Geoforum 72 (2016) 1–5

Contents lists available at ScienceDirect

Geoforum

journal homepage: www.elsevier.com/locate/geoforum

Critical review

Scaling the Anthropocene: How the stories we tell matter

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ARTICLE INFO

Article history:
Received 12 February 2016
Received in revised form 13 March 2016
Accepted 20 March 2016
Available online 26 March 2016

Keywords:
Anthropocene
Narrative
Anthropogenic transition
Tipping-point
Co-existence

ABSTRACT

Ongoing debates in the Earth, planetary, and social sciences examine the merits and implications of traces in the stratigraphic record that would indicate that humans are now one of the 'great forces of nature'. Candidates for key marker horizons in such a stratal section include noted changes in carbon and nitrogen concentrations, plastics, radionuclides, and metals. Candidates for determining calendar age, include the tipping point in land cover from wildlands to agriculture and the first nuclear detonation. Here we offer a critical review of recent literature contributing to delineating an Anthropogenic stratum, by exploring their interpretation as initiating, sustaining, or indeed ending an Anthropocene epoch. We also offer a reflection on the layer *not* representing a new period, any more than, for instance, iridium marks a 'meteoritic' epoch between the Cretaceous and Palaeogene. We examine temporal scales for their accord with geological methods of definition and delineation, and for the opportunities and constraints each presents for understanding and responding to transformations in the Earth system. Our thesis is that increasingly fortified stances on the 'right' definition of the Anthropocene epoch follow traditions of linear and authoritarian historical accounts, and prevent discovering epistemes of human-environment interactions that are open for coexistence. The co-existence of many key transitions will sustain ongoing and fruitful deliberations over human-environment interactions that the Anthropocene proposal has initiated, promoting research that can work with the many scales, discourses, and narratives of environmental change.
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1. Introduction

Geological time periods constitute delineations suggested by expert evaluations, agreed though the International Commission on Stratigraphy (ICS), of defined faunal stages with secondary markers and agreed radiometric dating. Delineations in Earth history suggest transformations that span global Earth systems. Naming eons and epochs represents methodological narratives of time and space that permit correlating and delineating records of significant historic periods. As such, they evolve with methodological developments, with recent examples being the rewriting of the Tertiary and Quaternary as Palaeogene and Holocene. Since Crutzen (2006) suggested delineating the Anthropocene as an epoch in which humans have become 'one of the great forces of

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http://dx.doi.org/10.1016/j.geoforum.2016.03.006
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nature', the search has been on for indicators that will span global spatial scales, and geologic time scales (Crutzen, 2006; Zalasiewicz et al., 2011a, 2011b; Waters et al., 2016). If the epoch is to be recognized by the ICS as a geological time period, it will be determined by either Global Standard Stratigraphic Age, or a Global Boundary Stratotype Section and Point, or a combination of the two (Waters et al., 2016). Potential methods for delineating by a stratotype section include carbon and nitrogen concentrations, or the presence of plastics, radionucleides, or concentrated metals. Possible events for delineation based on a standard stratigraphic age include the spread of agriculture, the invention of the steam engine, the Great Acceleration, and the first nuclear detonation (Lewis and Maslin, 2015). Indicating convergence on a mid-twentieth century delineation of the Anthropocene, Waters et al. (2016) declare this epoch is "functionally and stratigraphically distinct from the Holocene" (2016:137). As new definitions of the 'right' Anthropocene narrative emerge, Johnson and Morehouse (2014) ask whether the geographical landscape the Anthropocene imagines erases difference by universalizing human significance and naturalizing human history. However the Anthropocene is described, Latour (2015) argues that avoiding cataclysmic change requires careful attentiveness to learn what this human epoch *is* and what it might become.

Indeed, since Crutzen's "geology of mankind" (2002), the Anthropocene debate has remained entangled with concern for global environmental crises. Zalasiewicz et al. (2011b) argue this phenomenon has become the "most important question of our age—scientifically, socially and politically" (2011b:838). Yet, Hajer (1995) cautions that we are limited from finding solutions to environmental crises by the very discourse that has permitted their identification (1995). Relying on existing paradigms of human-environment interactions constricts our capacity to imagine alternatives. Latour (2015) suggests, what is "missing from the description of the Anthropocene is that it modifies the scale, the speed, the rhythm and ... the distribution of active agents in any political conversation ... about the entanglement of humans and non-humans" (2015:222). Such discussion around the Anthropocene is proving fertile ground for epistemic innovation (Head, 2015; Yusoff, 2013; Latour, 2015; Hamilton, 2015).

Here we consider narrative a fundamental human episteme that, through its discourses and scales, provides spatial–temporal coordinates for moving through and manipulating the world (Veland and Lynch, 2016). Drawing on this insight, we offer a critical review of the burgeoning literature on the Anthropocene by considering implications of the proposed anthropogenic strata representing a start-point, mid-point, or end-point of an epoch. Considering each of these as insisting on a linear, authoritarian, and universal narrative of human-environment relations, we argue for an alternative consideration of the human signal in the stratigraphic sections not constituting an epoch, but rather a transformative moment, or tipping-point at which multiple emergent antecedent causalities and possible future trajectories coexist. Each of these Anthropocene time scales contrapuntally directs research and management of environmental change.

2. An Anthropocene start-point

As start-point, the human signal in the stratigraphic section represents the dawn of a new epoch. This would follow convention in geology, where epochs are usually delineated by a beginning, or lower level (Lewis and Maslin, 2015). Anticipating this new condition, Zalasiewicz et al. (2011b) note that while the stratigraphic signal is negligible to date, its significance might emerge over centuries or millennia (2011b). Lewis and Maslin (2015) similarly interpret that because the geological stratigraphic record will likely allow signals of human activity to be observable for millions of years into the future, a new epoch can now be declared. Such anticipatory semantics rest on an expectation that cultural narratives, and humanity, will continue well into the future (Castree, 2015). As such, it is a hopeful narrative, both in terms of the perpetuity of human values, and in terms of the longevity of humans storying Earth systems. "We have seen the future, and it is good", Hamilton (2015:235) writes of Ecomodernists and their vision of the 'good anthropocene'. Its anticipation is akin to that of nuclear waste managers, who in their narratives of secure storage invoke expectations that the meaning of geological formations will transmit over generations and remain meaningful millennia from now. Such longevity of story-lines has so far only been achieved by Indigenous peoples, and most notably so by Indigenous Australians.

The significance of a start point more generally is that it defines components of a 'new normal' that provides distance to a time that was different and therefore not directly relevant from here on. As start-point, Anthropogenic strata take on the role of marking a trajectory along which Enlightenment storylines, and indeed their Abrahamic metanarratives, provide incremental and cumulative understanding of Earth systems now nearing 'completion' (Hamilton, 2015). The ability to recognize human signals in the planetary system is taken as simultaneously promising solutions to planetary problems. Anthropocene prehistory, correspondingly, marks Earth systems in a 'natural' state of minimal and benign human influence. Certainly, colonial history shows a methodological bias toward this imagined state; European settlers deemed 'natural' the carefully tended open woodlands that have now become overgrown forests of the east coast of Australia and the United States (Denevan, 1992). In creating a new chapter in narratives of Earth and human history, how might we avoid similar epistemic errors in reading human traces in Earth systems? Head (2014) considers lessons from similar debates over delineating the Neolithic period in the archaeological record. That debate, she reports, resulted in a much broader understanding of how societies manipulate ecosystem assemblages for human well-being, and in the inclusion of peoples outside Eurasia and in deeper time. The ongoing Anthropocene debate might similarly place its start-point further back in Earth history.

3. An Anthropocene mid-point

As the Anthropocene discourse remains closely associated with attention to environmental crises and planetary boundaries (Steffen, 2006; Rockström et al., 2009), it is invoked by an impending Earth system transformation that we hope to avoid. In a narrative of a sustained Anthropocene, where impending environmental catastrophe is reversible or avoidable, the Anthropogenic strata may in hindsight define not a new epoch, but the nadir of a time axis of human-environment interactions. Our current time period might then prove a mid-point of an axis extending from ancient human cultures, through the current era, and into the distant future. This hopeful view of temporary and transitory change would prove akin to Dansgaard-Oeschger events detected during glacial periods, and would helpfully situate all human societies in the grand narrative of the Anthropocene, avoiding the relegation of certain traditions into pre-Anthropocenic periods. Indeed, this Anthropocene narrative would provide an epoch that spans human societies –neither the Pleistocene (2.8 mil. to 11,700 BCE) nor the Holocene (11,700 BCE to the present) can represent this span.

The anticipatory semantics of Lewis and Maslin (2015) and Zalasiewicz et al. (2011) might also support a mid-point delineation. The invention of the steam engine, the nuclear detonation, and the invention of agriculture may look near simultaneous a million years from now. Hence, geologically and spatially, the Anthropogenic boundary will probably be more diffuse than

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