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ERRORS ARE FEARED IN CARBON DATING

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Since 1947, scientists have reckoned the ages of many old objects by measuring the amounts of radioactive carbon they contain. New research shows, however, that some estimates based on carbon may have erred by thousands of years.

It is too soon to know whether the discovery will seriously upset the estimated dates of events like the arrival of human beings in the Western Hemisphere, scientists said. But it is already clear that the carbon method of dating will have to be recalibrated and corrected in some cases.

Scientists at the Lamont-Doherty Geological Laboratory of Columbia University at Palisades, N.Y., reported today in the British journal Nature that some estimates of age based on carbon analyses were wrong by as much as 3,500 years. They arrived at this conclusion by comparing age estimates obtained using two different methods - analysis of radioactive carbon in a sample and determination of the ratio of uranium to thorium in the sample. In some cases, the latter ratio appears to be a much more accurate gauge of age than the customary method of carbon dating, the scientists said.

In principle, any material of plant or animal origin, including textiles, wood, bones and leather, can be dated by its content of carbon 14, a radioactive form of carbon in the environment that is incorporated by all living things. Because it is radioactive, carbon 14 steadily decays into other substances. But when a plant or animal dies, it can no longer accumulate fresh carbon 14, and the supply in the organism at the time of death is gradually depleted.

Since the rate of depletion has been accurately determined (half of any given amount of carbon 14 decays in 5,730 years), scientists can calculate the time elapsed since something died from its residual carbon 14.

Dating Subject to Error

But scientists have long recognized that carbon dating is subject to error because of a variety of factors, including contamination by outside sources of carbon. Therefore they have sought ways to calibrate and correct the carbon dating method. The best gauge they have found is dendrochronology: the measurement of age by tree rings.

Accurate tree ring records of age are available for a period extending 9,000 years into the past. But the tree ring record goes no further, so scientists have sought other indicators of age against which carbon dates can be compared. One such indicator is the uranium-thorium dating method used by the Lamont-Doherty group.

Uranium 234, a radioactive element present in the environment, slowly decays to form thorium 230. Using a mass spectrometer, an instrument that accelerates streams of atoms and uses magnets to sort them out according to mass and electric charge, the group has learned to measure the ratio of uranium to thorium very precisely.

The Lamont-Doherty scientists conducted their analyses on samples of coral drilled from a reef off the island of Barbados. The samples represented animals that lived at various times during the last 30,000 years.

Uranium-Thorium Dating

Dr. Alan Zindler, a professor of geology at Columbia University who is a member of the Lamont-Doherty research group, said age estimates using the carbon dating and uranium-thorium dating differed only slightly for the period from 9,000 years ago to the present. ''But at earlier times, the carbon dates were substantially younger than the dates we estimated by uranium-thorium analysis,'' he said. ''The largest deviation, 3,500 years, was obtained for samples that are about 20,000 years old.''

One reason the group believes the uranium-thorium estimates to be more accurate than carbon dating is that they produce better matches between known changes in the Earth's orbit and changes in global glaciation.

According to carbon dating of fossil animals and plants, the spreading and receding of great ice sheets lagged behind orbital changes by several thousand years, a delay that scientists found hard to explain. But Dr. Richard G. Fairbanks, a member of the Lamont-Doherty group, said that if the dates of glaciation were determined using the uranium-thorium method, the delay - and the puzzle - disappeared.

The group theorizes that large errors in carbon dating result from fluctuations in the amount of carbon 14 in the air. Changes in the Earth's magnetic field would change the deflection of cosmic-ray particles streaming toward the Earth from the Sun. Carbon 14 is thought to be mainly a product of bombardment of the atmosphere by cosmic rays, so cosmic ray intensity would affect the amount of carbon 14 in the environment at any given time. #30,000-Year Limit The Lamont-Doherty group says uranium-thorium dating not only is more precise than carbon dating in some cases, but also can be used to date much

older objects. Carbon dating is unreliable for objects older than about 30,000 years, but uranium-thorium dating may be possible for objects up to half a million years old, Dr. Zindler said. The method is less suitable, however, for land animals and plants than for marine organisms, because uranium is plentiful in sea water but less so in most soils.

But even if the method is limited to marine organisms, it will be extremely useful for deciphering the history of Earth's climate, ice, oceans and rocks, Dr. Fairbanks said.