Studies of ancient supercontinent don't match up

November 26 2007

For a quarter-century or more, the prevailing view among geoscientists—supported by paleomagnetic records in rock—has been that the portion of the ancient supercontinent of Pangea that is now the Colorado Plateau in southern Utah shifted more than 1,300 miles north during a 100-million-year span that ended about 200 million years ago in the early Jurassic Period, when Pangea began to break up.

But new research by a team of geoscientists from the University of Michigan and the University of Nebraska-Lincoln challenges that theory, based on extensive climate modeling studies and sedimentary records found from Wyoming into Utah and Arizona.

In a paper published in the Nov. 23 issue of the journal *Science*, U-M geophysicist Rob Van der Voo and co-authors report findings that indicate the area must have remained at the equator during the time in question.

"It's a puzzle, a 'conundrum' is the word we like to use," said Robert Oglesby of UNL. "And in the Science paper, we're not solving the conundrum, we're raising the conundrum."

The puzzle revolves around ongoing research by UNL researcher David Loope in the Colorado Plateau. A sedimentologist and an expert on dune formation, Loope found that from central Wyoming into central Utah, ancient dunes preserved in the region's sandstone formations from 300 million to 200 million years ago all faced southwest, meaning that the winds over that extensive area were almost constantly from the northeast.

As his study progressed, he discovered that the direction of the dunes shifted to the southeast in what is now southern Utah, meaning the wind direction shifted to the northwest. What's more, those prevailing winds were consistent over the entire 100 million years in question and the shift in wind direction could only have occurred at the equator.

"I thought that was very curious," Loope said. "It didn't seem to fit with what we think we know about where the continents were."

Loope is also a paleoclimatologist (someone who studies ancient climates), as are his UNL co-authors Oglesby and Clinton Rowe. The three geoscientists began working together, trying to find a computerized climate model that would explain the discrepancy, but they couldn't find one that worked.

"We ran the model in any different number of configurations just to see if we could make it do something different," Rowe said. "It didn't matter what we did to it, as long as you had some land, and it was distributed north and south of the equator, you would end up with this monsoonal flow that matched these records from the dunes. The equator is the only place you could get this large-scale arc of winds that turn from the northeast to the northwest as they moved south. Nowhere else would you get that as part of the general circulation unless the physics of the world 200 million years ago was very different from what it is today. And we just don't think that's the case."

Puzzled by the discrepancy between their research and the paleomagnetic records, they turned to Van der Voo, an expert on paleomagnetism.

Paleomagnetic records are found in igneous rocks that permanently record the direction of the Earth's magnetic field at the time they solidify from the molten state. They're an important tool for geoscientists in tracking the movement of Earth's tectonic plates over time, and records in North America indicate that the Colorado Plateau moved from the equator to about 20 degrees north latitude from 300 million years ago to 200 million years ago.

"We brought Rob in to try to see if he could help us sort it out, and he's like, 'Gosh, guys, I don't know. This is a conundrum,'" Oglesby said. "It's important to note that we have not just a paleomag person as a co-author, but arguably the best-known paleomag person in the world—and he's as confused as we are."

"The nicest thing would have been if we had a solution, but we don't," said Van der Voo, the Frank H. T. Rhodes Professor of Geological Sciences at U-M. "All we can say is that we have this enigma, so perhaps our model of Pangea for the period in question is wrong or the wind direction didn't follow the common patterns that we recognize in the modern world. Neither seems likely, but we're bringing this inconsistency to the attention of the scientific community in hopes of stimulating further research."

Van der Voo's co-authors agree there's only one thing to do: keep attacking the problem.

"We'll come up with everything we can possibly think of," Oglesby said. "From the point of view of the climate model, the paleogeography, the vegetation, the topography, local-scale vs. large-scale, paleomag, going back and rethinking everything that the dunes tell us. We'll go back to square one in everything, trying to figure it out."

In addition to Van der Voo, Loope, Oglesby and Rowe, former UNL graduate student Charles Broadwater was a co-author on the paper.

Source: University of Michigan