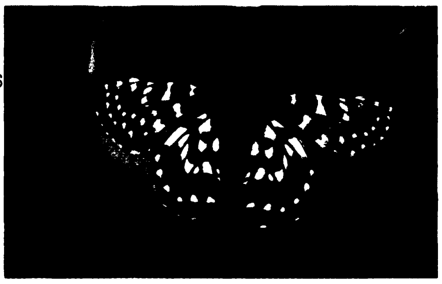
# Butterfly displaced by climate change?

Edith's checkerspot butterflies inhabit patches of fields, rocky hills, and alpine terraces from Baja California to British Columbia. But throughout their lives, they don't roam far. An entire population can confine its existence for decades to a piece of land 100 by 100 meters. Yet as a species, new data show, this butterfly is moving northward—big time.

Camille Parmesan of the National Center for Ecological Analysis and Synthesis, at the University of California, Santa Barbara, has just completed a census of 151 previously reported populations scattered along the west coast of North America. Because they are such stay-at-homes, the butterflies' apparent northward trek actually reflects large numbers of populations dying off at the southern end of their range and presumably new populations in the north. Mexican populations, for instance, were four times more likely to be extinct than ones in Canada. Low-altitude populations are also losing ground.



Cntr. for Conservation Biology/Stanford

*Female Edith's checkerspot.*

She says that the slow, difficult movement that she's documented in this species "tracks changes over the last 100 years."

Biologists have argued that if Earth's climate warms, whole ecosystems would begin moving into what had been cooler zones. While there has been evidence for several plant species that such a shifting may have begun (SN: 6/18/94, p. 399), Parmesan says those data came from only a fraction of each species' global population. Establishing a true shift requires canvasing the entire range of a plant or animal—which she has now done for Edith's checkerspot.

The result: "The clearest indication to date that global climate warming is already influencing species' distributions," she reports in the Aug. 29 NATURE.

Her conclusions make sense, says Paul R. Ehrlich of Stanford University. A renowned observer of this butterfly, he notes that even a small change in the microclimate—affecting moisture, temperature, or sunlight—can disrupt "the very complex relationship between [this checkerspot] and its food plants," causing extinctions locally. — *J. Raloff*

## Chem weapons: Burning issues

On Aug. 22, Army contractors opened an M55 rocket and began draining its load of GB, a lethal nerve agent. That marked the start-up of the nation's first full-scale facility for incinerating chemical weapons, a 19-acre plant situated within the remote Tooele (too-ella) Army Depot in northwest Utah.

Some 2 days—and 205 rockets—later, the Army shut the plant down to investigate how GB had gotten into enclosed areas adjacent to the massive filters that are used to clean munitions-contaminated air.

While GB didn't belong in these areas, "we don't see it as a major problem," says Marilyn Tischbin, at the Army's Aberdeen (Md.) Proving Ground. "It's just part of the fine-tuning we have to go through."

But citing safety concerns (SN: 12/10/94, p. 394), several individuals and groups continue to lobby against the plant. Indeed, notes Cindy King of the Utah Sierra Club in Salt Lake City, her group and others have multiple suits pending against the Army and Utah.

The United States announced 12 years ago that it would incinerate all of its toxic mustard gas and nerve agents. Tooele houses 42 percent of that stockpile. — *J. Raloff*

# Shaken bead beds show pimples and dimples

From a zebra's stripes or a leopard's spots to expanses of evenly spaced sand dunes, pattern formation is a common natural phenomenon.

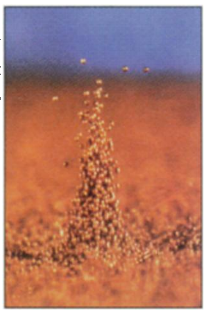
Scientists can make regular patterns in the laboratory by vibrating thin beds of granular materials such as sand, sugar, or tiny beads. Shaken up and down, the surfaces of these materials develop ridges and hollows that form arrays of stripes, squares, or hexagons.

These large-scale arrangements result from the banging together of neighboring particles in the material. Now, researchers have discovered that the same interactions can lead to the formation of individual, local features that resemble splashes in a puddle of water. Unlike water splashes, however, these structures don't spread. Instead, they slosh back and forth between a craterlike and a peaked geometry in time with the vertical vibrations.

Paul B. Umbanhowar of the University of Texas at Austin and his coworkers report this finding in the Aug. 29 NATURE.

The researchers performed their experiments using bronze spheres, each about 0.15 millimeter in diameter, spread in a layer across the bottom of a wide cylinder in a vacuum.

When the layers were less than 15 particles deep, the researchers observed reproducible geometric surface patterns determined by the rate and amplitude of vibration. Thicker layers usually remained flat and featureless until the vibrated system was momentarily disturbed, then one or more isolated structures emerged.



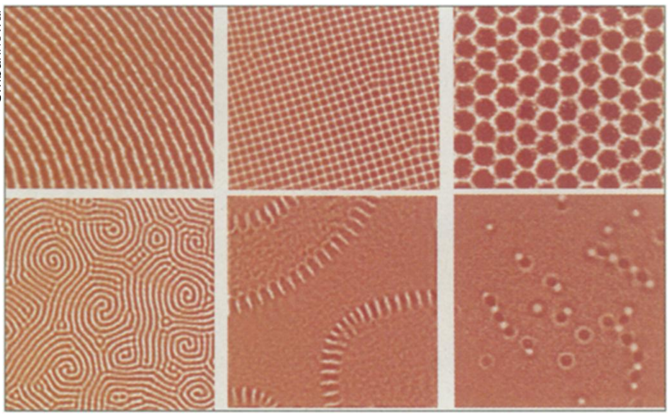
Umbanhowar

*Side view of an oscillon: The particles are thrown into a loose, peaked heap on the granular surface.*

Called oscillons, these features show up as a peak during one vibrational cycle and a crater during the next. They are remarkably robust, persisting for more than 500,000 container oscillations.

Oscillons slowly drift across the surface. When oscillons in opposite phase approach each other, they attract, partially overlap, and form a pair that moves around as a unit. Oscillons in the same phase tend to avoid each other.

Precisely why oscillons emerge and how they maintain their form is not yet fully understood, Umbanhowar says. Further studies of these features may shed light on the nature of granular flow and aid in the development of improved methods of mixing, sorting, and handling granular materials. — *I. Peterson*



Umbanhowar

*Different vibration rates and amplitudes ripple the surface of a shallow bed of tiny beads to form various patterns. Bottom right: Oscillon peaks (white dots) and craters (rings) can appear in a vibrated layer about 20 particles deep.*