

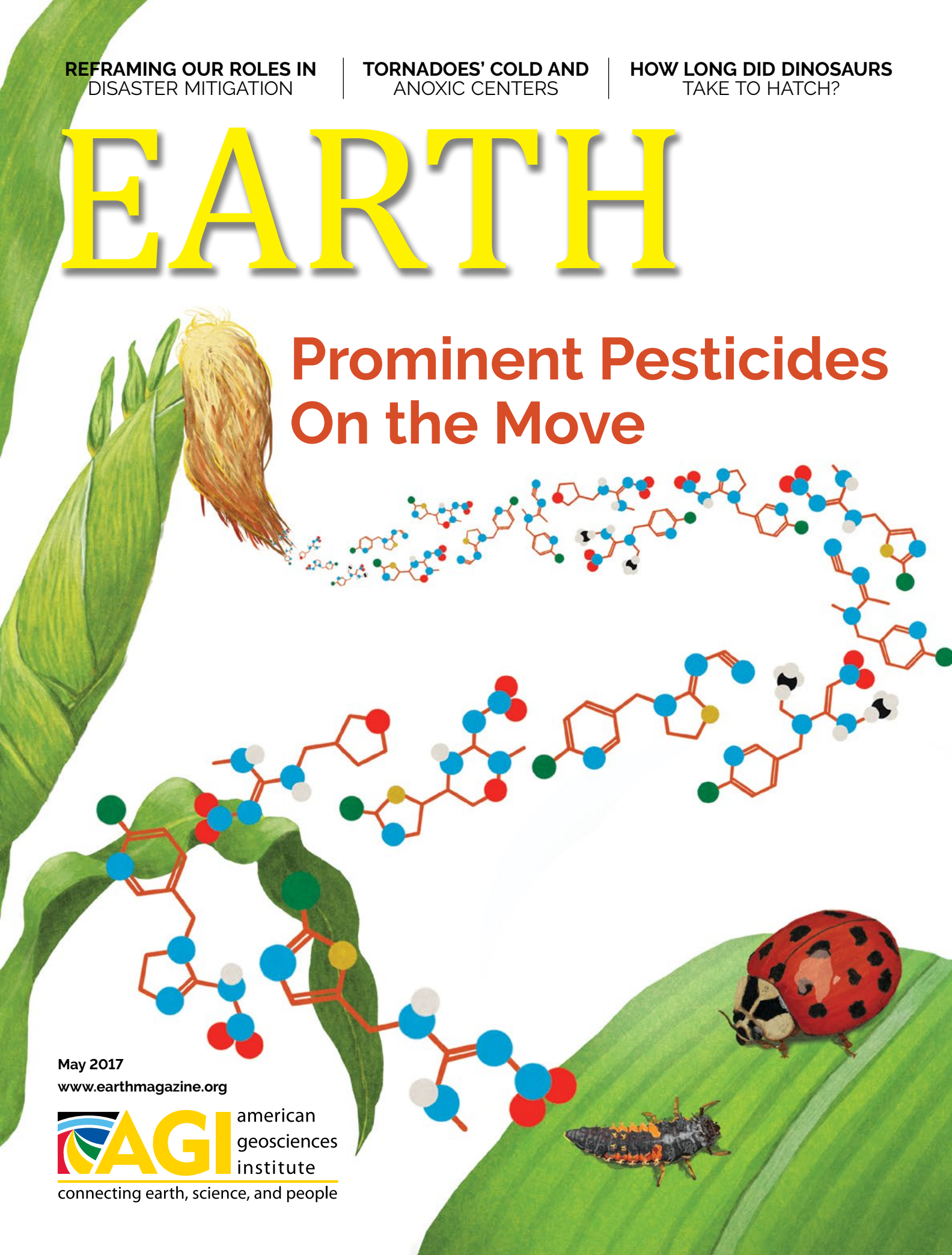
REFRAMING OUR ROLES IN  
DISASTER MITIGATION

TORNADOES' COLD AND  
ANOXIC CENTERS

HOW LONG DID DINOSAURS  
TAKE TO HATCH?

# EARTH

## Prominent Pesticides On the Move



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Blocks of volcanic tuff quarried from this mine in Turkey contain carcinogenic erionite.

Credit: F. Mighali (Kaltun Italia S.r.l.)

## Investigating erionite, asbestos' more carcinogenic cousin

**A**sbestos is notorious for causing lung cancer and other respiratory diseases, but it's not the only type of fibrous mineral that affects human health. In the mid-1970s, erionite was linked to the unprecedented high mortality rate from mesothelioma in villages in central Turkey where volcanic tuff had been used as a building material for centuries. Like asbestos, erionite can occur as long thin fibers that, when inhaled, can persist in lung tissue for decades. New research looking at associations of iron with erionite is helping pathologists better understand why embedded erionite fibers sometimes lead to lung cancer.

Since the mesothelioma epidemic in Turkey began, in vivo and in vitro studies have confirmed the carcinogenicity of erionite,

says [Alessandro Gualtieri](#), a mineralogist at the University of Modena and Reggio Emilia in Italy, and lead author of a [study](#) in *Scientific Reports* detailing the new work. "But we still know little about the mechanisms at the molecular scale that lead to disease," he says.

Researchers have suggested that the problem can be traced to iron associated with the erionite fibers, as is the case with asbestos, says [Victor Roggli](#), a pathologist at Duke University who was not involved in the new study. "With asbestos, iron gets adsorbed onto the surface of the fibers and when the fibers get embedded in the lungs, the iron sets off redox reactions that cause tissue damage, which can eventually lead to malignancy."

Gualtieri and colleagues used electron microscopy to examine erionite samples at high resolution. They found that the iron was not embedded in the mineral's crystal structure, as had generally been assumed. Instead, iron was present in association with impurities and accompanying minerals, and so was only attached to the erionite indirectly. "If iron is not part of the [mineral] structure, its role should be considered irrelevant for erionite toxicity, and other factors like biopersistence should be invoked," Gualtieri and his colleagues wrote.

Roggli says that iron's role in causing disease can't be fully ruled out yet. But, he says, the erionite fibers themselves could also be the main culprit, perhaps affecting the splitting of chromosomes in cell division, which has also been shown to lead to cancer.

Erionite appears to be even more toxic than asbestos, Gualtieri says, most likely due to its high level of biopersistence, the length of time it can exist

in the body. "If you inhale it, the fibers will stay in your lungs for the rest of your life." Some types of asbestos dissolve in a matter of months, though others can persist much longer.

Cases of erionite-related mesothelioma have been few outside of the cluster in Turkey and another cluster in central Mexico, but the mineral, formed when volcanic ash is altered by water, is also found in rocks [across the western U.S.](#), including in Arizona, California, Nevada, North Dakota, Oregon and Wyoming. Samples from different locations also appear to have varying levels of toxicity based on the length of the fibers, Gualtieri says. "Fortunately, it has no applications or industrial uses, unlike asbestos," he says, so exposure to the mineral is rare.

Mary Caperton Morton

### 2015–2016 El Niño eroded West Coast

Beach erosion at 29 beaches along more than 1,900 kilometers of Pacific coastline was 76 percent higher than normal during the winter 2015–2016 El Niño, one of the three strongest ever recorded, according to new research. Waves were "exceptional and among the largest ever recorded," said the lead author in a statement, despite the fact that rainfall during the El Niño was below average for an El Niño.

[Barnard et al., Nature Communications, February 2017; University of California, Santa Barbara, press release](#)

### Ventura Fault's risk revised

A new study of the Ventura-Pitas Point Fault — which underlies the cities of Ventura and Santa Barbara, Calif., and runs about 100 kilometers offshore — shows that more of the fault is closer to the surface than previously thought, suggesting that shaking during an earthquake on the fault would likely be stronger. The study also reaffirms that the fault has a staircase-like structure, with a flat section in between two vertical sections.

[Marshall et al., Geophysical Research Letters, February 2017](#)