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Conflicting Narratives in Geology: The Current Debate Surrounding the Beginning of the Anthropocene Epoch

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Competing Narratives in Geology:

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Abstract

Geologists currently debate the addition a new Epoch of geologic time called the Anthropocene. The Anthropocene is characterized by changes in the lithosphere resulting directly from human activity. This paper analyses the arguments in favor of and against the Anthropocene as well as the conflicting narratives concerning the beginning and scope of the Anthropocene.

Keywords: Anthropocene, stratigraphy, geochronology, geology

The Current Debate Surrounding the Beginning of the Anthropocene Epoch

In order to better understand Earth's geologic history, geologists abide by a system of chronology based on observable changes in rock stratigraphy. From largest to smallest in terms of timespan, the geologic timescale is broken up into units called eons, eras, periods, epochs, and ages. The boundaries between these geochronologic units are determined by evidence of a significant change in stratigraphic layers. The Earth is currently in the Phanerozoic Eon, the Cenozoic Era, and the Quaternary Period. There is current debate, however, over which epoch the Earth is currently in and when that epoch began. The prevailing theory until recently was that the Earth was in the Holocene Epoch, which started about twelve thousand years ago. The Anthropocene is a relatively new theory that suggests a new geologic Epoch brought about solely by human activity. There are disagreements over whether humans have left an impact on Earth's geology significant enough to warrant a new Epoch. Even among those who agree with the existence of the Anthropocene, there is debate over when it began.

First, we must understand the concepts of chronostratigraphic units and geochronologic units. The North American Commission on Stratigraphic Nomenclature defines a chronostratigraphic unit in Article 66 of the North American Stratigraphic Code:

> A chronostratigraphic unit is a body of rock established to serve as the material reference for all constituent rocks formed during the same span of time. Each boundary is synchronous. The body also serves as the basis for defining the specific interval of time, or geochronologic unit (Article 80), represented by the referent. (2005, p. 35)

Article 80 defines the meaning of a geochronolgic unit:

> Geochronologic units are divisions of time traditionally distinguished on the basis of the rock record as expressed by chronostratigraphic units. A geochronologic unit is not a

> stratigraphic unit (i.e., it is not a material unit), but it corresponds to the time span of an established chronostratigraphic unit (Articles 65 and 66), and its beginning and ending corresponds to the base and top of the referent. (North American Commission on Stratigraphic Nomenclature, 2005, p. 37)

In short, a chronostratigraphic unit is the physical rock body used to define the range of time represented by a geochronologic unit. The boundaries between chronostratigraphic units are defined by Article 67: "Boundaries of chronostratigraphic units should be defined in a designated stratotype on the basis of observable paleontological or physical features of the rocks." (North American Commission on Stratigraphic Nomenclature, 2005, p. 35). Stratigraphic principles must be taken into account when discussing the addition of a new geochronologic Epoch.

Proponents of the addition of the Anthropocene have been in search of hard evidence to support its existence and to define its scope. In order to concretely define a chronostratigraphic unit, geologists must find what is known as a Global Stratotype Section and Point (GSSP), also known as a 'golden spike' (Lewis & Maslin, 2015, p. 3). This means that multiple points of evidence must be proven to have occurred at the same time across the globe. A global extinction event, for example would result in observable paleontological change at roughly the same time worldwide which would serve as evidence for the beginning of a new geochronologic time period. Human activity causing most megafauna to go extinct is not sufficient evidence for the beginning of the Anthropocene because it did not occur globally at the same time (Lewis & Maslin, 2015, p. 3). One issue facing geologist in the search for the Anthropocene's golden spike is how small the margin for error is. The Earth is around 4.6 billion years old, and the boundaries between eons can have margins of error spanning millions of years. The inherent variations that occur when dating rocks billions of years old create those wide margins. Since the Holocene

Epoch began only about twelve thousand years ago, if disparity between evidence spans centuries or even decades it may fall outside the margin of error for being a GSSP. Because we can much more accurately date rocks that are only thousands of years old, evidence must line up very closely. Any proposals for the beginning of the Anthropocene must be backed up in order to be recognized.

There are several theories as to the when the Anthropocene began. One theory is that human activity did not begin to impact the lithosphere significantly until the Industrial Revolution in the late 1700s. This theory proposes that a combination of increased global temperatures due to greenhouse gas emissions and industrial waste pollution caused widespread change in Earth's ecology and geology (Zalasiewicz, et al., 2008). This theory has its faults, though, primarily the fact that industrialization was not a synchronous and global phenomenon. Another theory suggests that the Anthropocene can be geologically proven to have started around the 1950s, caused by nuclear weapon testing in the atmosphere. A study sampling 28 sites in southern Africa for indicators of the Anthropocene noticed a sharp increase in plutonium and cesium isotopes along with increased microplastic content in lacustrine environments that began around 1950 (Rose, Turner, Unger, & Curtis, 2021, pp. 2-3). If remnants of nuclear fallout can be identified across the globe, it may become the golden spike needed to prove that human activity has noticeably altered the Earth's geology and formalize the Anthropocene.

While many geologists are in favor of formalizing the Anthropocene, there are others who believe that doing so would go against the principles of stratigraphy. The argument here is not to suggest that humans have not impacted the Earth significantly, but to question if that impact is observable geologically. Some argue that the fact that a golden spike has yet to be found discredits the Anthropocene as an official geochronologic Epoch (Nikolov & Hristova,

2020). Another argument is that, by definition, stratigraphy is used to interpret the past based on geological evidence, but geologic events that occurred during the Anthropocene need no interpretation. These events were observed when they occurred or are still be observed today and are measured not by the age of their geologic remains, but by the date on the Gregorian calendar (Finney & Edwards, 2015, p. 5). The crux of these arguments is that our understanding of geology should not be clouded by philosophical notions of human importance. If it cannot be scientifically proven, is it really our place to name an Epoch that we currently live in?

Regardless of its status as an official geochronologic Epoch, the concept of the Anthropocene is important across a range of scientific disciplines. The notion that humans have permanently impacted the Earth is applicable to the realms of ecological conservation, meteorology, and even politics. The fact that the Anthropocene has been co-opted and utilized beyond just the realm of geology and stratigraphy is used to discredit its official geochronological status by its detractors: “The strong pressure to include the Anthropocene as an official unit in the ICS Chart comes not so much from geologists-stratigraphers, but rather from ecologists and physical geographers.” (Nikolov & Hristova, 2020, p. 7). Awareness of human activity’s impact on Earth has created political movements and activists who wish for humanity to utilize Earth’s resources more sustainably. Recognizing the Anthropocene would give geologists the potential to give further credence to this movement, even if it were technically against stratigraphic conventions (Coster, 2020). Alongside the belief that the Anthropocene should not be officialized is the understanding that it does not need to be. The Anthropocene is equally history and geology, and like most eras of history, it does not require a definitive start date for its contents and meaning to be understood (Finney & Edwards, 2015). The implications of the Anthropocene sheds greater light onto issues beyond the scope of geology.

The debate over the Anthropocene Epoch boils down to strict adherence to stratigraphic code. There are those who wish to formalize the Anthropocene by proving its boundaries by matching the geochronologic unit to physical evidence. The concept of the Anthropocene will still have wide ranging impacts on our perception towards human interference with the Earth, regardless of official recognition. Then there are those who believe labeling the Epoch we currently live in would be premature on our part and that the rules of stratigraphy must be maintained. Humans are in the unique position of having the ability to acknowledge the scope of our own impact on the planet. It is important that as our understanding of science changes, that we reevaluate the systems by which we define and delineate knowledge, and that is the driving force behind this debate.

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