# Central America: Jigsaw origin?

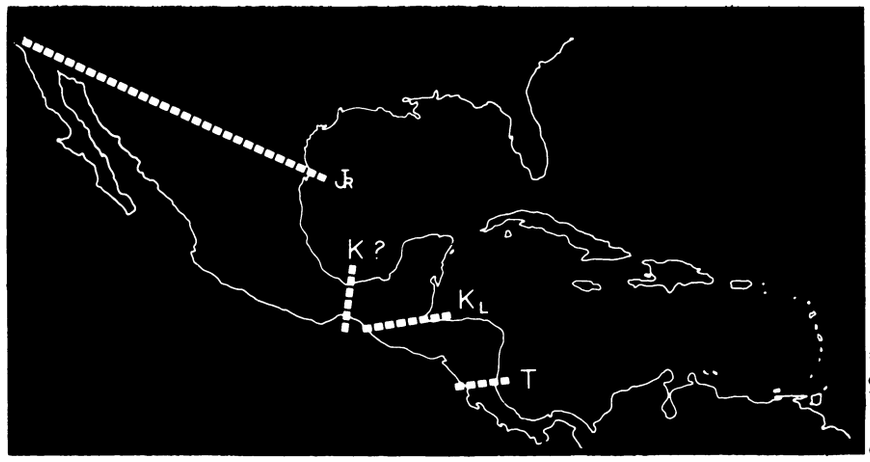
In any reconstruction of Pangaea — the postulated ancient land mass that broke apart to form the present-day continents — Central America has always been a problem. There wasn't quite enough room for it between North America and South America — geologists began proposing wierd configurations of overlapping continents — and the geology of the area is entirely different from that of the lands to the north and south. Researchers speculated that the central mass may have come from someplace else, but where, how and when have gone unexplained.

Now, Wulf A. Gose and Gary R. Scott of the Marine Science Institute at the University of Texas at Austin may have some answers to those mysteries. At the annual meeting of the Geological Society of America, held recently in San Diego, Gose described data indicating that Central America is actually made of four (or more) microplates that drifted from somewhere in the Pacific, falling in place one after another as North America and South America separated.

Using a tool called paleomagnetism — a technique that gives the ancient position of a piece of rock relative to the pole — Gose and Scott examined more than 2,500 sedimentary drill cores from Central America. They found that the region could be divided roughly into four parts — Mexico, the Yucatan, Honduras and Nicaragua-Costa Rica — based on the timing of their motion relative to the pole before they joined North America. Mexico, for example, showed a 60° counterclockwise rotation during the Permian and Triassic periods, ending about 180 million years ago when its relative pole position began to match that of North America. Honduras, on the other hand, showed clockwise, then counterclockwise rotation during the Cretaceous — 150 to 165 million years ago. Nicaragua and Costa Rica had pole positions different from that of North America until about 70 million to 60 million years ago.

These data, accumulated since 1975 and "put together in the last two weeks" before the meeting, indicate to Gose and Scott that "as South America moved away from North America [about 200 million years ago] one piece of real estate after another moved into place." Mexico, Gose says, came from somewhere south of the equator, moved a little north of its present position and slipped into place as soon as the two continents gave it room. Honduras began at its present latitude, moved northward, then fell in place. Nicaragua and Costa Rica remained at the same latitude, sliding into position last.

Though Gose says "it is clear that it all came from the Pacific," exactly where is less certain. Paleomagnetic data give only the ancient latitude and position relative to the pole so that the exact location and relationship of the pieces is unknown, but Gose says his "gut feeling is they were all one piece."




*Dotted lines mark the suture lines between four pieces of Central America believed to have come from the Pacific.*

And "the beauty of it," he says, is that a variety of evidence supports his hypothesized sequence of events. For instance, large salt domes formed in the Gulf of Mexico during the mid-Jurassic — about 165 million years ago. Salt domes can form only in enclosed basins; according to Gose and Scott's data, Mexico had recently moved into place, closing off the basin, by that time. Paleontological evidence — warm-climate, then cool-climate fossils found in the sediment cores — also supports the movement Gose and Scott suggest. The regional geology, though not well studied, indicates that microplates were all of one, or very similar, geologic origin. And the suture zones, now fault zones, between the pieces — most of which have been described or are active — have dates that correspond to the hypothesized timing of their creation. □

# Vitamin A and genetic machinery

Nutrition research is coming of age, and vitamins — once regarded mostly as dietary supplements — are assuming a major role. Vitamin A, researchers have learned, may play a part in cancer prevention, is necessary for the growth and development of the epithelial cells that line the cavities of the body and plays an essential role in vision. Now, National Institutes of Health scientists say that vitamin A may be even more important than they thought; it may affect the cells in a hormone-like fashion and interact directly with their genetic machinery. These findings were presented by Gerald R. Chader of the National Eye Institute at a recent NIH seminar on nutrition research.

Using epithelial cells from a retinoblastoma (cancer of the retina), Chader and co-workers incubated the cells with radioactive vitamin A. They were then able to explore the activities of both vitamin A and its metabolic end product, retinoic acid. Vitamin A, the researchers found, was not metabolized but traveled into the cytoplasm of the cells, where it seemed to bind to a protein receptor.

But the retinoic acid, somewhat to the researchers' surprise, migrated directly into the cell nucleus, where it became bound to a separate receptor and possibly to the genes themselves.

This is the first known evidence that a vitamin A compound could interact with the genetic machinery of cells, Chader says. It is possible, he added, that the cancerous origins of the retinoblastoma cells influenced the compound's behavior. This could be significant, since other researchers have found that in animals, pretreatment with vitamin A reduces tumor production by known cancer-causing chemicals.

The clinical applications of the research are uncertain at this point, Chader says, but it may prove useful in developing treatments for keratomalacia, a devastating vitamin-A deficiency disease that leads to blindness. During the visual cycle, first defined by Nobel laureate George Wald of Harvard, vitamin A binds to a retinal protein called opsin to form the visual pigment rhodopsin. Without vitamin A, rhodopsin is not formed. Vitamin A also stimulates fluid secretion by the epithelial cells of the eye, so when the supply of dietary vitamin A is inadequate, the cornea of the eye becomes dried, or keratinized. The cornea then becomes very vulnerable, and even a slight nick or scratch may cause it to perforate, which leads to irreversible blindness. The disease is the major cause of blindness in young children in most developing countries, and is estimated to affect hundreds of thousands of children around the world. Its progress can be halted but not reversed with treatment. □