

ARCHAEOLOGY

New Date With an Old Dish

Two archaeological dating methods will measure back at least 100,000 years, compared to the radiocarbon method using carbon-14 that is good for only about 40,000 years.

By TOVE NEVILLE

TWO ARCHAEOLOGICAL dating methods now enable scientists to date objects 60,000 years farther back in time than they have been able to do before.

One has so far been used to record the electron glow of dishes, vases and other pottery when heated; the other measures moisture layers in objects made of volcanic glass.

All materials contain traces of radioactive elements which emit radiation that traps electrons in solid crystals at ordinary temperatures. As this process progresses, the number of trapped electrons increases.

Drs. George C. Kennedy and Leon Knopoff of the University of California Institute of Geophysics, Los Angeles, heated pottery and lava rock to about 800 degrees Fahrenheit. At this point, trapped electrons are released and create a glow called thermoluminescence.

This glow is so faint that it is not visible, but it can be detected and measured by a photomultiplier tube. The more light emitted, the greater the length of time since the material was last heated to a temperature where it could give off electrons. In the case of a piece of pottery this would probably be when first fired or when last used in a hot fire.

The thermoluminescence technique could date objects up to about 100,000 years old. It has already been used to date 15,000-year-old lava rock from Arizona and ancient Greek pottery from the ninth century B.C., or about the time when Homer was writing the Iliad.

Dates for Prehistoric Societies

This dating method will be especially valuable in establishing dates and time sequences for prehistoric societies that have left no materials containing carbon, such as charcoal or wood, which can be dated by the radioactive carbon method.

It will also help establish correct chronology of varying styles and shapes of pottery. Archaeologists most commonly use a comparative dating method by considering such things as development of craftsmanship, decoration and design. The thermoluminescence technique can now be used to verify or correct the archaeologist's chronology. It is expected to be used next in dating Mayan and Mexican pottery.

The other new dating method was discovered by Drs. Irving Friedman and Robert L. Smith of the U.S. Geological Survey. By microscopic studies they found that water is absorbed through the surface of obsidian, or volcanic glass, from the time it is formed, and seeps deeper into the glass as time passes.

To determine how long it had taken the obsidian to absorb the moisture, the scientists measured this moisture layer in man-made obsidian objects that had already been dated by the radiocarbon method. The results were then used as a measuring stick to date other obsidian objects by measuring the moisture layer on their surfaces, and a new dating method was born.

Obsidian, ranging in color from almost clear to jet black, has been used widely by man from the time he began to shape his own tools, utensils, weapons and ornaments. It holds a good edge and is excellently suited for knife-blades and arrowheads. It also has the advantage of being easy to work, and has been used for scrapers to work skins by Alaskan Indians, as mirrors by the American Indians, and for jewelry and statuary by many ancient peoples, including the Egyptians and Assyrians.

However, since obsidian is somewhat

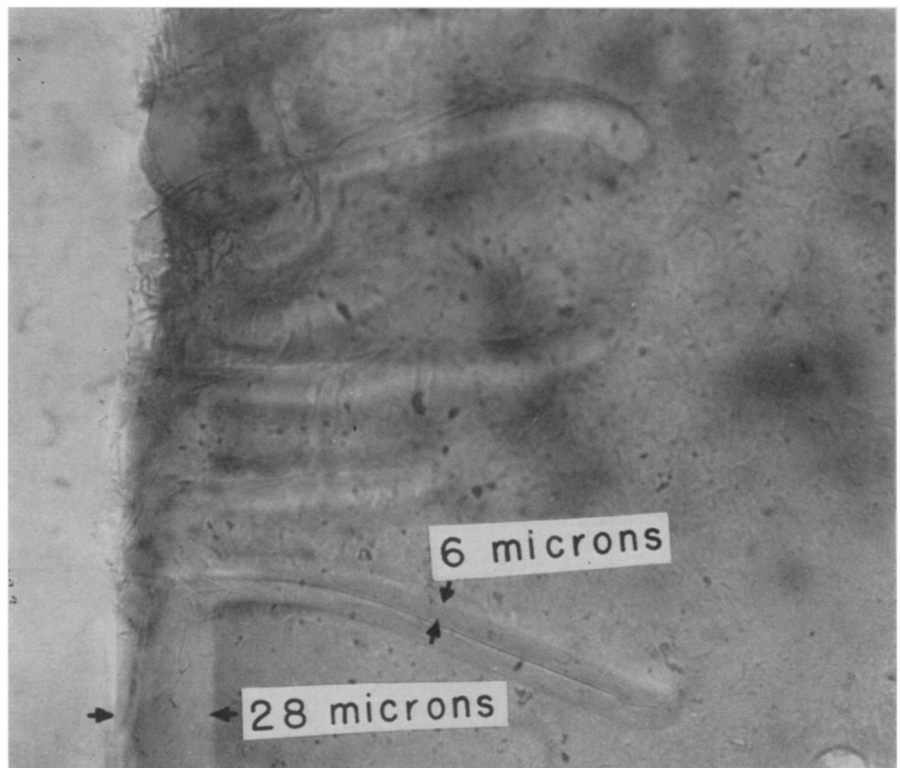
brittle, it was not widely used for hard-hitting weapons, such as axes, although some ancient obsidian axes have been found.

The obsidian method will date objects more than 100,000 years old but much work remains to be done before an exact measuring scale is developed. The rate of hydration, or the time it takes the moisture to form in the surface layer of the obsidian, depends on temperature, the scientists believe. The warmer the climate, the faster the moisture layer will form.

Chemical composition of the obsidian in relation to moisture absorption must also be investigated by the team of scientists, who will do further work on the time-scale of this dating method during the next two years.

Re-use Is Obstacle

In working with man-made obsidian objects that have some of the original surface intact, it is possible to measure both how old the glass is, if conditions under which it was formed are known, and how long ago man worked the surface. However, re-use of objects by several cultural groups might make it difficult to measure



SIX MICRONS EQUAL 3,000 YEARS—This photomicrograph of a thin slice of obsidian shows that the moisture layer on the surface, developed since the glass was formed, is 28 microns deep. Another moisture layer has developed around cracks in the surface, caused by the Ecuadorian craftsman who worked it 3,000 years ago. This layer is six microns deep (a micron is 40-millionths of an inch). The age of the glass itself is not known at present. The time it took the 28-micron layer to form would depend on temperature conditions at the time it was formed.

when they were worked. Faked archaeological "finds" would be easy to detect by this method.

In recent years, the radiocarbon dating method has virtually revolutionized archaeological dating for objects of wood, charcoal, shells, grain and bone up to about 40,000 years old.

As a result of cosmic radiation, radioactive carbon with the atomic weight of 14, instead of 12, that of ordinary carbon, is present in carbon dioxide in the atmosphere. As plants use the carbon dioxide, they absorb the carbon-14. In turn, all animal life, feeding on plant life directly or indirectly, absorbs some of the carbon-14.

When plants and animals die, they stop absorbing carbon-14 and it disintegrates as all radioactive materials do. Eventually it breaks down, and the rate of its breakdown is measured in terms of its half-life. The half-life of carbon-14 is the amount of time it takes for the radiocarbon to be reduced to half the amount that was originally present. As this has been measured to be about 5,568 years, it will take that many years to bring the amount down to one half the original amount and so on. The beauty of this method is that it can be checked on materials of known age and therefore verified. It has been found to work with a fairly small margin of error, although the problems of the method have not been ironed out yet. In some cases, scientists have found different results for samples from the same site.

Chemist and Geologist Help

By finding new ways of dating old objects, the archaeologist with the help of the chemist and the geologist, is able to give nearly accurate historic dates to archaic materials belonging to prehistoric times.

Wooden objects have been dated on the basis of the annual growth rings, whose thickness depends on the amount of moisture the tree absorbs. Sections of trees were fitted together so as to make a "tree-ring calendar." This dating scale has been used mainly to measure wooden beams of ancient constructions as far back as 3,000 years.

Bands in clay deposits from the annual melt-water from the retreating glaciers of the ice ages have also been used as a dating method. In northern Europe this technique has been used to measure back about 12,000 years.

A similar method based on the geological layers of the earth's crust is called stratigraphy. Each layer, or stratum, is known to have a certain time span, and archaeological finds can be dated according to the material in which they are embedded.

Related to this method is dating artifacts by the volcanic ash layers in which they are found.

Trade materials also give clues to the archaeologist. If certain vases of Greek manufacture, known to have been made in a certain century, show up in a buried village on the Baltic, it is probable that the village was occupied about the time of manufacture.

Animal remains found on sites where human remains are found can also give a

clue to the date. When remains of horses and mammoths were found together with human remains in Mexico and Arizona, this was evidence that the human remains were at least 8,000 years old because it had already been determined that the animals were extinct in these areas 8,000 years ago.

When the archaeologist wants to determine which bones from a site are the oldest, or if animal and human remains found together are of the same age, he can use the fluorine test. Fluorine from ground water forms fluorapatite in the bones so the oldest bones at any one find would contain the largest amount of fluorapatite.

Even the natural vegetation of an area has been used to tell time. Pollen grains found in utensils where graves or village sites are uncovered give a clue to their place in time. It has been fairly well determined when certain trees and plants could possibly have grown in an area as the four ice ages passed over the earth during the last million years or so. This at least is valid for the Northern Hemisphere.

Science News Letter, May 7, 1960

GEOPHYSICS

Undefined High Altitude Energy Source at Pole

A HITHERTO undefined energy source over the North Pole at high altitudes has been found by Dr. W. W. Kellogg of the Rand Corporation. This newly discovered source of heat is a release of chemical energy stored in atomic oxygen. Despite the darkness of the Arctic winter, at a 60-mile altitude over the North Pole the temperature is 40 to 60 degrees Fahrenheit hotter than during the period of the summer sun. In fact, it is believed to be hotter over the North Pole than over any other portion of the globe at a similar altitude. The cold air over the North Pole at lower levels sucks the upper atmosphere downward, causing some warming by adiabatic compression. But the recombining of atomic oxygen as it moves to a lower altitude creates about ten times the amount of heat as that created by the adiabatic warming.

Science News Letter, May 7, 1960

FORESTRY

Trees on Mine Wastes Reclaim Piled-Up Earth

ONE OF the best ways to reclaim the waste earth piled up from mining excavations is by planting trees on it, the U.S. Department of Agriculture reported. A handbook entitled "Forestation on Strip-Mined Land in the Central States" tells how 20 species of trees can be planted successfully on such land. These include green and white ash, cottonwood, black locust, sweetgum, sycamore, black walnut, yellow poplar and several varieties of maple, oak and pine. The booklet, available for 36 cents each through the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., tells which trees will grow best on different types of spoil banks.

Science News Letter, May 7, 1960

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