tamount to war—it is the objectification of humans. This flat ontological object-subject conflation is a frame of war that enables those of us who are subjects and have subjectivity to be reduced to the nongrievable equivalent of an object (Butler 2009). It is the equivalence, the erasure of difference, that reduces us. It is distinctly unethical. Humans are not equivalents of objects. Being is hierarchical—we live in a round world.

Once we distinguish humans from objects and recognize them as the locus of agency, then responsibility can be attributed and response can begin. I see no utility in asking whether humans are nature, since human nature, the ability to think and judge, is nature and is what distinguishes us from the remainder of the nature of which we are a part.

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The Geological and Earth System Reality of the Anthropocene

"A word means what I choose it to mean, no more and no less." This pronouncement by Humpty Dumpty in Lewis Carroll's *Through the Looking Glass* might be recalled in considering Bauer and Ellis's contention that the "Anthropocene" as a sharply delineated geological term does not serve anthropology well and therefore should be more generally rejected. Their contention and accompanying assertions, though, are widely open to question.

Bauer and Ellis begin by saying that any such sharp delineation ("periodization") is invalid because the relationship of humans to the Earth reflects a complex continuum (paradoxically, they do not reject the Holocene and Late Pleistocene even though these cut across the same continuum). We emphasize here that scientists working in the framework of geology and Earth system science (ESS) see all Earth history as comprising complex, continuous, and pervasively diachronous change and yet they regard the "periodization" given by formal geological time units as essential to their work. This is because these precise, synchronous, internationally agreed boundaries lead to unambiguous communication and enhance interpretation and understanding. They intermesh effectively with a wide and varied array of other time-related units (litho-, bio-, cyclo-, magnetostratigraphic, etc.) to build a detailed picture of Earth history. Earth system scientists find such "periodization" exceptionally useful because it provides a consistent way to discern and communicate significant changes in the structure and functioning of the Earth system from a very large amount of useful data, including data from archaeology and anthropology.

The Anthropocene concept and term indeed originated with Paul Crutzen (Crutzen 2002; Crutzen and Stoermer 2000) explicitly as a geological epoch/series to succeed the Holocene and was soon widely adopted by the ESS community. As interest in this concept grew, the term was also noticed by stratigraphers, with initial evaluation suggesting that it "had merit" as a potential formal geological time unit and should be investigated further, an extensive technical process initiated in 2009 by the Anthropocene Working Group (AWG) of the Subcommission on Quaternary Stratigraphy, part of the International Commission on Stratigraphy (ICS). In this context, the Anthropocene is being examined as a potential unit in the parallel chronostratigraphic/geochronologic "dual hierarchy" (i.e., as both a potential series and epoch) of the International Geological Time Scale.

This "dual" timescale is specific to geology but is just one of many means by which humans measure or subdivide time and is distinctive in simultaneously comprising synchronously bounded material units of strata (e.g., series) and their equivalent "pure" time units (e.g., epochs; Zalasiewicz et al. 2013). It is used to subdivide Earth history (not human history), which continues to the present and in recent times encompasses both human- and nonhuman-formed phenomena. We know of no equivalent timescale in anthropology, archaeology, history, or other cognate disciplines. It may of course be used in these or other disciplines when considered appropriate (see, e.g., Vidas, Zalasiewicz, and Williams 2016 regarding its relevance for international law), as with Bauer and Ellis's use of Late Pleistocene and Holocene.

Key to the geological viability of the term is the distinctiveness of the stratal record, not least because this is the only means by which recent events can be related to the whole of Earth history. This record shows Holocene relative stability persisting even as substantial human civilizations rose and fell, leaving rich archaeological traces of their interaction with the environment. Plausibly, anthropogenic activities might have drip-fed greenhouse gases into the atmosphere for millennia to maintain CO_2 levels and therefore Holocene climate stability (Ganopolski, Winkelmann, and Schellnhuber 2016; Ruddiman 2013). "Anthropogenic," though, is not synonymous with "Anthropocene," for which the key distinction is decisive and essentially synchronous impact at a geological scale.

Diverse stratigraphic markers indicate that strata from the mid-twentieth century onward can be clearly and widely distinguished from earlier strata (Waters et al. 2016*a*). These indicators belie Bauer and Ellis's complaints (i) that the archaeological record has been ignored in the process, as they are commonly archaeological in nature (e.g., plastics, concrete, persistent organic pollutants, fly ash, artificial radionuclides), and (ii) that the currently suggested start of the Anthropocene

represents "an arbitrary break." The accompanying perturbation to sedimentation has been large and global, producing pervasive stratigraphic records. For instance, humans have placed large dams on the main stems of ~2,500 rivers globally in less than a century, reducing sediment delivery to the coast such that coastal successions on every continent except Antarctica now record this near-synchronous event. Overall, since 1950, humans have been moving more sediment annually than wind, glaciers, and rivers combined. Earlier records of humans engaged in terracing, emplacing small check dams, or deforesting areas of Europe represent an important, indeed fundamental precursor to this phenomenon, but one that was patchy, diachronous over several millennia, and largely confined to land. These early records, for all their historical importance, cannot satisfactorily define a global and synchronous (chronostratigraphic) boundary that is geologically effective.

The stratigraphic record is congruent with the recognition of a major, ongoing perturbation of the Earth system (Steffen et al. 2016; Zalasiewicz, Waters, and Head 2017), including unprecedented change to the carbon, phosphorus, and nitrogen cycles and the biosphere, both marine and terrestrial. Energy consumption by humans since 1950 exceeds, by some 1.6 times, that of all of human history before 1950. One metric, the Anthropocene factor (Gaffney and Steffen 2017), over the last 65 years is orders of magnitude larger than for the entire Holocene interval prior to 1950. Such force multipliers show that humans have geologically very recently acquired the energy levels, the population, and the resource (engineering) application to significantly and globally change the Earth system: abundant evidence of this transformation now exists in the stratigraphic record (Waters et al. 2016*a*; see fig. 1).

Whether ultimately formalized or not, this is a major change in our planet's history, considerably sharper than most other boundary intervals of the Geological Time Scale and capable of being precisely defined stratigraphically. It is a phenomenon also sharply distinct from the first evidence of, or early trends in, anthropogenic traces on land. It would be obfuscatory to conceal this change under the cover of "a complex continuum."

This stratigraphic record represents a precise, clear, and valid definition of "Anthropocene"—but it is not an exclusive one, and it may not be relevant to all fields of human-dimension scholarship. The interpretation of the Anthropocene as presented by Bauer and Ellis bears scant relation to the one we have described above. Rather, it resembles the Anthropocene proposal of Ellis et al. (2016; although they do not mention this proposal nor responses to it [e.g., Zalasiewicz, Waters, and Head 2017]); this former proposal by Ellis et al. was similarly nonviable as a Geological Time Scale unit and similarly obscured the post-mid-twentieth-century changes. Ellis et al. (2016) had argued that the Anthropocene should not be rejected but rather removed from the ICS mandate and recast in social science terms.

In the English language, many words bear multiple, distinct meanings ("nature," for instance). Naturally, this risks confusion, but nevertheless we would not presume to "supplant" other interpretations of the Anthropocene. The remit of the AWG is understandably to frame the Anthropocene in a geological context.

If such terms as Capitalocene and Plantationocene are thought useful by social-science communities to describe human influence on Earth, then perhaps this will resolve the "many Anthropocenes" in current use. These terms do not, however, "supplant" the "geological" Anthropocene, as they represent different concepts, from different contextual backgrounds, with social science interest on the socioeconomic drivers of change rather than on resultant Earth system behavior and its petrified and strata-bound consequences. Social science investigations are not irrelevant to understanding Anthropocene stratigraphic and Earth system change; to the contrary, the dynamics of human/technology interactions are clearly crucial to this question. Similarly, the Ordovician-Silurian boundary may be satisfactorily and pragmatically defined in strata even as the Earth system dynamics that drove this period-scale change remain unresolved, intensely debated—and hugely important.

The main thrust of Bauer and Ellis's paper is captured by their claim that the stratigraphic and ESS definitions of the Anthropocene are based on "distinguishing a recent time when the Earth system was external to or unaffected by humans from a more recent period in which it is not." This is obviously not true. The ESS definition is based on the evidence that the planet is on a strong trajectory out of the Holocene (and indeed out of the glacial-interglacial cycling of the late Quaternary) and that human activities are the primary driver of this trajectory (Steffen et al. 2016). This does not imply that there was inconsequential human influence on the Earth system before the Anthropocene. Of course there was, as the Bauer and Ellis paper shows in some detail. However, it was only since the mid-twentieth century that Earth system scientists can say with some confidence that a trajectory out of the Holocene clearly began. For them, placing a Holocene-Anthropocene boundary there seems natural and incontrovertible given the evidence. This parallels the stratigraphic perspective, where the putative Anthropocene series, although clearly characterized by a range of novel proxy signals (e.g., Waters et al. 2016*a*), negates Bauer and Ellis's argument that the Anthropocene somehow represents a black-white divide between no human influence and massive human influence. The Holocene already accommodates the rich evidence of human environmental imprint (Gibbard and Walker 2014).

Bauer and Ellis fail to acknowledge the complex-system nature of our ocean-dominated planet and this importance for the Earth system definition of the Anthropocene. Complex systems have many definitions, but two features are common to all of them: (i) emergent properties at the level of the system as a whole that cannot be aggregated up from subsystems or individual components of the whole system and (ii) attractors or reasonably well-defined states that are characteristic of the system as whole. The Anthropocene is on a rapid trajectory away from the Holocene/interglacial attractor (or more appropriately, away from the glacial-interglacial limit cycle of

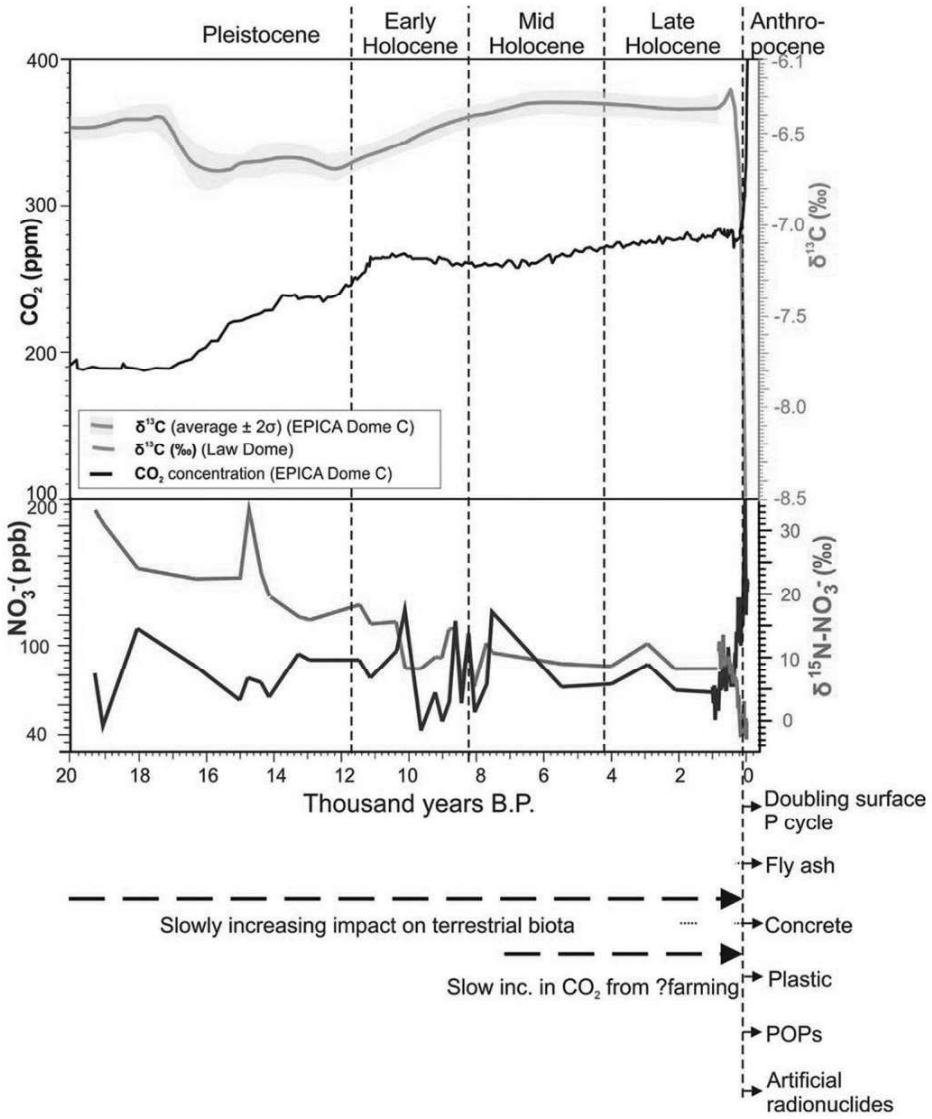

Figure 1. Geological identity of the Anthropocene: trends in key Earth system and stratigraphic indicators from the late Pleistocene to the present time. Note the largely gradual change (at this scale) across the Pleistocene/Holocene boundary, the general stability through the Holocene, the marked inflections, and the incoming of novel indicators that clearly demarcate a changed trajectory that we identify with the Anthropocene, most sharply defined from the mid-twentieth century. Adapted from Waters et al. (2016*a*) and sources therein. POPs = persistent organic pollutants. A color version of this figure is available online.

the late Quaternary) but is not yet an attractor in its own right. Bauer and Ellis detail the rich background to human development and influence on the Earth system but do not acknowledge our planet's shift as a complex system that began around the mid-twentieth century. The long anthropological story of human development occurred within the Pleistocene glacial-interglacial limit cycle (the Holocene being the latest interglacial) of the Earth system. In short, Bauer and Ellis confuse human influence on the Earth system with a change in state of the Earth system as a whole. This confusion has long surrounded the Anthropocene concept and is not unique to their paper.

We emphasize that all these various approaches are nonexclusive and complementary, and we are puzzled as to why Bauer and Ellis should regard them as some kind of battlefield, with the Anthropocene as a singular trophy to be fought over and won or lost. Anthropologists and archaeologists, who search for and map out the early evidence of human activities and their patterns, offer much to the stratigraphic/ESS study of the Anthropocene (and, we trust, vice versa). Without the

evolving dynamics of human-Earth relations over the long term, the Anthropocene as we consider it here would not have happened. We note the genuine, wide-ranging, and generous interdisciplinarity that the Anthropocene has stimulated; this has been among the most positive features of this phenomenon. We dearly hope to see it continue and strengthen but note that interdisciplinarity does not mean an absence of disciplinary coherence.

Reply

Missing the Mark: On the Matter of Narrative and Social Difference

We are grateful to the commentators for engaging our essay and contributing to this forum. Their diverse perspectives emphasize the many distinct ways that the Anthropocene is being imported across the academy. Some see its utility as a political label, others stress its utility as a neutral geological period, and still others question its usefulness as either. While there is much agreement among the positions offered and the views we expressed in our essay, there are also significant points of misunderstanding or avoidance of our principal critiques of the Anthropocene periodization that deserve clarification in the interest of fostering productive interdisciplinary discussion.

The commentary of Zalasiewicz and colleagues of the Anthropocene Working Group was ostensibly the most critical of our position. Yet they also miscast our argument, evaded the more significant critiques that we foregrounded, and failed to acknowledge that the main Anthropocene narrative to which we and others are responding was in fact generated by Earth system scientists who promote the designation. To be clear, our essay does not challenge whether the Earth system is undergoing a state shift related to recent human activities or whether the magnitude of human impact has significantly increased. Rather, our essay problematizes the way in which geological systematics and the scientific narratives produced by Earth system scientists in accounting for this state shift frame historical processes and how that framing has been taken up by scholars.

Zalasiewicz et al. argue that we confuse "anthropogenic" for the "Anthropocene" (despite our explicit discussion of a tipping point and a recent state shift) and that we fail to recognize Earth as a "complex system." Here they seemingly misunderstand our usage of the term "assemblage." Similar to how natural scientists define "complex systems," social scientists conceptualize assemblages as complexes of heterogeneous elements that, through their historical configurations and dynamic interactions, produce emergent outcomes—in other words, the whole is greater than the sum of its parts (cf. Bennett 2010; DeLanda 2006; Thomas 2015). We are aware that human activities do not simply add up to systemic change (cf. Turner et al. 1990), and we are not denying that geological or historiographic periods have disciplinary utility—indeed, archaeologists make heavy use of periodizations, albeit primarily at regional scales (e.g., South Indian Iron Age). As Finney noted, our essay does not challenge the validity or usefulness of an Anthropocene chronostratigraphic unit to geological systematics, though as both Finney and Kaplan diligently point out, its utility remains far from certain (see also Ruddiman et al. 2015).

The thrust of our argument is that the Anthropocene divide, the separation of a pre-Anthropocene from the Anthropocene, neither represents a shift in human agency from being merely "ecological" to becoming fully "geophysical," as many have argued (see below), nor helps us to understand the historical, cultural, and political processes through which humans contribute to and transform Earth's functioning as a system. Zalasiewicz et al. reiterate the geological need for a globally isochronous marker for anthropogenic global change; our point is that such a marker would not capture the socially differentiated and diachronous character of historical human-environmental entanglements that have contributed to a state shift in the Earth system. While one might question the degree to which any periodization could reflect such historical processes—as Kaplan's commentary lucidly addresses in considering the anachronism of the Geological Time Scale more generally—our concern is explicitly with how the Anthropocene periodization obscures connections between pre-Anthropocene/Anthropocene human-environmental relationships while also foreclosing socially differentiated understandings of human-environmental interactions with its emphasis on the species. Zalasiewicz et al. mistake our interests in the geophysical impacts of human activities in prehistoric periods and the previous call of Ellis et al. (2016) for broadening interdisciplinary discussion with an attempt to win the "Anthropocene as a singular trophy" and sidestep our actual concerns for how human-environmental relationships are understood and narrated, given the critical recognition that narratives, scientific or otherwise, have ideological and political consequences.

When Zalasiewicz et al. sardonically dismiss the variable "meanings" of the Anthropocene to claim that a geological Anthropocene references the period in which the Earth has undergone its most recent state shift and little more with respect to historical processes or different kinds of human agency, they are reinforcing disciplinary divides and blatantly ignoring that many of the Anthropocene's principal advocates, including Earth system scientists responsible for promoting the term, have explicitly provided narratives of human history to accompany the geological designation. Steffen, Crutzen, and McNeill (2007), for instance, state that the Anthropocene is "the current epoch in which humans . . . have become a global geophysical force" and that their "objective" is to examine the "evolution of humans and our societies from hunter-gatherers to a global geophysical force" (614). Such historical claims imply that humans did not have (global) geophysical effects prior to the Anthropocene. Thus, as humanities scholars have taken up the Anthropocene as a period when humans transitioned from being eco-