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Scientists say humans have now brought on an entirely new geologic epoch

By Chris Mooney January 7 at 2:36 PM

A group of 24 geoscientists on Thursday released a bracing assessment, suggesting that humans have altered the Earth so extensively that the consequences will be detectable in current and future geological records. They therefore suggest that we should consider the Earth to have moved into a new geologic epoch, the "Anthropocene," sometime circa 1945-1964.

The current era (at least under present definitions), known as the Holocene, began about 11,700 years ago, and was marked by warming and large sea level rise coming out of a major cool period, the Younger Dryas. However, the researchers suggest, changes ranging from growing levels of carbon dioxide in the atmosphere to infusions of plastics into marine sediments suggest that we've now left the Holocene decisively behind — and that the proof is already being laid down in polar ice cores, deep ocean sediments, and future rocks themselves.

"In a way it's a thought experiment," said Naomi Oreskes, a geologically trained Harvard historian of science and one of the study's authors. "We're imagining what a future geologist will see when he or she looks at the rock record. But it's not that difficult a thought experiment to do, because so many of these signals are already present."

The paper was published Thursday in the journal Science and was led by Colin Waters, a geologist with the British Geological Survey.

"Quite unlike other subdivisions of geological time, the implication of formalizing the Anthropocene reach well beyond the geological community," the authors conclude. "Not only would this represent the first instance of a new epoch having been witnessed firsthand by advanced human societies, it would be one stemming from the consequences of their own doing."

It's important to emphasize that the new study does not itself amount to a formal or official declaration of a new geologic epoch. Rather, the 24 authors are part of what is called the "Anthropocene Working Group," convened

by the University of Leicester's Jan Zalasiewicz (the current paper's second author) and organized under the Subcommission on Quaternary Stratigraphy, a scientific body that oversees geological definitions for the period spanning roughly the last 2.6 million years (the "Quaternary" period). That subcommission, in turn, is part of the broader International Commission on Stratigraphy, the body that would ultimately have to approve the authors' suggestion if a new era is to be formalized.

So the new paper certainly doesn't mean geology textbooks will be rewritten — that would require numerous further scientific steps, and assent extending far beyond the current 24 authors. But it makes a strong case that they ought to be.

"The scale is incredible," said Waters of the geological changes that the "Anthropocene" has brought on. But he also admits that defining a new epoch, even as we're observing its beginning, is a rather tricky affair — and one that will inevitably be shaded not only by how we think in the present, but also by how generations in the far future think of us.

"I suppose it's a bit like, if you were writing this article just at the start of the Holocene, and you're finding that Washington, D.C., or New York no longer has an ice sheet across it, would you know what the repercussions of that would be in several thousand years' time?" Waters asked.

The concept of the "Anthropocene" was originally suggested by Paul Crutzen, a Nobel Prize winning atmospheric chemist who is also part of the "Anthropocene Working Group," in the year 2000. The term has always denoted a new era or epoch uniquely defined by humans' large scale impact on the environment — but the precise time of its beginning has been variously defined.

After all, humans started deforesting vast landscapes, and causing species extinctions, thousands of years ago. The industrial revolution, meanwhile, began around 200 years ago and represented a major step in how we influence the environment and consume Earth's materials — as well as the kickstart to global warming.

However, the new study homes in on the middle of the last century as the likely marker for when the geologic "Anthropocene" truly began. The authors suggest that around this time, a confluence of major trends — population explosion, new technological advances, and booming rates of consumption — triggered changes that will be unmistakable in geologic records.

We began the 1900s with 1.65 billion people on Earth and ended them with 6 billion, according to the United

Nations. But the majority of the growth was in the second half of the century — the world population did not reach 2 billion until 1927 and 3 billion until 1960.

Over the same broad period we managed to design nuclear weapons and warm the climate. And along with technological leaps and the population boom has come dramatically more uses of resources and transformations of natural environments — which, in turn, has affected the sediment layers that have been formed recently, or are being formed right now. These are likely to feature unprecedented levels of aluminum, concrete, plastics, and black carbon, the study asserts.

Humans have also dramatically changed the sedimentary processes of river systems — look what we've done to the Mississippi River and its wetlands, for instance. Soil levels of nitrogen and phosphorous have also exploded, the study asserts, from use of fertilizers. Perhaps the most distinctive change of all, however, may be the unmistakable signature of thermonuclear weapons testing, which began in 1952, and leaves a clear geological record of plutonium 239 that, the paper said, "will be identifiable in sediments and ice for the next 100,000 years."

And then, well, there's the record of human caused climate change. Atmospheric carbon dioxide levels have grown at an extraordinarily rapid rate, roughly 2 parts per million per year of late, and this will be distinctly recorded in the air bubbles contained in polar ice cores, one key type of geologic record. "Modern rates of atmospheric C emission … are probably the highest of the Cenozoic era," or the last 65 million years, the study says.

Atmospheric methane levels have shown a similar rapid burst. And sea levels are surging rapidly upward, at least when viewed in geological context. They are probably higher now than they have been in the past 115,000 years, the paper said.

It's all of these changes, at roughly the same time, that mark the onset of the Anthropocene, the authors suggested. "It's not just carbon dioxide, and it's not just in Europe and the United States," said Harvard's Oreskes. "It's this whole set of things that reflect human economic activity basically since World War II."

Previous reasons for geological demarcations, the researchers note, include changing solar cycles or major volcanic activity — but also sometimes stark and sudden events. For instance, the famous K-T event or K-T boundary, which marked the end of the Cretaceous period 65 million years ago, features a global layer of the element iridium in rock, the signature of a major asteroid impact.

It's perhaps only fitting, then, that the current paper hints that something much bigger than a mere shift into a new geologic epoch may be afoot. Epochs, after all, are relatively short periods in the grand geological scheme of things, when compared with larger units of time like eons, eras, and periods.

More momentous geological demarcations have often been based upon major changes in the composition of life on Earth — the Cambrian explosion, say, or the extinction of the dinosaurs. However, the paper notes that there are also signs that we may be at the beginning of what some have termed the "Sixth Great Extinction" in all of Earth's history.

"Current trends of habitat loss and overexploitation, if maintained, would push Earth into the sixth mass extinction event (with ~75% of species extinct) in the next few centuries, a process that is probably already underway," the paper said.

So, yes — we don't formally, officially live in the Anthropocene yet. On the other hand, when you look at what we've done to the planet, saying that we still live in the Holocene seems to really miss something pretty important.

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