Rare rocks drilled from Pangaean time

This summer, while drilling into an underwater plateau off the northwest coast of Australia, an international scientific team pulled up a rich haul of sediments chronicling the breakup of the supercontinent Pangaea, the waxing and waning of global seas and the evolution of one of the most important marine plants. Investigators on Leg 122 of the Ocean Drilling Program also collected the oldest section of sedimentary rock ever obtained during scientific ocean drilling.

"There has never been a leg where they have recovered such a diverse set of sediments," says paleontologist Timothy J. Bralower from Florida International University in Miami, who returned last week from the drilling.

For Leg 122, the drilling program focused on the Exmouth plateau. This submerged feature sits on a sunken piece of the Australian continent that was once attached to India when all the continents were assembled into a single land mass called Pangaea.

For safety reasons, previous scientific drilling projects have avoided this kind of location. Continental margins often contain pockets of oil or gas, and the program's drillship *JOIDES Resolution* is not equipped to deal with hitting a hydrocarbon deposit. For Leg 122, however, the investigators drilled near oil-company holes that had already shown an absence of deposits. The co-chief scientist of the cruise, Bilal U. Haq of the National Science Foundation, says the success of Leg 122 provides incentive for planning more drilling into the scientifically important continental margins.

The oldest sediments collected during the leg date back approximately 220 million years to the later part of the Triassic period. Made of clay and silt, these rocks formed from deposits at the bottom of shallow seas or river deltas along the coast of Pangaea.

Within the Triassic sections of rock, the shipboard crew found some of the oldest fossilized shells of calcareous nannoplankton — single-celled marine plants with a hard covering of calcium carbonate. Through the new specimens, scientists hope to gain clues about the early evolution of these tiny plants, which have been the dominant plankton in the ocean during certain periods in Earth's history, says Bralower.

Researchers also hope to use some sediments from Leg 122 to help decipher how global sea levels have wavered over time. Findings from the cores will bear on a controversy concerning whether scientists can compare sea level changes recorded on different continental margins around the world (SN: 3/7/87, p.154).

— R. Monastersky

Plastic stretches transistor science

Traditional semiconductors are made of inorganic materials such as silicon or germanium, but for nearly a decade, researchers have tried crafting semiconductors from organic polymers — the family of carbon-based materials that includes vinyl. British scientists now say they have manufactured polymer diodes and transistors that are superior in several ways to any built of polymer before. Moreover, they say, the devices eventually might double as elements for computers that use light in addition to electricity to compute.

The transistors and diodes are fashioned out of a stretchy material called polyacetylene, a collection of long, zigzagging chains of carbon atoms. Semiconductors have been made from polyacetylene before, but the newly manufactured devices are better at directing electrons — up to "three orders of magnitude better" — and have some novel properties that seem useful, report Jeremy Burroughes, Carole Jones and Richard Friend of Cavendish Laboratory in Cambridge, England, in the Sept. 8 Nature.

Usually polyacetylene semiconductors, like traditional semiconductors, need to be "doped" with impurities in order to conduct electricity. The British scientists, however, have not needed to dope their material because it has picked up some trace impurity in the processing, Friend says. Because of the relative purity of their polyacetylene, the group claims to be able to resolve a controversial question about whether defects in a molecule's electron cloud called "solitons" (SN: 6/11/83, p.378) exist in the polymer, endowing it with its conductive properties. "What we've shown is that you actually get [solitons] in the devices," he says.

Doping can also change polyacetylene's optical properties, so another advantage of not doping the mixture is that optical changes occur only when an electric field is passed through the devices. This ultimately may be useful to create a transistor-like "gate" to steer light in optical computers, Friend says. "But we're some way from that at the moment," and the new semiconductors will be used mostly to further understanding of these materials, he adds.

— C. Vaughan

Experiments challenge genetic theory

For more than 40 years, microbiologists have held that the only bacteria able to survive environmental upheavals, such as abrupt temperature shifts or food shortages, are those that have changed, or mutated, before encountering the stress. But recent experiments may prompt scientists to revise this view. Researchers at the Harvard School of Public Health in Boston say they have shown that bacteria can somehow adopt genetic traits in response to a particular environment, then pass on these acquired characteristics to their offspring.

This field has long remained dormant, says one of the researchers, in part because it is so complicated.

In one set of experiments, reported in the Sept. 8 Nature, the scientists began with a population of *Escherichia coli* bacteria incapable of metabolizing the sugar lactose. When such *lac*$^-$ *E. coli* mutate to *lac*$^+$, they acquire the ability to survive in an environment whose only source of sugar is lactose. The researchers introduced *lac*$^-$ *E. coli* to lactose and, not surprisingly, verified established genetic rules: The *lac*$^-$ *E. coli* that happened to have mutated to *lac*$^+$ before encountering lactose survive. But using complex statistical analysis, the scientists also observed that a small number of bacteria mutate from *lac*$^-$ to *lac*$^+$ when they encounter lactose.

The experiments revealed that the response was specific to the *lac* gene; other genes did not mutate in response to the lactose. The researchers conclude that bacterial mutations arise spontaneously and randomly *and* that bacteria can mutate in a more purposeful manner, to adapt to a particular environment. In other words, the two genetic views are not necessarily mutually exclusive, they believe.

John Cairns, who led the study, says he does not have the final explanation for the unexpected results, although he suggests that yet-undiscovered molecular mechanisms may provide an answer, and proposes a theory along those lines. On the other hand, evolutionary biologist Barry Hall of the University of Connecticut in Storrs, who will report findings supporting Cairns' in an upcoming issue of Genetics, says scientists in the field do not yet have enough information to propose such theories. Another possibility is that certain experimental factors, such as the culture medium changing the rate of mutation, might account for the results, suggests population geneticist Bruce Levin of the University of Massachusetts in Amherst.

Whatever the explanation, says Levin, "these experiments are important because they force scientists to reconsider an issue thought to be closed."

— M. Hendricks