

## COMMENTS AND REPLIES

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## Reply

## Reply to Jan Zalasiewicz et al. on Response to Autin and Holbrook on “Is the Anthropocene an issue of stratigraphy or pop culture?”

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We thank Jan Zalasiewicz and his colleagues for their thoughtful review and critique of our comment on the stratigraphic relevance of the term *Anthropocene*. We agree that broad and open discussion is useful; however, we wish to clearly iterate that we are not taking a position as flag bearers for the anti-Anthropocene side of the debate. We simply wish to offer our concerns about the formal adoption of the Anthropocene into stratigraphic practice and its growing interplay with the environmental movement at large.

Amendment of stratigraphic code requires a formal process, and proposals that do not ultimately provide useful field application are unlikely to gain traction within the scientific community. Regardless of whether Zalasiewicz et al. feel a need “to seek a boundary stratigraphic marker,” stratigraphic code is explicit in the requirement to establish boundary stratotypes with widespread, preferably global, correlation significance. Recognition of a boundary stratotype is a practical requirement that must also prove necessary and useful to the resolution of field stratigraphic problems. Neglecting to develop stratotypes or deferring the definition of boundary criteria to future generations should inhibit the acceptance of Anthropocene as a practical stratigraphic concept. If developing a consistently recognizable stratotype is indeed such a challenge, then the stratigraphic utility of the concept is in question from the onset.

Establishing rock and time stratigraphies are partially separate exercises because they depend on different criteria. Lithostratigraphy

depends on physical changes in sediment character that define boundaries mapped with consistent and objective criteria. Anthropogenic markers are used in Quaternary stratigraphy, but no single marker defines a mappable shift to human environmental dominance. Instead, currently recognized markers define a temporally and spatially diverse sequence of human events recorded as a complex and variable stratigraphy. Furthermore, such markers are not consistently used in all settings, but they are informally chosen to suit local stratigraphic practice. We can think of few, if any, markers that are globally consistent and therefore suitable candidates for a stratotype. In contrast, chronostratigraphy defines the time that a stratigraphic marker formed with mappable features that conform to identified time lines. Modern geochemical and radiometric techniques can establish time lines in strata of historic age; however, which precise temporal datum reflects the onset of Anthropocene is still an open question. Presently, the selection of markers to identify the base of the Anthropocene seems arbitrary and may be of little stratigraphic use, particularly since the impact of humans appears acutely time transgressive across the Holocene.

The debate about stratigraphic relevance is primarily deductive in that global change theory suggests there must be a physical, chemical, or biological signal of human alteration consistent with the projected exponential rate of environmental change. Therefore, the data we collect should identify a master stratigraphic marker. This reasoning is contrasted with inductive analysis where one finds a signal and seeks to explain its occurrence. Proposals for Anthropocene time- or rock-stratigraphic units did not arise because we found a practical, mappable, and useful stratigraphic boundary that marks a discrete onset of modern human influence to the Earth system. In contrast, Anthropocene appears to interject a conceptual idea onto the stratigraphic record. In the present day of deductive dominance, is the simple scientific reasoning that suggests observations trump theory now considered outdated?

In summary, the scientific community will attain greater benefit by recognizing human-induced environmental processes instead of chasing nomenclature that did not arise independently of ideology. With regard to “the end game,” we suggest that recognizing the causes of environmental change by either human or other causal mechanisms is a critical research topic to which geoscientists of all specialties can contribute. However, our discipline can best contribute to society by maintaining a focus on using our resources to solve problems that benefit the sustainability of the Earth system.

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