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Source: [Indiana University](#)

Date: September 28, 2006

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Dinosaurs' Climate Shifted Too, Reports Show

Ancient rocks from the bottom of the Pacific Ocean suggest dramatic [climate](#) changes during the dinosaur-dominated Mesozoic Era, a time once thought to have been monotonously hot and humid.

In this month's *Geology*, scientists from Indiana University Bloomington and the Royal Netherlands Institute for Sea Research present new evidence that ocean surface temperatures varied as much as 6 degrees Celsius (about 11 degrees Fahrenheit) during the Aptian Epoch of the Cretaceous Period 120 million years ago.

The finding is relevant to the ongoing climate change discussion, IUB geologist Simon Brassell says, because it portrays an ancient Earth whose temperatures shifted erratically due to changes in carbon cycling and did so without human input.

"Combined with data from the Atlantic, it appears clear that climate changes were taking place on a global scale during this time period," said Brassell, who led the study.

A previous study from an Atlantic Ocean site had suggested a changeable climate around the same time period. But it was not known whether the Atlantic data indicated regional climate change unique to the area or something grander.

"We had virtually no data from the middle of the largest ocean at that time period," Brassell said. "The data we collected suggest significant global fluctuations in temperature."

As part of the National [Science](#) Foundation's Ocean Drilling Project, the geoscientists voyaged in 2001 to Shatsky Rise, a study site 1,600 kilometers (1,000 miles) east of Japan and 3,100 meters below the ocean surface. Shatsky Rise is known to have formed at the end of the Jurassic Period immediately prior to the beginning of the Cretaceous, the last period of the Mesozoic Era.

The scientists' vessel, the JOIDES Resolution, is specially outfitted with a drill that can be lowered to the sea floor for the collection of rock samples.

The drill bit was driven 566 meters into Shatsky Rise. Rocks freed by the drill were transported directly to the surface for analysis. The rocks corresponding to early Aptian time were extremely rich in organic material. By analyzing the carbon and nitrogen content of the samples, the geochemists found evidence for changes in carbon cycling and in nitrogen fixation by ocean biological communities associated with changing climate. A special analysis method targeting certain complex carbon-containing molecules provided values for a measurement called TEX86 that revealed mean temperature variations between 30 deg C (86 deg F) and 36 deg C (97 deg F) with two prominent cooling episodes of approximately 4 deg C (7 deg F) in tropical surface temperatures during the early Aptian. By comparison, today's tropical sea surface temperatures typically lie between 29 and 30 deg C.

Brassell says that findings of a changeable climate during the Cretaceous, a time period dominated by [dinosaurs](#) and noted for the spread of flowering plants, could influence the current climate change debate.

"One of the key challenges for us is trying to predict climate change," Brassell said. "If there are big, inherent fluctuations in the system, as paleoclimate studies are showing, it could make determining Earth's climatic future even harder than it is. We're learning our climate, throughout time, has been a wild beast."

IU Bloomington Geological Sciences graduate student Mirela Dumitrescu and Royal Netherlands Institute for Sea Research scientists Stefan Schouten, Ellen Hopmans and Jaap Sinninghe Damsté also contributed to the report. It was funded with grants from the Geological Society of America and the IU Bloomington Department of Geological Sciences, with ongoing research support from the



U Bloomington geochemist Simon Brassell (right), Penn State sedimentologist Michael Arthur (middle), and Tohoku Univ. sedimentologist Harumasa Kano (left) inspect an ancient shale aboard the JOIDES Resolution research vessel. (Credit: Ocean Drilling Program)

National Science Foundation, the United States Science Advisory Committee, and the American Chemical Society. A related paper by Mirela Dumitrescu and Simon Brassell recently won the 2006 Best Paper Award from the Organic Geochemistry Division of the Geochemical Society.

More information about the Ocean Drilling Program can be found at <http://www.oceandrilling.org/>.

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