Life in the Jurassic: Stability amid chaos

The geological equivalent of the turbulent 1960s, the Jurassic proved a tumultuous time. During this period, from 205 million to 140 million years ago, Africa tore away from North America, leaving a yawning gap that would eventually grow into the Atlantic Ocean. Sea level and climate changed dramatically as the continents pulled away from each other.

Yet some communities of creatures endured for millions of years with little modification, seemingly oblivious to the upheaval around them.

This picture of constancy emerges from a new study of fossilized bivalves that lived along the western edge of North America. "This came as a great surprise. At first glance, you wouldn't think of the Jurassic as a time when you would find a lot of stability," says Carol M. Tang, a paleontologist at the University of California, Berkeley. She and David J. Bottjer of the University of Southern California in Los Angeles report their discovery in the September GEOLOGY.

Tang and Bottjer analyzed records of fossils from Jurassic rock layers in the northwestern United States, which was covered by a giant saltwater bay at the time. As sea level rose and fell throughout the Jurassic, the bay expanded and contracted. The two paleontologists determined which of the species survived these trying episodes.

On average, about half the species in any one interval reappeared when sea levels rose again. In some cases, two-thirds to four-fifths of the species survived into the subsequent interval of high water.

The strange stability of Jurassic bivalves plays into a growing paleontological debate about how communities of species weather difficult times. The discussion stems, in part, from work by Carlton E. Brett of the University of Rochester (N.Y.), who studies Appalachian marine fossils dating from the Silurian and Devonian periods, 438 million to 355 million years ago.

Brett has documented that communities of organisms from this time tended to live and die as a group. Disparate species survived together through millions of years of environmental change and then disappeared en masse during particularly abrupt upheavals. This pattern, known as coordinated stasis, runs counter to traditional evolutionary theory, in which species evolve on their own.

Paleontologist Paul J. Morris of the University of Massachusetts at Amherst and his colleagues have proposed a mechanism to explain coordinated stasis. Communities of organisms, they suggest, might become linked in ways that help them survive some types of disturbances. Such ecological locking works only up to a certain point, however. If sea level, climate, or some other environmental factor swerves sharply, the community becomes unglued and species go extinct.

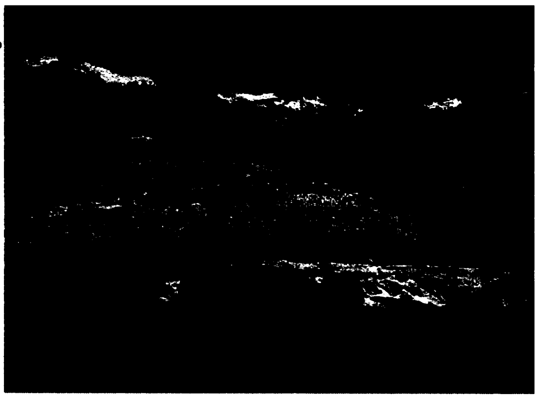
Tang and Bottjer's observations do not support coordinated stasis. Although Jurassic species survived for long periods, each group appeared and went extinct separately, with apparently little interaction among species. "We don't see coordination, we just see stasis," says Bottjer.

The Jurassic bivalves from western North America raise questions about the universality of coordinated stasis, says Tang. Moreover, ecologists have criticized the theory because ecosystems do not show evidence of coordination in the last 10,000 years.

Brett readily acknowledges that the pattern does not apply at all times and in all places. In a more recent analysis of the Silurian and Devonian fossils, he has discovered stasis without coordination among marine creatures living close to shore—an environment similar to the one studied by Tang and Bottjer.

To date, only a few in-depth studies have tried to search for patterns of coordinated stasis in the fossil record. Nevertheless, the theory is starting to capture widespread attention among paleontologists, ensuring more investigations in the future. "It will be a while before this gets shaken out as to how pervasive this pattern is," says Brett. *—R. Monastersky*

Tang



Sedimentary layers in Wyoming record the rise and fall of Jurassic sea levels.

Ocean bacteria need iron with dinner

Pumping iron to get big may be an activity most people associate with bodybuilders at the local gym, but the true champions of the art dwell in the world's oceans. There, phytoplankton bask in the sun's rays, absorbing carbon dioxide from the atmosphere and exhaling oxygen, while oceangoing bacteria scavenge organic matter from the water and breathe out carbon dioxide.

Iron regulates the lives of both kinds of microorganisms, according to new research. Scientists learned 3 years ago that phytoplankton populations in iron-deficient waters grow tremendously when given a small dose of the trace mineral (SN: 3/5/94, p. 148). Few suspected, however, that the growth efficiency of oceanic bacteria is also ruled by iron, as Philippe Tortell and his colleagues at McGill University in Montreal report in the Sept. 26 NATURE.

"Sure, there's a lot of phytoplankton," says Tortell, now at Princeton University. "But there are even more bacteria out there." Fifty percent of the organic carbon in oceans resides in bacteria.

The researchers divided laboratory-grown colonies of bacteria into two batches and provided them with different amounts of iron but equal amounts of carbon. Both colonies consumed their allotment of carbon, but the iron-deficient colonies grew more sparsely. The researchers added iron to the deficient colony, but the mineral failed to spur growth. Nor did carbon alone have an effect. Only when they increased both iron and carbon supplements did the bacteria start bulking up.

"The low-iron cultures had somehow not been as efficient at converting that carbon into cells," says Tortell. Without iron, the microorganisms release most of the carbon into the atmosphere instead of using it to build new cells.

Tortell and his colleagues had thought that this release of carbon dioxide by bacteria would balance the removal of it from the atmosphere by phytoplankton. Their results show, however, that iron-rich bacteria sock away much more carbon in their cells than they give off as carbon dioxide.

The scientists worry that their findings may give additional impetus to a controversial idea for controlling global warming. The late oceanographer John Martin had suggested that adding iron to the oceans would boost the growth of marine organisms that take up atmospheric carbon dioxide (SN: 9/30/95, p. 220).

"No way," says David Kirchman of the University of Delaware in Lewes, who believes scientists know too little about the ocean to tamper with it. "These types of bacteria hadn't been considered in the 10 years we've been studying the role of iron in the ocean."

Seagoing bacteria compete with phytoplankton for iron, a factor not considered in previous studies of the ocean's life cycle. Lab and field results show that, gram for gram, bacteria contain twice as much iron as phytoplankton.

Researchers now plan to study the role of other trace minerals in the life of oceanic microorganisms. *—D. Vergano*