New Arrangement of Southern Continents

Over 50 years ago, German meteorologist Alfred Wegener proposed that continents are like huge wandering rafts, which originally (some 300 million years ago) broke free and floated away from a single primordial land mass called Pangaea. Although reconstructing the mammoth jigsaw puzzle of the continents can be done roughly well by any child studying a world map, detailed accommodation of this or that piece of land still inspires scientific debate.

The latest contribution to this dialogue was reported last week by a group of scientists from the University of Miami's Rosenstiel School of Marine and Atmospheric Science at the American Geophysical Union meeting in Washington. They quote evidence that suggests Gondwanaland, massive primeval precursor of the southern continents, looked a bit different from what is currently believed.

The notable differences between theirs and the classical arrangement of continents are that the Antarctic peninsula curls around, instead of to the east of, the long finger of South America, and Madagascar is placed opposite Mozambique, instead of Kenya. Furthermore, the close fit between Australia and India eliminates the presence of a hypothesized waterway, Sinus Australis.

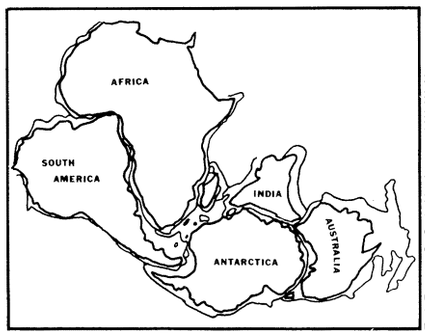
Of the several discrepancies, the one involving Madagascar is the most controversial. The battleline in this issue is unmistakenly drawn between two principal opinions that Madagascar was either in the northerly or southerly position.

The authors of the new grouping, Eric J. Barron, Christopher G. A. Harrison and William W. Hay, were compelled to place Madagascar in the southern paleoposition because of geophysical information obtained from the Mozambique channel and some history of the Kenyan coast.

They found Jurassic basalt deposits on either side of the Mozambique channel that match up Madagascar with the coast of southern Africa. According to Harrison, basalts of this kind are often found along the sutures of continental splitting, because they are produced by the volcanic activity that is associated with the fragmentation.

Furthermore, old deepsea sediments found off the coast of Kenya indicate that from a very early period, the coastal part of Africa was exposed to the ocean. This, they surmise, could not have been the case if Madagascar had been situated there.

Besides these researchers, a number of others have announced their endorsement of a similar nonclassical arrangement of the southern continents. Among them is Rhodes W. Fairbridge of Columbia University, who generally corroborates this new view in a forthcoming issue of GEOLOGY, but for somewhat different reasons. For one thing, he cites evidence for a Permian (about 260 million years old) marine basin that seems to have straddled what would be the boundary between Africa and Madagascar in the southerly position. The marine sediments found both in southern African rock and in the soil of Madagascar suggest that the two locations were once united.



The proposed new look of Gondwanaland.

He also emphasizes that the alignment of faults existing in the area goes contrary to any attempt to position proto-Madagascar opposite Kenya. If that were its original station, he says, then it would have needed to retrogress against the flow generally ascribed to movements in the area, for example that which carried India away to its present site.

Other evidence for Madagascar's southerly location comes from some measurements by Jan Kutina of American University. He mapped the distribution of land fractures along the southern African coast and on Madagascar itself. The two patterns he found match up remarkably well if one adopts the southerly arrangement of proto-Madagascar.

The Miami authors observe that the dispute will be settled quite swiftly when measurements of magnetic seafloor spreading anomalies are made in the area. The general pattern of magnetism frozen into the seabottom rock throughout these past millions of years is literally a history book, which when read can verify if Madagascar did indeed pull away from Mozambique. These measurements could be taken within the next several years, although no specific plans now exist. □

Prediction of ozone loss down, and up

The chemistry of the atmosphere is an intricate tangle of dynamic components with many interactions. Scientists have dealt with that complexity by designing computer models of the atmosphere and then plugging in their best observations and estimates. Because the elements of the model are all interrelated by numerous equations, an improved measurement of one value can have far-reaching ramifications.

Direct laboratory measurements of a critical reaction have now led scientists to revise their predictions of potential depletion of the ozone layer by human activities. The newest data decrease the predicted damage by supersonic aircraft, but increase the potential threat by chlorofluorocarbon aerosol sprays.

Carleton J. Howard of the National Oceanic and Atmospheric Administration developed a technique that uses lasers to detect quantities of gases as small as one-part-per-trillion. He and Kenneth M. Evenson of the National Bureau of Standards discovered that one reaction, the combination of nitric oxide and hydroperoxyl radicals (HO_2), occurs 10 to 40 times more rapidly than previously estimated, Howard reported at the meeting of the American Geophysical Union last week in Washington.

The researchers took their new value to "the Boulder oracle," Paul Crutzen of the National Center for Atmospheric Research in Boulder, Colo. Crutzen and John McAfee of the Aeronomy Laboratory inserted the new value into their computer model to see whether it would significantly change their predictions of atmospheric trends. The revised reaction rate set off a chain of modifications. "The effects of these changes are most dramatic when the computer model is used with the new measurement to predict ozone depletion by high-flying aircraft such as the SST and by chlorofluoromethanes—the so-called fluorocarbons," Howard said.

The revised model indicates that chlorofluorocarbons are about 35 percent more destructive to the earth's ozone layer than was previously estimated. Crutzen's model predicts that in 1976 the amounts of fluorocarbons in the atmosphere would destroy 1.2 percent, instead of 0.9 percent, of the ozone layer.

Crutzen and McAfee also now predict that high-flying aircraft, such as the Concorde SST, would destroy only about half as much ozone as previously believed. When Howard's new reaction rate was inserted into the computer models of several other research groups, it caused them to predict that low-altitude subsonic planes may actually produce small amounts of ozone.

The new rate constant will also affect studies of reactions closer to the ground.

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