New view surfaces of ancient Atlantic

Most geologists believe an ocean similar in size to the North Atlantic occupied that same general area about 500 million years ago. A British geologist now suggests this ocean looked not like the open body of water that today separates Europe from North America, but instead like a smaller version of the island-dotted sea between Southeast Asia and Australia.

This cluttered sea would have flanked a larger ocean to the south, says Roger Mason of University College in London. Although other geologists accept Mason's geographic analogy, few appear to agree with the small size he proposes for the North Atlantic's ancient predecessor.

Mason's evidence for a smaller northern sea rests on Scandinavian rocks previously identified as ocean-floor fragments. These rocks derive from the bases of volcanic islands formed atop oceanic crust and not from the bottom of a wide ocean, he says. According to plate-tectonic theory, the oceanic crustal plate carrying the islands would have disappeared gradually beneath thicker continental crust, eventually rafting the islands into collision with the continent and depositing the once-submerged rocks on what is now the west coast of Norway. In the September GEOLOGY, Mason contends the Norwegian rocks do not possess the full sequence of minerals and mineral-grain sizes associated with deposits in large oceans.

Paleomagnetic data – which indicate where rocks form in relation to the Earth's magnetic poles – constitute another pillar of Mason's argument. He admits models based on these data can be risky, but, his report asserts, sediment and fauna patterns along the North Sea and the English Channel also point to the past existence of a smaller sea north of a larger ocean.

Mason's conclusions contradict many models holding that the North Atlantic precursor, often called Iapetus, was similar in size to its southern neighbor. These interpretations draw on much the same evidence Mason does, and some explanations include estimated positions of rocks prior to their displacement by interactions between the Earth's drifting crustal plates. Researchers establishing these estimates examine fragments found in a variety of places and conditions, determine the strength and direction of the forces that moved them and create maps locating their probable origins.

One such restoration based on Newfoundland formations shows Iapetus covered at least 1,000 miles from east to west, according to Harold Williams of Memorial University of Newfoundland in St. John's. Another indicator of a wide Iapetus is the continuous coast that stretched from Georgia to Newfoundland from about 570 million until about 480 million years ago, says Douglas W. Rankin of the U.S. Geological Survey in Reston, Va. But Mason claims this ancient East Coast would have bordered the larger sea to the south, not Iapetus.

Rankin and colleague Avery A. Drake agree with Williams that Iapetus must have covered more area than Mason suggests. But while Williams says "the modern Atlantic provides a good model for Iapetus," Rankin and Drake support Mason's idea that 500 million years ago Iapetus looked more like the island-strewn area now north of Australia. Geologists believe Iapetus closed up about 400 million years ago – 200 million years before the modern Atlantic began to open.

Mason's model indicates that pieces of land now in western Europe migrated into Iapetus from the area of ancient Africa, in the same way Asiatic chunks have traveled atop oceanic crust to form much of western North America. This accretion from primeval Africa might help explain inconsistencies in the fauna records of England and northwest France, Mason says. – *C. Knox*

Shrinking ice may mean warmer Earth

Scientists have observed one of the first possible signs that rising global temperatures have started to warm the oceans. Satellite measurements reveal that over the last 15 years, the extent of polar sea ice has shrunk by 6 percent.

Researchers remain cautious, however, about interpreting this observation. "This is a negative trend. It does loosely imply warmer oceans, which of course would be in step with an increasing greenhouse effect. But we can't be 99 percent certain. We're not saying that," explains Per Gloersen of NASA's Goddard Space Flight Center in Greenbelt, Md.

The 99 percent figure has taken on special meaning in debates concerning the "greenhouse" warming of Earth's climate. In early summer, James Hansen of the NASA Goddard Institute for Space Sciences in New York City leaped far ahead of his more conservative colleagues when he told Congress he was 99 percent certain the world is warming due to an accumulation of such gases as carbon dioxide, methane and chlorofluorocarbons (SN: 7/2/88, p.4).

Most experts believe Earth definitely will warm as these gases thicken in the atmosphere. The controversy centers on whether the greenhouse warming has already started. Observations show that average global temperatures have risen over the last century and that five of the warmest years on record occurred in the 1980s. The drop in sea-ice extent may add another shard of evidence in support of present global warming.

"By itself, it can't say anything conclusive about the climate. Taken together with other things, it might mean something," says Gloersen, who worked with William J. Campbell of the U.S. Geological Survey in Tacoma, Wash. They report their findings in the Sept. 15 JOURNAL OF GEOPHYSICAL RESEARCH.

Gloersen and Campbell examined two sets of polar microwave measurements from the Nimbus 5 and Nimbus 7 satellites covering the periods 1973-76 and 1978-87. Since ice and water emit different microwave signals, a computer algorithm can chart changes in the sea-ice pattern. Sea ice forms a frozen band around Antarctica and covers most of the relatively land-free Arctic Ocean during the winter season in each hemisphere.

Scientists have expected that the ice pack would serve as a sensitive indicator for ocean changes. Yet the statistics collected by satellite are far from simple. The total surface area of ice has not changed during the study period. What the analysis reveals is a shrinking in the maximum *extent* of ice – a term that describes how far the ice pack reaches from the poles. This area includes regions of open water within the pack.

Combining Antarctic and Arctic measurements, Gloersen and Campbell found the global ice extent peaks each year during the Southern Hemisphere's springtime, when Antarctic ice is breaking up and Arctic ice is starting to spread. The maximum global sum for ice extent dropped by 5 percent from 1978 to 1987 and by 1 percent from 1973 to 1976. Because the area covered by ice has not decreased, the contracting perimeter implies that open-water regions within the pack are also shrinking.

Although intuition and computer models suggest that both ice area and extent should fall as ocean temperatures rise, Gloersen says it is possible that extent would respond first to a climate shift. Normally, as the Antarctic pack begins to break apart, the ice perimeter spreads away from the pole while regions of open water develop within the pack. If ocean temperatures were warmer, ice would melt closer to the poles, reducing the perimeter, he suggests tentatively.

Climate experts are not ready to say that global warming is causing the ice changes. Because researchers have only 15 years' worth of satellite ice data, the changes could merely reflect a previously unknown natural fluctuation in ice extent, says Roger Barry of the National Snow and Ice Data Center in Boulder, Colo. "It's always dangerous to speak about trends over a 10- to 15-year period," he says. He adds, however, that scientists will continue to watch sea ice for clues about the climate. – *R. Monastersky*