

VO 105 | NO. 6  
JUNE 2024

# EOS

SCIENCE NEWS BY AGU

Whither the Anthropocene?

The Source of Swift Quakes

Tatooine, Trisolaris,  
and Thessia, Oh My!

## ALL ROADS LEAD TO...

*Seatbelt Rock*

*the Order of the Red Nose*

*luna firma*

*\$13,000 worth of missing acid*

*Teletubby training*

*beanbag sampling*

*cruise hands*

*stickers and geotags*

*penguins*

## SCIENCE



about earthquake magnitude,” she said. “The concept of magnitude is very much wrapped up in the physics of how earthquakes shake the ground.” Crowd motion doesn’t happen underground or on a fault. Nor does it break the rock or make it slip.

Some measures of an earthquake’s effect would be tricky to translate to swaying or dancing Swifties, but the researchers reasoned that both types of events release energy into the ground. On the basis of the spectrograms, they determined the energy released by concertgoers and used this to calculate an equivalent magnitude for each song. The greatest of these was 0.85.

With a motion sensor inside the stadium, the team also observed the intensity of shaking. The strongest shaking was between II and III on the Modified Mercalli Intensity Scale. “It’s not going to be super strong, but you would definitely feel it,” Tepp said.

The magnitude calculation is a “unique contribution” to the field, Caplan-Auerbach said. She and her colleagues published a separate study in *GSA Today* in March analyzing several of Swift’s concerts in the Seattle area ([bit.ly/Swift-quake-Seattle](http://bit.ly/Swift-quake-Seattle)). The group compared seismic signals from preconcert sound checks; concerts when fans were jumping; and Swift’s acoustic sets during which the band didn’t play. Their findings largely echo the study by Tepp and her colleagues. “The strongest ground shaking is definitively caused by the crowd,” Caplan-Auerbach said.

The seismic spikes caused by jumping fans resemble the repetitive trembles of earthquake swarms, Tepp said. And volcanic sys-

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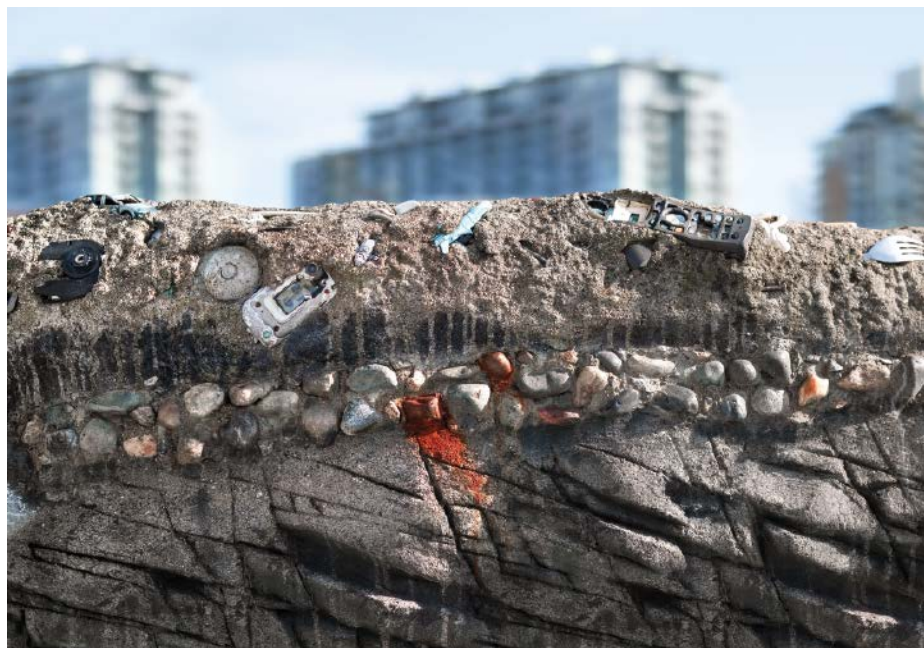
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tems often have harmonic signals associated with gases or magma traveling through a conduit. Studying harmonics from crowds could provide clues for seismologists figuring out how to identify these unusual signals in seismic data.

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By **Carolyn Wilke** (@CarolynMWilke), Science Writer

## What’s Next for the Anthropocene?



In late March, the International Union of Geological Sciences (IUGS) issued a statement: The process that a few weeks earlier had rejected identifying the Anthropocene as a formal geological epoch was settled, and the downvote was valid. The statement came after a heated discussion about the vote’s validity and whether the Subcommittee on Quaternary Stratigraphy (SQS) had followed the statutes of the International Commission on Stratigraphy (ICS).

Despite IUGS’s formal acknowledgment of the vote, “some uncomfortable facts will not go away,” said Martin Head, a vice-chair of SQS and a palynologist and stratigrapher at Brock University in Ontario, Canada. Head suggested that there were breaches in the decisionmaking process.

“The Anthropocene Working Group was not allowed to revise its proposal after discussions within SQS had been brought to a halt, even though this is customary. This meant that important results that had recently become available were excluded from consideration,” Head explained. “Even worse,” he continued, “there were several statutory violations that call the validity of the vote into question.”

Last year, the Anthropocene Working Group (AWG) proposed that the IUGS designate a new geological epoch, the Anthropocene, as having started in the mid-20th century.

Radionuclides such as plutonium (emitted by nuclear tests) were put forth as physical markers of the new epoch. The team chose Crawford Lake in southern Canada as the reference site for the globally synchronous event that would mark the end of the Holocene.

Philip Gibbard, an SQS voting member and Quaternary geologist at the University of Cambridge in the United Kingdom, said that even if the subcommittee had approved the proposal, the ICS probably would not have let it move forward. “The ‘epoch-division’ is too large scale when compared to other epochs such as Oligocene or Miocene—which are characterized by a whole series of elements” as opposed to the single set of radionuclide markers, he said.

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**“The marker is not the issue.”**

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For Fernanda Quaglio, a paleontologist at the Universidade Federal de São Paulo in Brazil, “the marker is not the issue.” To her, markers of the Anthropocene could be plastics or other proxies.

“The point,” she explained, “is the temporal scale. Eighty years is a drop in the ocean in geological terms.”

**“It might be too early to define the Anthropocene as a new epoch, but it’s also too early to end the debate.”**

“But that does not invalidate the discussion at all,” she continued. Quaglio is worried that the downvote may have put a premature end to discussion of the Anthropocene. “It might be too early to define the Anthropocene as a new epoch, but it’s also too early to end the debate.... We have to keep the conversation going,” she said.

Renato de Almeida, a sedimentary geologist at the Universidade de São Paulo, has a similar view. “The issue is what the marker is signaling. Is it the beginning of a new epoch? We are at the margin of error of that limit,” he said. Epochs are large geological intervals marked by patterns associated with events such as extinctions, he explained, and “the Holocene clearly hasn’t ended, as its fauna and flora are still here.”

“Everything we say about the human impact over the planet is true,” Almeida

stressed. “The problem is calling it an epoch.”

To Almeida, the problem in defining an epoch stems mainly from the fact that geologists cannot know for certain what planetary changes will come after the new epoch is defined. All the epochal language of current geology is made in retrospect.

“Geologists don’t deal with the future,” Gibbard said, “just the past.”

#### Event or Epoch

Gibbard and a group of colleagues defend the Anthropocene not as an epoch but as a geological “event” ([bit.ly/event-not-epoch](https://bit.ly/event-not-epoch)), a term that is used for occurrences such as the Great Ordovician Biodiversification Event, which took place more than 400 million years ago ([bit.ly/GOBE](https://bit.ly/GOBE)). During this pivotal time in Earth’s history, changes in tectonic activity and an uptick in marine oxygen are thought to have contributed to a radical increase in marine biodiversity—but it is not an epoch.

To Head, however, “the Anthropocene is not an event...and it’s not strictly geological, as it combines social criteria. It is in fact interdisciplinary, local to regional in scale, and always subject to reinterpretation.” The most substantial signals of the Anthropocene, he said, include a significant increase in human population, energy consumption, and greenhouse gas emissions.

To Simon Turner, a geographer at University College London and AWG secretary, conditions now are “very much post-Holocene.” He said the recent downvote “makes Quaternary geology look further out of sync with

other sciences concerned with climate change and other destructive impacts of recent human activity to our planet.”

According to Almeida, it ultimately doesn’t matter whether the Anthropocene is an event or an epoch. “The term is larger than stratigraphy, and it gave the discipline a visibility it never had before,” he said. “Nomenclature

**“The term is larger than stratigraphy, and it gave the discipline a visibility it never had before.”**

doesn’t change its importance.... People in geology and other disciplines will keep on using” the term, he said.

Almeida pointed out that something very similar happened when stratigraphers grappled with Quaternary nomenclature ([bit.ly/Quaternary-period](https://bit.ly/Quaternary-period)). “It was only officially approved as a period in 2009, but people were already using the term in that way decades before it happened” he said. “The ICS sort of adjusted to a change that had happened already.”

By **Meghie Rodrigues** (@meghier), Science Writer

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