Buoyancy key to Caribbean evolution

Tracing the evolution of the Caribbean plate is as difficult as keeping track of the tumultuous politics of the Central American countries that ride atop it. It is an area of unusual geology and perilous geophysics (SN: 10/9/76, p. 234); an area that gives few clues to its history. But a theory of Caribbean plate evolution recently proposed by investigators at the State University of New York at Albany may strip away some of the mystique.

The Caribbean has tried hard to hide its past. Most researchers accept that the Caribbean ocean floor formed during the Jurassic and Cretaceous times (beginning about 180 million years ago) when the Atlantic opened between the bulge of Africa and the east coast of North America. However, the ocean basement samples that could confirm or deny the theory have never been obtained because they are topped by sediments which lie two kilometers thick in some places. Usually the history of an ocean floor can be read from the magnetic field reversals that mark sea-floor spreading ridges. But an invasion of magma into most of the Caribbean ocean crust about 80 million years ago wiped out the telltale pattern.

The intrusion of volcanic rock is responsible for still another curious feature. Based on its age and on the weight of the overlying sediments, the ocean floor in that region should lie five to six kilometers below sea level, yet it is one to two kilometers shallower than predicted. After it was discovered, researchers proposed that the magmatic intrusion made the crust abnormally thick and, because magma is less dense than normal mantle, more buoyant than surrounding crust. The thicker, buoyant crust, in turn, created a shallower sea.

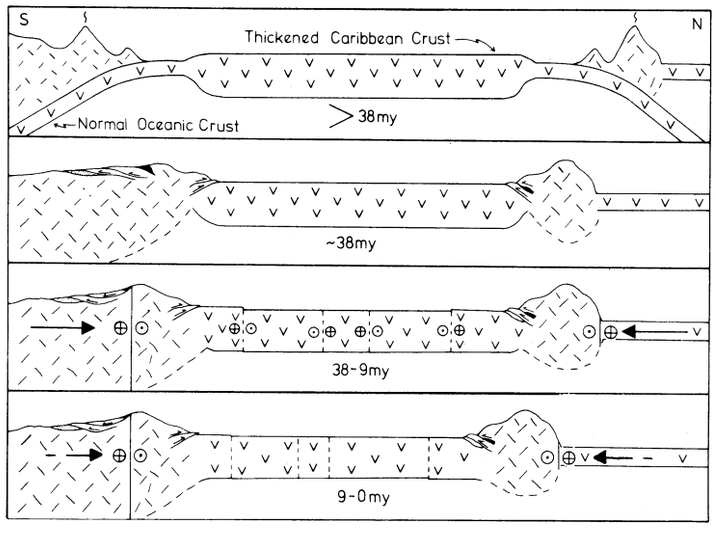
This buoyancy is the key to analyzing the evolution of the Caribbean plate, according to SUNY researchers Kevin Burke, Paul J. Fox and A. M. C. Sengör reporting in the Aug. 10 JOURNAL OF GEOPHYSICAL RESEARCH. Burke and his colleagues suggest that the island arc trenches at the edges of the North American and South American plates nibbled progressively at the normal Caribbean floor until about 40 million years ago, when only the abnormally buoyant floor was left. Previous research has shown that the shape and motion of the Caribbean plate changed radically at that time. The change resulted from the arrival of the thicker and shallower crust at the trenches, the researchers hypothesize.

As any Halloween party veteran knows, it's hard to bite into a bobbing apple. Similarly, buoyant ocean crust is more difficult to swallow or subduct than denser, normal ocean crust. "It's our idea that all the regular pieces went down the tube except this indigestable bit," Burke told SCIENCE NEWS.

Though pressure continued from the northern and southern plates, the indigestable floor could no longer be normally subducted. Burke says transform faults to the north and south noted by earlier research and subduction of the Atlantic and Cocos plates were the earth's means of dealing with the Caribbean anomaly.

In addition, since 38 million years ago, the Caribbean plate has shortened about 200 kilometers from north to south. The shortening could not have resulted from subduction or from transform faulting as earlier suggested, Burke and colleagues maintain. Rather, they suggest that the Caribbean floor behaved in a style intermediate to oceanic and continental crust, by folding and faulting internally, a process that Burke says resembles that which formed the Alpine-Himalayan system. They attribute the hybrid behavior to the floor's unusual character.

Burke says the theory can be confirmed only by further drilling at the north and south margins of the plate. Though the floor has stubbornly held its own the last 40 million years, "it seems likely" it will eventually be consumed. □



Before 38 million years ago, normal ocean crust was consumed in the Caribbean. When the plates hit buoyant crust something had to give. What gave was the thick, shallow crust, behaving somewhere in between oceanic and continental crust.

Mandatory coal scrubbing

All new coal-fired power plants will have to scrub, or clean, coal equally, regardless of a coal's sulfur content, according to regulations proposed by the Environmental Protection Agency this week. Stack-gas scrubbers use chemical-mechanical cleaners to wash and dust emissions.

Electric utilities and the Department of Energy have criticized this approach for removing any incentive to burn less polluting, low-sulfur coal. Plants emitting less than 0.2 pounds of sulfur per million btus of coal burned would be exempt. This level is believed so low, however, that few if any plants would likely comply. EPA will consider less severe alternatives before it issues final regulations in six months, such as partial scrubbing of all plants, with a sliding scale for how much more is required being determined by a coal's sulfur content. □

Solar-energy policy review

On Sun Day, May 3, President Carter ordered formation of a Cabinet-level domestic review of solar energy to develop policy options and recommendations — for presidential consideration — that would speed development and ultimately lower the cost of solar power. An 81-page draft was released this week. Prepared by a task force representing more than 30 federal departments and agencies, its goal was to outline a strategy for pulling together federal, state and private efforts to accelerate use of solar energy. The report mentions 75 areas within five major energy-consuming sectors, where federal involvement might prove helpful. □

Tuition-free degree

The University of Dayton is offering a tuition-free educational program to train women for careers in chemical and electrical engineering. The year-long, 35-credit-hour course is available to women who completed bachelor's or master's degrees in mathematics, chemistry or physics between 1950 and 1977. Women completing the course will have fulfilled all the technical requirements of the university's engineering-degree program and will receive a certificate explaining their training. If their previous course work fulfills other university degree requirements, the women will be eligible for an engineering degree at no additional cost. Counseling, tutoring, a refresher course in math and some living stipends are among support services offered entrants. Applications will be accepted through October 10 for the program beginning January 8; interested persons should contact Carol Shaw, assistant dean of engineering. □