures are not strong enough to be fully applicable to the Anthropocene epoch. The Anthropocene is more about the present and future, so there hasn't been enough time for strong signatures to develop in the rocks. Further, much of the evidence for the Anthropocene comes from non-rock sources, such as atmospheric carbon dioxide measurements, tree rings, traces of radioactive elements from nuclear weapons testing, and even the written historical record (e.g. of past temperatures and fish stocks). There is some evidence in the rocks but evidence for the Anthropocene is not just stratigraphic. Indeed, some stratigraphers argue that the rock record on its own is not enough to warrant the identification of the Anthropocene as a new geological unit. Ratifying the Anthropocene will, for some stratigraphers, require the admission of new kinds of evidence into existing and well-established standards.

Now, of course, scientific standards can and do change as new kinds of evidence and techniques become available and previous practices or standards fall out of consensual favour. And perhaps the stratigraphic community will consensually decide to admit new kinds of evidence into their deliberations over the Anthropocene. This by itself is not an issue. However, for anyone who might care to take note, this alteration of evidentiary standards in order to ratify a new geological unit could be interpreted as unscientific. This action could be interpreted as an example of a group of scientists altering the "rules of the game" in order to achieve a desired outcome, in this case the ratification of the Anthropocene. Though it may be completely legitimate for a community of scientific practitioners to disagree about and consensually alter standards,⁸⁸ this practice does not mesh well with an image of science in which scientific knowledge and practice are taken to be certain and largely unchanging once adopted. In this account, scientists work to discover the Truth about the world that is already present, eternal, and simply waiting for discovery. Humans do the work of discovery but what is discovered is independent of human concerns and contexts. From this perspective, evidence of human involvement is a kind of taint, a sign that the science is not yet settled, or still worse, an indication that the science has been gerrymandered. It is this conception of science that skeptics latch onto in order to create doubt and

⁸⁸ As noted above, there is a large body of HPST literature regarding scientific standard development and change. Work by philosopher of science Miriam Solomon on social epistemological issues has suggested that disagreement and dissent in a scientific community are often normal states of affairs for the sciences, and that its presence is often indicative of a healthy and fruitful scientific community. See, Miriam Solomon, *Social Empiricism* (Cambridge, MA: MIT Press, 2001).

prevent regulations or adverse market effects. Anything that has not achieved total certainty is controversial science in need of further research.⁸⁹ In the event that stratigraphers ratify the Anthropocene, some may argue that this has happened only because there have been changes in evidentiary standards. The change in stratigraphic standards could be interpreted as an instance of scientists manipulating the evidence for “political” purposes. This could then be taken up by those wishing to delegitimize the whole Anthropocene concept. And so, ratification of the Anthropocene as a formal geological unit runs the risk of providing potential fuel to those wishing to foment skepticism about it. Ratification, like rejection, could prove detrimental to the cause of building a sound scientific basis for the Anthropocene concept.

Conclusion

This paper is not suggesting that the Anthropocene does not already have a strong and widespread scientific foundation. Clearly it does. The Earth and environmental sciences provide considerable and overwhelming evidence that human activities affect the planet in a number of large-scale ways.⁹⁰ This paper’s question was: should the Anthropocene epoch be treated as a *geological* hypothesis to be examined by stratigraphers? The main reason that the Anthropocene is, among other things, a geological hypothesis seems largely a product of historical circumstances. That is, this is how it was first presented by non-geologists Crutzen and Stoermer in 2000. They defined the Anthropocene as a new “geological epoch” in which humans were a major force of global change. Although they use the term “epoch,” they clearly indicate that arrival of the Anthropocene is evident not just in the stratigraphic record but is observable in the entirety of the Earth system. In their original article, Crutzen and Stoermer offer a variety of evidence of human activities affecting the planet from a variety of

⁸⁹ Proctor, “Agnotology,” 1-35; Oreskes and Conway, 1-9, 240-274.

⁹⁰ Even some climate “skeptics” are moving away from the denial of human-induced climate change. A common tactic now is to affirm that the climate is indeed changing, but assert that this change might actually be a good thing. For instance, at the Global Warming Policy Foundation 2016 annual lecture hosted by the Royal Society of London, the British journalist, businessman, and climate change “skeptic” Matt Ridley argued that, yes, increased levels of carbon dioxide from fossil fuel burning were warming the planet, but this causes a “global greening,” which is actually beneficial for humans and other species. See, Matt Ridley, “Global Warming Versus Global Cooling,” accessed 23 April 2017, <http://www.thegwpf.org/content/uploads/2016/10/Ridley-GWPFlecture.pdf>.

sciences and using a variety of measurements and calculations.⁹¹ Their invocation of the geological term *epoch* as part of their discussion may have had unintended consequences.

Calling the Anthropocene an epoch brought the concept to the attention of geologists, specifically stratigraphers, and eventually drew the concept into their institutional mechanisms for demarcating geological units of time.⁹² Now the question to ask is: was it a prudent decision to attempt to naturalize the Anthropocene concept via the institutional mechanisms of the stratigraphic community? As noted above, these mechanisms are of an inherently and historically conservative nature.⁹³ Up to this point stratigraphers have relied almost exclusively on stratigraphic evidence observable in the rock record. Given this, and that the Anthropocene concept is often viewed as an important *political* tool for framing a problem that could then be tackled by governments and other institutions, is the Anthropocene really a *geological* hypothesis that needs to be addressed by the international stratigraphic community? Are their institutional mechanisms the proper venue for its evaluation? Of course, simply because the Anthropocene concept emerged outside of geology does not mean that it cannot also be of geological interest and concern.⁹⁴ However, as a result of the attention given to the Anthropocene by the AWG and the stratigraphic community more generally, the Anthropocene risks being treated as a concept that is *only* geological, or *primarily*

⁹¹ Crutzen and Stoermer, 17-18. Given their involvement with the International Geosphere Biosphere Program and its emphasis on studying the Earth as an integrated system with interacting components in the atmosphere, biosphere, hydrosphere, cryosphere, and lithosphere, it's not surprising that Crutzen and Stoermer do not distinguish between the *kinds* of evidence they use from the various Earth and environmental sciences. From their perspective, evidence from any of these disciplines would be relevant and need not be differentiated. This is sometimes called an "Earth system science" approach, and it differs from how geologists have traditionally mustered and evaluated evidence. As noted above, in geology, evidence is generally restricted to that which is detectable in the rock layers. Even the AWG maintains that they are focused solely on the *stratigraphic* evidence for the Anthropocene. See, Zalasiewicz, et al., "Making the Case," 216.

⁹² In an interview, Zalasiewicz recalled that, after the Anthropocene epoch was proposed by Crutzen and Stoermer, the concept began appearing in a wide variety of literature in both the humanities and sciences. Zalasiewicz (and perhaps others in the stratigraphic community) thought it would be useful to see if it was actually a new geological epoch that could, therefore, be formalized. See, *Anthropocene*, directed by Steve Bradshaw (Oley, PA: Bullfrog Films, 2015), DVD.

⁹³ Monastersky, 147; Zalasiewicz, et al., "Making the Case," 206.

⁹⁴ Zalasiewicz, et al., "Making the Case," 207-208.

geological, despite the wealth of evidence amassed from *all* of the Earth and environmental science disciplines.

As this paper has argued, there may be more at stake than simply the correction of the category error of treating the Anthropocene concept as geological rather than understanding it more broadly as part of the Earth and environmental sciences. The Anthropocene concept also has implications and utility that go beyond the sciences. It can serve as a political tool that reframes a variety of deleterious effects from human activities into a single problem—*the* Anthropocene—that governments and others can then work towards addressing. In their attempt to naturalize the Anthropocene as a formal geological epoch, stratigraphers seem to have given little attention to the potential scientific and political consequences of this action. This paper presented possible outcomes for either decision made by the international stratigraphic community regarding the Anthropocene epoch, arguing that both ratification and rejection of this epoch could destabilize the scientific credibility of the concept.

The Anthropocene concept clearly would be harmed if stratigraphers rejected it as having no scientific merit. But, as I have suggested, the Anthropocene concept might also be harmed if it were endorsed, since such an endorsement would require adjusting existing stratigraphic standards. And changing stratigraphic standards for the sole reason of endorsing the Anthropocene may (yet again) invite scepticism about the Anthropocene and the seriousness of human impacts on the planetary environment. Whatever the AWG, SQS, ICS, and IUGS do, there is no way to preclude the possibility that the outcome of their decisions could actually undermine not just the geological component of the Anthropocene, but the entire scientific basis of the concept along with its hope to mobilize global political action. If this process receives scant future attention, then perhaps little or no damage has been or will be done. It might therefore be best if the Anthropocene epoch remains largely obscure and of merely academic concern into the future.