

# A question to ecosocialists: When did the Anthropocene begin, and why does it matter?

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**“In our time, understanding and responding to the Anthropocene must be at the top of the socialist agenda.”**

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The word Anthropocene, unknown twenty years ago, now appears in the titles of three academic journals, dozens of books, and hundreds of academic papers, not to mention innumerable articles in newspapers, magazines, websites, and blogs. There are exhibitions about art in the Anthropocene, conferences about the humanities in the Anthropocene, and novels about love in the Anthropocene. There is even a heavy metal album called *The Anthropocene Extinction*. Rarely has a scientific term moved so quickly into wide acceptance and general use.

Behind what might appear to be just a trendy buzzword are important scientific discussions that have radical implications for the future of life on Earth. Three leading authorities on the science of the Anthropocene express the issues clearly:

*“The term Anthropocene ... suggests that the Earth has now left its natural geological epoch, the present interglacial state called the Holocene. Human activities have become so pervasive and profound that they rival the great forces of Nature and are pushing the Earth into planetary terra incognita. The Earth is rapidly moving into a less biologically diverse, less forested, much warmer, and probably wetter and stormier state.”*[1]

Socialists cannot ignore a change of this magnitude, or treat it as just one aspect of our program. As the Brazilian ecosocialist and atmospheric scientist Alexandre Costa writes, “The fight to avoid a catastrophic outcome to this crisis engendered by capitalism is the fight to safeguard the material conditions for survival with dignity of humankind ... Socialism is not possible on a scorched Earth.”[2]

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In 1995, Paul Crutzen, then vice-chair of the International Geosphere-Biosphere Program (IGBP), received a Nobel Prize for showing that widely used chemicals were destroying the ozone layer in earth’s upper atmosphere, with potentially catastrophic effects for all life on Earth. In his Nobel acceptance speech, he said that his research on ozone had convinced him that the balance of forces on Earth had changed dramatically. It was now “utterly clear,” he said, “that human activities had grown so much that they could compete and interfere with natural processes.”[3] Over the next five

years that insight developed until, at an IGBP meeting in 2000, he argued that human activity had driven the earth into a new geological epoch, which he proposed to call the Anthropocene.

Crutzen and Will Steffen, then executive director of the IGBP, minced no words in describing the Anthropocene as a qualitative and dangerous change in the Earth system:

*“Earth is currently operating in a no-analogue state. In terms of key environmental parameters, the Earth System has recently moved well outside the range of natural variability exhibited over at least the last half million years. The nature of changes now occurring simultaneously in the Earth System, their magnitudes and rates of change are unprecedented and unsustainable.”*[4]

A no-analogue state. Planetary terra incognita. Unprecedented and unsustainable. These phrases are not used lightly: the earth has entered a new epoch, one that is likely to continue changing in unpredictable and dangerous ways.

This radical transformation was first extensively described by the IGBP in 2004, in *Global Change and the Earth System*, a broad synthesis of scientific knowledge about the state of our planet that remains the most authoritative book on the Anthropocene.[5] Since then, a great deal of scientific discussion has focused on a question that book did not answer: When did the Anthropocene begin? Of course this has involved technical discussions among experts in various disciplines, but it is not just a technical question. Technical studies can determine when an asteroid hit our planet or when an ice age ended, but a discussion of when human society pushed the Earth system into a no-analogue state must address social, economic, and political issues.

There is a reciprocal process here. Examining social, economic, and political developments can help identify social changes that might have changed the Earth system, and determining when radical physical changes in the Earth system happened provides a basis for determining which human activities were responsible, and thus what measures humans might take to prevent the change from reaching catastrophic proportions. In this article I offer an overview of the issues and stakes in the “when it happened” debate.

## **Geological Time Scale**

Geologists divide the earth’s 4.5 billion year history into a hierarchy of time intervals — eons, eras, periods, epochs, and ages — called the Geological Time Scale. We live in the Quaternary Period, the most recent subdivision of the Cenozoic Era, which began 65 million years ago. The Quaternary in turn is divided into two epochs — the Pleistocene, which began 2.58 million years ago, and the Holocene, which started 11,700 years ago and runs to the present.

The divisions are not arbitrary: they reflect major changes in the dominant conditions and forms of life on Earth. The Cenozoic Era is marked by the rise of mammals, following the mass extinction of dinosaurs and most other plants and animals at the end of the Mesozoic. The Pleistocene Epoch was characterized by the repeated expansions and contractions of continental ice sheets in the Northern hemisphere that are popularly called “ice ages.” The last glacial retreat marks the beginning of the Holocene, which has been characterized by a stable, relatively warm climate: all human history since shortly before the invention of agriculture has occurred in Holocene conditions.

So the scientists who argue that a new geological epoch has begun are not suggesting a faddish label for a current trend, comparable to the Jazz Age or the Dirty Thirties. They are declaring that the present is as different from the Holocene as the Holocene was from the Pleistocene before it. By labelling our time the Anthropocene — from the Greek *anthropos*, meaning human being — Crutzen

was saying that human activity is driving the change, and that barring catastrophe, “mankind will remain a major geological force for many millennia, maybe millions of years, to come.”[6]

In 2008, the International Commission on Stratigraphy (ICS) — the committee of the International Union of Geological Sciences (IUGS) that has responsibility for the Geological Time Scale — created an Anthropocene Working Group, chaired by British geologist Jan Zalasiewicz, to investigate and report on whether formally to define the Anthropocene as a geological epoch. To recommend that change, the AWG must find that there have been major, qualitative changes to the Earth system, and that geological evidence preserved in rock, sediment, or ice uniquely differentiates layers laid down in the Anthropocene from earlier times. To define when the Holocene/Anthropocene transition occurred, they must propose either a specific stratigraphic marker (often called a “golden spike”) or a specific date, or both.[7]

The AWG must also decide whether the Anthropocene should be accepted as a new epoch following the Holocene, or a new age within the Holocene. The former has been generally assumed so far, but the latter would be less controversial.

At present, the Anthropocene Working Group includes some thirty-eight members from thirteen countries on five continents, all working as volunteers. About half are geologists; the rest have backgrounds in other earth sciences, archaeology, and history. They hope to make recommendations during the 35<sup>th</sup> International Geological Congress in South Africa in August 2016, but formalization of the Anthropocene is not a foregone conclusion. The recommendation might be that the term should remain informal, or that a decision should be delayed. If the AWG recommends formalization, the Geological Time Scale still will not be changed unless 60 percent majorities in the ICS and the IUGS agree.

In his first articles on the Anthropocene, Paul Crutzen suggested that the new epoch may have begun at the time of the Industrial Revolution, when large-scale burning of coal launched a long-term rise in atmospheric concentrations of greenhouse gases. That led some observers to conclude that the issue had been prejudged, and many words have been wasted criticizing or praising Crutzen and his co-thinkers for supposedly believing (as some green theorists do) that *industrialization as such* is the source of all environmental problems. Actually Crutzen was opening a discussion, not declaring a conclusion: he clearly stated that “alternative proposals can be made.”[8]

And in fact, a dozen or more proposals for dating the Anthropocene have been made to the AWG. While they differ substantially from each other, the starting dates under serious consideration fall into two broad groups that can be labelled Early and Recent, depending on whether the proposed starting date is in the distant past, or relatively close to the present.

### **An Early Anthropocene?**

The first Early Anthropocene proposal was advanced by U.S. geologist William Ruddiman, who argues that the Anthropocene started when humans began large-scale agriculture in various parts of the world between eight and five thousand years ago. Those activities, he believes, produced carbon dioxide and methane emissions that raised global temperatures just enough to prevent a return to an Ice Age.[9]

Other Early Anthropocene arguments suggest dating the Anthropocene from the first large-scale landscape modifications by humans, from the extinction of many large mammals in the late Pleistocene, from the formation of anthropogenic soils in Europe, or from the European invasions of the Americas in the 1500s. Some archeologists propose to extend the beginning of the Anthropocene

back to the earliest surviving traces of human activity, which would take in much of the Pleistocene, and others have suggested that the entire Holocene should simply be renamed Anthropocene, since it is the period when settled human civilizations first developed.

This outpouring of proposals reflects humanity's long and complex relationships with the earth's ecosystems — many of the proposed beginnings are significant turning points in those relationships, and deserve careful study. But the current discussion is not just about human impact: "the Anthropocene is not defined by the broadening impact of humans on the environment, but by active human interference in the processes that govern the geological evolution of the planet." [10] None of the Early Anthropocene options meet that standard, and none of them led to a qualitative break with Holocene conditions.

Even if Ruddiman's controversial claim that the agriculture revolution caused some global warming is correct, that would only mean that human activity had extended Holocene conditions. The recent shift out of Holocene conditions, to a no-analogue state, would still need to be evaluated and understood. Noted climatologist James Hansen and his colleagues make this argument clearly in a recent paper:

*"Even if the Anthropocene began millennia ago, a fundamentally different phase, a Hyper-Anthropocene, was initiated by explosive 20<sup>th</sup> century growth of fossil fuel use. Human-made climate forcings now overwhelm natural forcings. CO<sub>2</sub>, at 400 ppm in 2015, is off the scale ... Most of the forcing growth occurred in the past several decades, and two-thirds of the 0.9 C global warming (since 1850) has occurred since 1975."* [11]

The Early Anthropocene has been promoted by anti-environmental lobbyists associated with the Breakthrough Institute, because it supports their claim that there has been no recent qualitative change and thus there is no need for a radical response. In their view, today's environmental crises "represent an acceleration of trends going back hundreds and even thousands of years earlier, not the starting point of a new epoch." [12]

As Clive Hamilton and Jacques Grinevald explain, the Early Anthropocene argument is attractive to conservatives because it minimizes recent changes to the Earth System:

*"It 'gradualizes' the new epoch so that it is no longer a rupture due principally to the burning of fossil fuels but a creeping phenomenon due to the incremental spread of human influence over the landscape. This misconstrues the suddenness, severity, duration and irreversibility of the Anthropocene leading to a serious underestimation and mischaracterization of the kind of human response necessary to slow its onset and ameliorate its impacts."* [13]

## **A Recent Anthropocene?**

Moving in exactly the opposite direction, the IGBP's 2004 book *Global Change and the Earth System* included several pages of graphs showing historical trends in human activity (GDP growth, population, energy consumption, water use, etc.) and physical changes in the Earth system (atmospheric carbon dioxide, ozone depletion, species extinctions, loss of forests, etc.) from 1750 to 2000. Every trend line showed gradual growth from 1750 and a sharp upturn in about 1950. The authors said that "the last 50 years have without doubt seen the most rapid transformation of the human relationship with the natural world in the history of the species," but did not explicitly connect that to dating the Anthropocene. [14]

In 2005, Will Steffen, principal author of that book, together with Crutzen and environmental

historian John McNeill and others, coined the term Great Acceleration for the dramatic social-environmental changes after 1950. The name was a deliberate homage to The Great Transformation, Karl Polanyi's influential book on the social, economic, and political upheavals that accompanied the rise of market society in England.[15]

*[Graphs not reproduced here: Updated versions of the 2004 Great Acceleration graphs were prepared this year by the IGBP. As in the original graphs all the trend lines show hockey stick-shaped trajectories. These graphs are based on the updated IGBP data.]*

## Great Acceleration Earth SystemGreat Acceleration Socio-Economic

Created by R. Jamil Jonna based on data in Will Steffen, Wendy Broadgate, Lisa Deutsch, Owen Gaffney, and Cornelia Ludwig, "The Trajectory of the Anthropocene: The Great Acceleration," Anthropocene Review 2, no. 1 (April 2015): 81-98.]

In 2007, in a journal article provocatively titled "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?," Steffen, Crutzen, and McNeill republished the Great Acceleration graphs, and suggested that the second half of the twentieth century should be viewed as Stage 2 of the Anthropocene. The three authors leave no doubt that their answer to the question in their title is an emphatic Yes.

*"Over the past 50 years, humans have changed the world's ecosystems more rapidly and extensively than in any other comparable period in human history. The Earth is in its sixth great extinction event, with rates of species loss growing rapidly for both terrestrial and marine ecosystems. The atmospheric concentrations of several important greenhouse gases have increased substantially, and the Earth is warming rapidly. More nitrogen is now converted from the atmosphere into reactive forms by fertilizer production and fossil fuel combustion than by all of the natural processes in terrestrial ecosystems put together."*[16]

Since then, many Earth System scientists have come to view the Great Acceleration not as a second stage but as the actual beginning of the Anthropocene. In an article published in January 2015, over two-thirds of the Anthropocene Working Group's members endorse 1945 as the beginning of the Anthropocene, because the Great Acceleration is a geological and social turning point, and because it can be located in geological strata by the presence of radiation from nuclear fallout.

They reject the various early Anthropocene proposals because they only address one aspect of the case for a new epoch: "The significance of the Anthropocene lies not so much in seeing within it the 'first traces of our species' (i.e. an anthropocentric perspective upon geology), but in the scale, significance and longevity of change (that happens to be currently human-driven) to the Earth system." [17]

They view the nineteenth-century Industrial Revolution as "more clearly representative of major change," but argue that its effects did not reach the threshold of global change to the Earth system. "With the onset of the Industrial Revolution, humankind became a more pronounced geological factor, but in our present view it was from the mid-twentieth century that the worldwide impact of the accelerating Industrial Revolution became both global and near-synchronous."

As an alternative to nuclear fallout as an indicator, other scientists have proposed using distinctive forms of soot from high-temperature coal combustion that started to appear in geological strata around the world in about 1950. There is also disagreement about whether the beginning of the Anthropocene should be located at the beginning or the peak of the fallout record from nuclear bomb tests — in 1945 or 1964. These and other technical issues remain to be resolved, and of course

the AWG only makes recommendations: the final decision rests with the Commission to which it reports.

While not drawing a final conclusion about whether it should be formally added to the Geological Time Scale, the authors note that “the Anthropocene already has a robust geological basis, is in widespread use and indeed is becoming a central, integrating concept in the consideration of global change.”

## **For a New Synthesis**

The idea that a radical change in the relationship between human society and the global environment occurred in the mid-twentieth century is not new to the radical left. As I have written elsewhere, in the 1960s and '70s noted environmentalists Rachel Carson, Murray Bookchin, and especially Barry Commoner pointed to “the sweeping transformation of productive technology since World War II” as the fundamental cause of growing environmental crises. Crutzen’s argument was anticipated by Commoner: “The technosphere has become sufficiently large and intense to alter the natural processes that govern the ecosphere.”[18]

A generation later, but still ten years before the IGBP’s pathbreaking synthesis report was published, John Bellamy Foster updated Commoner’s argument, and initiated a Marxist analysis of the social and economic changes that caused what would later be dubbed the Great Acceleration:

*“In the period after 1945 the world entered a new stage of planetary crisis in which human economic activities began to affect in entirely new ways the basic conditions of life on earth. This new ecological stage was connected to the rise, earlier in the century, of monopoly capitalism, an economy dominated by large firms, and to the accompanying transformations in the relation between science and industry. Synthetic products that were not biodegradable — that could not be broken down by natural cycles — became basic elements of industrial output. Moreover, as the world economy continued to grow, the scale of human economic processes began to rival the ecological cycles of the planet, opening up as never before the possibility of planet-wide ecological disaster. Today few can doubt that the system has crossed critical thresholds of ecological sustainability, raising questions about the vulnerability of the entire planet.”*[19]

“What transpired in the post-World War II period,” Foster wrote, was “a qualitative transformation in the level of human destructiveness.”[20]

The last two decades of scientific research have thoroughly confirmed what Commoner and Foster wrote, but their analysis has remained a minority position in the left. Some prominent Marxists deride such views as “catastrophism,” and others still treat the environment as just one of many concerns and possibly a diversion from the “real” class struggle. Even among ecosocialists who see the fights against capitalism and for the environment as inextricably linked, there has so far been little recognition that monopoly-finance capitalism and the third technological revolution have produced unique forms of ecological destruction in the past half century, leading to qualitative changes in the entire Earth system.[21]

Similarly, Earth system scientists have shown little awareness of the analyses developed by radical environmentalists who preceded them in identifying a mid-century transformation. In fact, according to former IGBP director Will Steffen, when they began work on their iconic graphs the IGBP expected to identify the Industrial Revolution as a turning point: “we didn’t, however, expect to see the dramatic change in magnitude and rate of the human imprint from about 1950 onwards.”[22]

In the past twenty years, science has taken a giant leap forward, combining new research in multiple disciplines to radically expand our knowledge and understanding of the Earth system as a whole. At the same time, ecosocialists have made huge strides in rediscovering and extending Marx's view that capitalism creates an "irreparable rift in the interdependent process of social metabolism," leading inevitably to ecological crises. These two developments have for the most part occurred separately — despite their mutual relevance, there has been little interchange between Earth system science and ecological Marxism. That has been particularly damaging for Earth system science, which now has a clear view of the physical, chemical, and biological threats to our world, but offers little insight into the underlying causes of the postwar explosion of environmentally destructive activity.

Rather than carping from the sidelines about the scientists' lack of social analysis, ecosocialists need to approach the Anthropocene project as an opportunity to unite an ecological Marxist analysis with the latest scientific research, in a new synthesis — a socio-ecological account of the origins, nature, and direction of the current crisis in the Earth system. Moving towards such a synthesis is an essential part of developing a program and strategy for twenty-first-century socialism: if we do not understand what is driving capitalism's hell-bound train, we will not be able to stop it.

As Foster wrote recently, our goal now must be "to employ the ecological foundations of classical Marxian thought to confront present-day capitalism and the planetary ecological crisis that it has engendered — together with the ruling forms of ideology that block the development of a genuine alternative." [23]

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Modern humans evolved about 160,000 years ago, but for 95 percent of that time our ancestors lived exclusively in small groups of nomadic hunter-gatherers. Only the warmer and climatically stable conditions that began about 10,000 years ago permitted agriculture, permanent settlements, and complex civilizations to develop and thrive. As Earth system science shows, those Holocene conditions constitute "the only global environment that we are sure is 'safe operating space' for the complex, extensive civilization that *Homo sapiens* has constructed," and now "we risk driving the Earth System onto a trajectory toward more hostile states from which we cannot easily return." [24]

No matter what happens in the formal geological decision process, that new epoch is now upon us. What we face is not just extensive pollution, not just rising temperatures, not just rising sea levels, but many centuries in which a safe operating space for humanity may no longer exist. That is why, in our time, understanding and responding to the Anthropocene must be at the top of the socialist agenda.

**Ian Angus**

*Notes*

I'm very pleased and honored to have my essay on the Anthropocene published in the independent socialist journal *Monthly Review*. This article is one of a series on aspects of the Anthropocene and its implications for ecosocialists and ecological Marxism. This is a new subject for the left, and the science is evolving rapidly, so my judgments are preliminary and subject to change. Links to the articles can be found here [original versions]. I look forward to receiving comments and suggestions.

1. Will Steffen, Paul. J. Crutzen, and John R. McNeill, "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?," *Ambio* 36, no. 8 (December 2007): 614.

2. Alexandre Costa, "Socialism Is Not Possible on a Ruined Planet," *Climate & Capitalism*, April 17,



2014, <http://climateandcapitalism.com>.

3. Paul J. Crutzen. "My Life With O<sub>3</sub>, NO<sub>x</sub> And Other YZO<sub>x</sub>s," Nobel Prize lecture, December 8, 1995, <http://nobelprize.org>.

4. Paul J. Crutzen and Will Steffen, "How Long Have We Been In The Anthropocene Era? An Editorial Comment," *Climatic Change* 61 (2003): 253.

5. W. Steffen, et al., *Global Change and the Earth System: A Planet Under Pressure* (Berlin: Springer 2004), 258-59, <http://igbp.net>.

6. Ibid.

7. The requirements for formally defining a new geological interval, and issues that are specific to this case, are discussed in several essays in C.N. Waters, et al., eds., *A Stratigraphical Basis for the Anthropocene* (London: Geological Society, 2014).

8. Paul J. Crutzen, "Geology of Mankind," *Nature* 415, no. 23 (January 3, 2002): 23; Paul J. Crutzen and Eugene F. Stoermer, "The Anthropocene," *Global Change Newsletter*, no. 41, May 2000, 17, <http://igbp.net>.

9. William F. Ruddiman, "The Anthropogenic Greenhouse Era Began Thousands of Years Ago," *Climatic Change* no. 61, December 2003, 261-93. William F. Ruddiman, "How Did Humans First Alter Global Climate?," *Scientific American* no. 292 March 2005, 46-53.

10. Clive Hamilton, "Can Humans Survive the Anthropocene?," originally May 2014, <http://rampages.us>.

11. James Hansen, et al. "Ice Melt, Sea Level Rise and Superstorms," *Atmospheric Chemistry and Physics* 15 (July 2015), <http://columbia.edu>.

12. Ted Nordhaus, Michael Shellenberger, and Jenna Mukuno, "Ecomodernism and the Anthropocene: Humanity as a Force for Good," *Breakthrough Journal*, Summer 2015, <http://thebreakthrough.org>. For a discussion of the reactionary role of the Breakthrough Institute in Anthropocene discussions, see Ian Angus, "Hijacking the Anthropocene," *Climate & Capitalism*, May 19, 2015, <http://climateandcapitalism.com>.

13. Clive Hamilton and Jacques Grinevald, "Was the Anthropocene Anticipated?," *Anthropocene Review* 2, no. 1 (April 2015): 59-72.

14. Will Steffen, et al., *Global Change and the Earth System*, 132, 133, 258-60.

15. Will Steffen, et al., "The Trajectory of the Anthropocene: The Great Acceleration," *Anthropocene Review* 2, no.1 (April 2015): 81-98.

16. Steffen, Crutzen, and McNeill, "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?," 617.

17. Jan Zalasiewicz, et al., "When Did the Anthropocene Begin? A Mid-Twentieth Century Boundary Level Is Stratigraphically Optimal," *Quaternary International*, January 2015 (in press), <http://sciencedirect.com>.

18. Ian Angus, "Barry Commoner and the Great Acceleration," *Climate & Capitalism*, June 29, 2014,



<http://climateandcapitalism.com>.

19. John Bellamy Foster, *The Vulnerable Planet* (New York: Monthly Review Press, 1994), 109.

20. *Ibid*, 114.

21. In most cases, this “it’s just capitalism” view is implicit, not formally defended, but some people do argue that the birth of capitalism and the end of the Holocene were one process. This leaves the qualitative global change of the mid-twentieth century unexplained.

22. Will Steffen, et al., “The Trajectory of the Anthropocene,” 82.

23. John Bellamy Foster, “Foreword,” in Paul Burkett, *Marx and Nature: A Red and Green Perspective* (Chicago: Haymarket Books: 2014), xii.

24. Will Steffen, et al., “The Anthropocene: From Global Change to Planetary Stewardship,” *Ambio* 40, no.7 (October 2011): 739—61.

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## **P.S.**

\* “When did the Anthropocene begin, and why does it matter?”. First published in *Monthly Review*, September 2015.:

<http://monthlyreview.org/2015/09/01/when-did-the-anthropocene-beginand-why-does-it-matter/>

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