

EARTH SCIENCES

Susan West reports from the Second Maurice Ewing Memorial Symposium, "Implications of Deep Sea Drilling Results in the Atlantic Ocean"

DSDP: Clues to margin faulting . . .

As William Benson of the National Science Foundation said at the recent Ewing Symposium on deep sea drilling, "There is no hypothesis about a third dimension of land or sea that we haven't had to change when we've gotten drilling samples." Core samples from the Deep Sea Drilling Project often have destroyed theories based on other means such as seismic reflection profiling. But some theories have stood the test.

Lucien Montadert of the Institut Francais du Petrole presented data from core samples in the eastern Atlantic near France and Spain that confirm the hypothesized model of faulting along the continental margins. The samples are from the "starved" continental margin — an area lacking the typical heavy load of sediment. This allowed researchers to attack the problem without the variable of sediment loading. The model and evidence agree: As spreading started, the brittle crust extended and broke into blocks that tilted and rotated along the fault lines. Heated ocean crust pushed the blocks, "healed" the faults and the margins subsided as the crust cooled. The samples show that extension and thinning of the crust caused rifting rather than swelling from beneath.

sea level changes . . .

Anthony Watts of Lamont-Doherty Geological Observatory offered support for Benson's axiom. Watts and Michael Steckler, also from Lamont-Doherty, tackled one of the major unknowns in oceanography: sea-level changes through the ages. Researchers have estimated the rise and fall of the sea from the types and location of fossil deposits and from changes in the volume of ocean crust, but these indirect means leave much of the detail to the imagination. Watts seems to have found a more direct way. He chose sites near the continental margin where sinking due to cooling follows a simple curve and can easily be factored out of any model. Proprietary data from oil wells off the coast of New York and Nova Scotia provided three pieces of information: the depth where each sediment layer was found, its thickness and its porosity. Adding the pieces, the researchers found how much the sediment had packed. They factored out the forces of cooling and sediment loading. The remaining force, the weight of the water, is directly related to depth. Though the results are preliminary, Watts says their sea level curve is consistently lower and rises more gently than the reigning model.

and spreading

And yet another theory is felled by the loot of the *Glomar Challenger*. William B.F. Ryan of Lamont-Doherty added up a few bits of drilling evidence and came up with a theory about the onset of spreading and sinking of the margins.

The standing theory proposes long and intense heating of the upper mantle (lithosphere and athenosphere). The mantle swelled, lifting the crust. Erosion thinned the crust and it broke. The margins slid apart and sank as the mantle cooled.

First, Ryan says, the thickness of the mantle means it would have had to cook about 50 million years before it would expand. Core samples dispute this; they show the initial split took much less time. Second, evidence from studies such as Montadert's shows that the crucial uplift did not occur.

Ryan's theory is based on "subsidence by cooling that doesn't require heating." He proposes a five-million-year stretching phase of the lithosphere that thinned the brittle crust and broke it into Montadert's blocks. Stretching left cavities above and below the lithosphere. Thinning of the crust caused the margins to sink into the upper cavity. The hot athenosphere filled the lower cavity, cooled and became new lithosphere.

BIOLOGY

A taste of firefly

Fireflies taste bad, but their flavor protects them against predators. Cornell University researchers now have discovered three closely related compounds responsible for the firefly's unpalatability. The chemicals, named "lucibufagins" by Thomas Eisner and colleagues, are steroidal pyrones. Such chemicals had been found previously only in the venom of some toads and in squill, a Mediterranean lily-like plant.

A taste panel of thrushes helped identify the new compounds. The birds rejected three species of fireflies and only a few other types of insects from a selection of 500 specimens. The researchers extracted chemicals from fireflies and applied the extracts to mealworms (a normal laboratory food). More than half the mealworms treated with lucibufagin were rejected or left untouched, while only 7 percent of untreated mealworms went uneaten. Birds that did eat a firefly or a lucibufagin-treated mealworm sometimes vomited, suggesting that the chemicals might have a systemic toxic effect in addition to being potent repellents.

Lucibufagins have an immediate action on the predator. Often the fireflies are rejected soon enough to survive. Ten of 30 fireflies rejected by the laboratory birds escaped the pecking with no noticeable injury. The researchers hypothesize in the February PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES that fireflies produce the lucibufagins from cholesterol in their diet.

Not two, but three genetic messages

Compacting of genetic information has reached its limit. Last year Fred Sanger and colleagues at the Medical Research Council in Cambridge, England, surprised biologists with their discovery that the same stretch of DNA in a small virus contained the blueprints for two completely different proteins (SN: 11/13/76, p. 310; 3/5/77, p. 149). The trick is that during gene expression the nucleotide "letters" are grouped into different three-letter "words" that specify amino acids. Now some of the same investigators using a new technique to determine the nucleotide sequence in DNA have examined a related small virus called G4. The same regions of overlapping genes exist in G4 as in the previously sequenced virus, phiX174. But a third region of overlaps demonstrates even greater efficiency, the researchers report in the April 6 NATURE. One gene (K) completely overlaps the spans of two other genes, which themselves overlap by two nucleotides. In this and one other area the coding capacity of the DNA is used in all three possible "reading frames." The sequence TGATG is grouped TGA-TG, T-GAT-G and TG-ATG in the three genes. The protein product of gene K had not been known before the sequencing, but now has been isolated and analyzed. Although relatively large amounts of protein K are present in G-4 infected bacteria, its function is not yet known.

Weeds safely slumber

Sleeping leaves catch less herbicide, a U.S. Department of Agriculture agronomist told a recent meeting of the Weed Society of America. Robert N. Andersen advises that spraying herbicide on the weed velvetleaf early in the morning or late at night is not as effective as spraying in the middle of the day. During velvetleaf's daily "sleep," from late afternoon until morning, its large, circular leaves droop to a nearly vertical position. In greenhouse experiments, Andersen and Willard L. Koukkari of the University of Minnesota found that herbicide that kills the weeds at midday shows as little as 28 percent damage at night. However if the leaves are mechanically supported so they do not droop, herbicide is effective day and night.