

## THE ANTHROPOCENE DEBATE: MARKING HUMANITY'S IMPACT<sup>1</sup>

Elizabeth Kolbert<sup>©</sup>

Is human activity altering the planet on a scale comparable to major geological events of the past? Scientists are now considering whether to officially designate a new geological epoch to reflect the changes that homo sapiens have wrought: the Anthropocene. The Holocene — or “wholly recent” epoch — is what geologists call the 11,000 years or so since the end of the last ice age. As epochs go, the Holocene is barely out of diapers; its immediate predecessor, the Pleistocene, lasted more than two million years, while many earlier epochs, like the Eocene, went on for more than 20 million years. Still, the Holocene may be done for. People have become such a driving force on the planet that many geologists argue a new epoch — informally dubbed the Anthropocene — has begun.

In a recent paper titled “[The New World of the Anthropocene](#),” which appeared in the journal *Environmental Science and Technology*,<sup>2</sup> a group of geologists listed more than a half dozen human-driven processes that are likely to leave a lasting mark on the planet — lasting here understood to mean likely to leave traces that will last tens of millions of years. These include: habitat destruction and the introduction of invasive species, which are causing widespread extinctions; ocean acidification, which is changing the chemical makeup of the seas; and urbanization, which is vastly increasing rates of sedimentation and erosion. Human activity, the group wrote, is altering the planet “on a scale comparable with some of the major events of the ancient past. Some of these changes are now seen as permanent, even on a geological time-scale.”

Prompted by the group’s paper, the *Independent* of London last month conducted a straw poll of the members of the International Commission on Stratigraphy, the official keeper of the geological time scale. Half the commission members surveyed said they thought the case for a new epoch was already strong enough to consider a formal designation. “Human activities, particularly since the onset of the industrial revolution, are clearly having a major impact on the Earth,” Barry Richards of the Geological Survey of Canada told the newspaper. “We are leaving a clear and unique record.”

The term “Anthropocene” was coined a decade ago by Paul Crutzen, one of the three chemists who shared the 1995 Nobel Prize for discovering the effects of ozone-depleting compounds. In a paper published in 2000, Crutzen and Eugene Stoermer, a professor at the University of Michigan, noted that many forms of human activity now dwarf their natural counterparts; for instance, more nitrogen today is fixed synthetically than is fixed by all the world’s plants, on land and in the ocean. Considering this, the pair wrote in the newsletter of the International Geosphere-Biosphere Programme, “it seems to us more than appropriate to emphasize the central role of mankind in geology and ecology by proposing to use the term ‘anthropocene’ for the current geological epoch.” Two years later, Crutzen restated the argument in an article in *Nature* titled “Geology of Mankind.” The Anthropocene, Crutzen wrote, “could be said to have started in the latter part of the eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane.”

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<sup>1</sup> environment 360, Yale University, May 17, 2010

<sup>2</sup> Zalasiewicz, J., M. Williams, W. Steffen and P. Crutzen. 2010. The new world of Anthropocene. *Environ. Sci. Technol.*, 2010, 44 (7), pp 2228–2231. DOI: 10.1021/es903118j. Copyright © 2010 American Chemical Society

Soon, the term began popping up in other scientific publications. “Riverine quality of the Anthropocene” was the title of a 2002 paper in the journal *Aquatic Sciences*. “Soils and sediments in the anthropocene,” read the title of a 2004 editorial in the *Journal of Soils and Sediments*. Jan Zalasiewicz, a geologist at the Britain’s University of Leicester, found the spread of the concept intriguing. “I noticed that Paul Crutzen’s term was appearing in the serious literature, in papers in *Science* and such like, without inverted commas and without a sense of irony,” he recalled in a recent interview. At the time, Zalasiewicz was the head of the stratigraphic commission of the Geological Society of London. At a luncheon meeting of the commission, he asked his fellow stratigraphers what they thought of the idea. “We simply discussed it,” he said. “And to my surprise, because these are technical geologists, a majority of us thought that there was something to this term.”

In 2008, Zalasiewicz and 20 other British geologists published an article in *GSA Today*, the magazine of the Geological Society of America, that asked: “Are we now living in the Anthropocene?” The answer, the group concluded, was probably yes: “Sufficient evidence has emerged of stratigraphically significant change (both elapsed and imminent) for recognition of the Anthropocene... as a new geological epoch to be considered for formalization.” (An epoch, in geological terms, is a relatively short span of time; a period, like the Cretaceous, can last for tens of millions of years, and an era, like the Mesozoic, for hundreds of millions.) The group pointed to changes in sedimentation rates, in ocean chemistry, in the climate, and in the global distribution of plants and animals as phenomena that would all leave lasting traces. Increasing carbon dioxide levels in the atmosphere, the group wrote, are predicted to lead to “global temperatures not encountered since the Tertiary,” the period that ended 2.6 million years ago.

Zalasiewicz now heads of the Anthropocene Working Group of the International Commission on Stratigraphy, which is looking into whether a new epoch should be officially designated, and if so, how. Traditionally, the boundaries between geological time periods have been established on the basis of changes in the fossil record — by, for example, the appearance of one type of commonly preserved organism or the disappearance of another. The process of naming the various periods and their various subsets is often quite contentious; for years, geologists have debated whether the Quaternary — the geological period that includes both the Holocene and its predecessor, the Pleistocene — ought to exist, or if the term ought to be abolished, in which case the Holocene and Pleistocene would become epochs of the Neogene, which began some 23 million years ago. (Just last year, the International Commission on Stratigraphy decided to keep the Quaternary, but to push back its boundary by almost a million years.)

In recent decades, the ICS has been trying to standardize the geological time scale by choosing a rock sequence in a particular place to serve as a marker. Thus, for example, the marker for the Calabrian stage of the Pleistocene can be found at 39.0385°N 17.1348°E, which is in the toe of the boot of Italy. Since there is no rock record yet of the Anthropocene, its boundary would obviously have to be marked in a different way. The epoch could be said simply to have begun at a certain date, say 1800. Or its onset could be correlated to the first atomic tests, in the 1940s, which left behind a permanent record in the form of radioactive isotopes.

One argument against the idea that a new human-dominated epoch has recently begun is that humans have been changing the planet for a long time already, indeed practically since the start of the Holocene. People have been farming for 8,000 or 9,000 years, and some scientists — most notably William Ruddiman, of the University of Virginia — have proposed that this development already represents an impact on a geological scale. Alternatively, it could be argued that the Anthropocene has not yet arrived because human impacts on the planet are destined to

be even greater 50 or a hundred years from now. “We’re still now debating whether we’ve actually got to the event horizon, because potentially what’s going to happen in the 21st century could be even more significant,” observed Mark Williams, a member of the Anthropocene Working Group who is also a geologist at the University of Leicester.

In general, Williams said, the reaction that the working group had received to its efforts so far has been positive. “Most of the geologists and stratigraphers that we’ve spoken with think it’s a very good idea in that they agree that the degree of change is very significant.” Zalasiewicz said that even if new epoch is not formally designated, the exercise of considering it was still useful. “Really it’s a piece of science,” he said. “We’re trying to get some handle on the scale of contemporary change in its very largest context.”