EARTH SCIENCES

From our reporter at the annual meeting of the Geological Society of America in Denver

Ancient 'dubiofossils' of Wyoming

A diverse array of tubelike structures found in Precambrian rock on a mountain in southern Wyoming has the scientists studying them in a quandary. The series of curving indentations of various configurations look like the fossil traces of wormlike metazoan animals. There is only one problem: They are a billion years older than any previous proven metazoan fossil. And that seems way too old to be possible.

The structures, some of them sinuous tubes up to 20 centimeters long, occur in the upper Medicine Peak quartzite of southern Wyoming. The quartzite, slightly metamorphosed, displays well-preserved sedimentary structures formed when submerged near shore in a shallow lake bed. The quartzite has been indirectly dated at 2.0 billion to 2.5 billion years old. Metamorphism in the overlying and underlying schists is dated at 1.65 billion and 1.55 billion years old, respectively.

The tubelike forms resemble metazoan burrows in many ways, report Erle G. Kauffman of the U.S. National Museum in Washington and James R. Steidtmann of the University of Wyoming. Their shape and distribution preclude immediate interpretation as inorganic. But there is as yet no clear proof that their origin is biological either.

Kauffman reports no fewer than seven lines of evidence for biological origin, including the fact that all the forms have Cambrian and younger counterparts considered to be biogenic. Their size and density is identical to known biogenic structures of similar form, and their frequency decreases downward from bedding planes that once were on the surface just as you would expect with burrowing animals. The size frequency distribution of maximum tube diameter fits the pattern of living populations of organisms, and shallow-water environments like those with which they were originally associated would seem perfect for diverse communities of burrowing organisms if any existed.

Nevertheless, Kauffman says he believes the "odds are overwhelming" against their being biological. If they are organic, he says, "they present a considerable engima." They are a billion years too old (if all other evidence is a guide) and they are too diverse and too abundant. He calls them dubiofossils.

"They are possibly biological in origin, possibly not." As he put it in concluding his presentation: "They are the right shapes in the right place at the wrong time."

Tides in the interior American seaway

Whether the Interior Cretaceous seaway of western North America of about 100 million years ago had normal astronomical tides has often been in question. The answer is of great importance to workers studying the paleoenvironments of the near-shore areas of this past waterway and to paleoecologists interested in the marine invertebrates near shore.

A widely read text, *Time in Stratigraphy* by A. B. Shaw, concluded that the ancient interior seas like the one in western North America should have lacked astronomical tides. There was geological evidence attributable to tides, such as near-shore sediments that show signs of bidirectional flow of water, but the possibility remained that shifts in wind direction might have been responsible for that.

The strongest evidence indicating tides, says Thomas A. Ryer of the U.S. Geological Survey in Denver, is paleontological. The evidence includes the presence of diverse marginal-marine animal groups, some of which contain organisms normally restricted to marine conditions; the presence of groups of organisms closely related to modern organisms that require habitats subjected to tidal fluctuations of water; and the presence of lunar monthly clustering of daily growth increments in shells of shallow-marine bivalves. These lines of evidence, says Ryer, "all point conclusively to astronomical tides."

In fact, he says, the Arafura Sea, between Australia and New Guinea, has a configuration and distribution of water depths much like those reconstructed for the Interior Cretaceous seaway of western North America. He offers it as a modern analog.

Indian Ocean climate 18,000 years ago

One of the important parts of the worldwide effort to better understand climatic change is to precisely map the climates of different parts of the earth for specific times in the past. The initial maps for a paleooceanographic reconstruction of the Indian Ocean at 18,000 years ago have now been completed. They are reported by W. L. Prell and five colleagues from the CLIMAP program at Brown University plus A. W. H. Be and K. Geitzenauer of Lamont-Doherty Geological Observatory.

The maps, derived from more than 40 core samples, show sea surface temperatures of the Indian Ocean for August and February 18,000 years ago. They show that the general temperature structure of the Indian Ocean did not change as much as the Atlantic and Pacific Oceans. The August map reveals that temperatures north of the equator were similar to those of today but that the southern boundary of the warmer surface waters (27°C) moved north by about 10° latitude. South of 20°S, surface waters showed significant cooling.

The February map shows that the extent of warm water (27°C) was greatly restricted, especially from the equator to 15°N, so that the Arabian Sea and Bay of Bengal were cooler than present. Waters off South Africa were 4°C cooler than now.

Quickness of climate reversal

How fast does climate change from glacial to interglacial periods? The question is of crucial importance. J. H. Mercer of Ohio State University's Institute of Polar Studies reports that in southern Chile the deglaciation that began about 13,000 years ago was very rapid. The ice had receded into the mountains by 12,500 years ago and to within its present borders by 11,000 years ago. "Thus," he says, "temperatures must have risen from full glacial to full interglacial levels in no more than 2,000 years between 13,000 and 11,000 years before present."

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On a much longer time scale, James D. Hays of Lamont-Doherty Geological Observatory reports that his studies of deep-sea cores from the Antarctic and South Atlantic show that transitions from relatively warm to succeeding colder intervals during the period 200,000 to 80,000 years ago always occur in less than 10,000 years. The range is from 4,000 to 8,000 years, and the average is 5,000 years.

Audible microquakes off Cape Fear

For at least a decade, audible seismic disturbances have been reported in the Cape Fear, N.C., area. Reports include booming noises, falling plaster and rattling doors. There are some colorful folk names for the noises, and one common folk theory is "the continental shelf is falling off." Manmade origins seem to have been ruled out. David M. Stewart and Kenneth B. Taylor of the University of North Carolina present five sets of facts for a natural origin and conclude: "Our tentative hypothesis is that they are shallow submarine microearthquakes."