Research links uplifting continents to crashes in biodiversity on Earth

February 22 2012

(PhysOrg.com) -- A mysterious cycle of booms and busts in marine biodiversity over the past 500 million years could be tied to a periodic uplifting of the world's continents, scientists report in the latest issue of *The Journal of Geology*.

The researchers discovered periodic increases in the amount of the isotope strontium-87 found in marine fossils. The timing of these increases corresponds to previously discovered low points in marine biodiversity that occur in the fossil record roughly every 60 million years. Adrian Melott, professor of physics and astronomy at the University of Kansas and lead author, thinks these periodic extinctions and the increased amounts of strontium-87 are linked.

"Strontium-87 is produced by radioactive decay of another element, rubidium, which is common in igneous rocks in continental crust," Melott said. "So, when a lot of this type of rock erodes, a lot more Sr-87 is dumped into the ocean, and its fraction rises compared with another strontium isotope, Sr-86."

An uplifting of the continents, Melott explains, is the most likely explanation for this type of massive erosion event.

"Continental uplift increases erosion in several ways," he said. "First, it pushes the continental basement rocks containing rubidium up to where they are exposed to erosive forces. Uplift also creates highlands and mountains where glaciers and freeze-thaw cycles erode rock. The steep

slopes cause faster water flow in streams and sheet-wash from rains, which strips off the soil and exposes bedrock. Uplift also elevates the deeper-seated igneous rocks where the Sr-87 is sequestered, permitting it to be exposed, eroded and put into the ocean."

The massive continental uplift suggested by the strontium data would also reduce sea depth along the continental shelf where most sea animals live. That loss of habitat due to shallow water, Melott and collaborators say, could be the reason for the periodic mass extinctions and periodic decline in diversity found in the marine fossil record.

"What we're seeing could be evidence of a 'pulse of the earth' phenomenon," Melott said. "There are some theoretical works which suggest that convection of mantle plumes, rather like a lava lamp, should be coordinated in periodic waves." The result of this convection deep inside the earth could be a rhythmic throbbing—almost like a cartoon thumb smacked with a hammer—that pushes the continents up and down.

Melott's data suggest that such pulses likely affected the North American continent. The same phenomenon may have affected other continents as well, but more research would be needed to show that, he says.

The co-authors on the study were Richard Bambach of the National Museum of Natural History, Kenni Petersen of Aarhus University, Denmark, and John McArthur of University College London.

More information: Adrian L. Melott, Richard K. Bambach, Kenni D. Petersen, and John M. McArthur, "A ~60 Myr periodicity is common to marine-87Sr/86Sr, fossil biodiversity, and large-scale sedimentation: what does the periodicity reflect?" *The Journal of Geology* 120:2 (March 2012, forthcoming).

Provided by University of Kansas