ARCHAEOLOGY

How Old Is It?

This question turns archaeologists into super-sleuths who sift the ground for every scrap of evidence and call for help on all the other sciences. New dating methods used.

See Front Cover

By MARJORIE VAN DE WATER

➤ HOW OLD is it? That is the question the archaeologist searching among the relics of man's past is most often called upon to answer.

Here are a few practical problems that face him:

Soldiers engaged in engineering work in Germany find a pit containing the bones of a large group of persons. Is the find mute testimony of another mass war atrocity slaughter of World War II, or are they the hastily buried bodies of victims of a terrible epidemic of bygone days? How old are the bones?

In the sparkling white lime of a cave in South Africa a quarry man came across a fossil skull. The nearly perfect little face was that of a child with six-year molars just cut through—very human in appearance. How many hundreds of thousand years ago did this child live in his cave home?

Two stone weapon points, each one chipped or flaked in its own distinctive style are found where they came to earth as some American of the past hunted a now extinct animal. Which weapon is the older?

A pair of rope sandals in wonderful state of preservation so that they look as if they might have been kicked off yesterday were found in an Oregon cave. How old are these?

A-Bomb Research Result

The most satisfactory method of dating available to archaeologists today is one born of the research on the atomic bomb, radiocarbon dating. Developed by Dr. Willard F. Libby and his associates at the University of Chicago, this method can provide an exact date, within a known margin of possible error, for any specimen from a group of organic substances such as charcoal, plant fiber, flesh and well-preserved shell.

The principle of radioactive carbon dating is this: The earth in which we live is under constant bombardment by cosmic rays from outer space. This action makes all the carbon dioxide in the earth's atmosphere faintly radioactive. Plants live off the carbon dioxide in the air. Thus, plants soon become radioactive. Animals live by eating plants. Thus, animals, in their turn, become radioactive. All living creatures, plant and animal, have within them their share of radioactive carbon.

When a plant or an animal dies, however, it no longer continues to share in this general distribution of the radioactive element. It then begins to lose its radioactivity by radiation. The rate of the dissipation is known to the scientist.

It is such that after some 30,000 years the amount remaining will be too small to measure accurately. But if those rope sandals in the Oregon cave were made from a plant that was living within the last 30,000 years, scientists can measure the radioactive carbon remaining in the fiber and tell us how old they are.

"Push-Button Archaeology"

This has been done; the sandals have been lying in that cave for more than 9,000 years since the one-time owner kicked them off his tired feet.

This is what one archaeologist described as "push-button archaeology."

Beside the chemist, chief ally to the anthropologist is the geologist. If you look at the side of a bank where a road has been cut through, you will notice that the earth consists of a series of layers of different kinds of soil or rock. Long study of the earth has taught the geologist how to give a date to each of these layers. This method of dating human remains by the strata of earth in which they are found is one of the most widely used dating methods.

Tree-Ring Calendar

It was an astronomer, however, who furnished archaeology with one of its most remarkable methods of dating, useful especially in the dry climate of southwestern United States, the tree-ring calendar. Dr. A. E. Douglass, director of Steward Observatory at the University of Arizona, had wondered about the clearly marked growth rings which show up when a tree is cut. He noticed that some rings are wide in years of good growth and that others are very narrow. The idea occurred to him that these good and bad years might be associated with periods of high and low sunspot activity.

ANCIENT WEAPONS—These Folsom stone points were used by men in America to shoot down now extinct bison 10,000 years ago. They were dated by the time at which the bison became extinct and this date was later confirmed by means of radiocarbon dating of charred fragments of the animal bones.

He found that the ring pattern was strikingly similar in different trees of about the same age. Then he thought to take a very old tree and try to match up its rings with those in the beam of an old house. This in turn he matched with older beams. He continued making such tree-ring matchings until he finally had a calendar that stretched back for two thousand years or more.

Notable achievement of Dr. Douglass and his method was the dating of Pueblo Bonito, a great thousand-room ruin in New Mexico. After a ten-year study, Dr. Douglass was able to report that the oldest timber in this Indian village was cut in the year 919. The major part of the construction went on from 1050 to 1085, starting before the conquest of England by William the Conqueror.

The ornamented jugs, shown on the cover of this week's SCIENCE NEWS LETTER, were the treasures of a housewife who lived in Pueblo Bonito.

Many Sciences Contribute

These are just a few of the ways in which archaeologists receive the help of other sciences to map man's remote past.

Sometimes, association of human remains with those of animals is the clue which leads to their dating.

The distinctive Folsom points were once thought to be the oldest handiwork of man in America. They were found with the bones of an extinct bison and were estimated to be ten to twelve thousand years old. This date was confirmed by radiocarbon dating of some of the charred bones of the bison.

Now, however, another distinctive point has been found with the remains of an extinct elephant, the mammoth. The mammoth is known to have died out long before the bison and so this "Clovis" point is estimated to be about 15,000 years old, maybe older.

The little fossil child skull from South Africa was dated partly because it was found with the skulls of extinct baboons and the bones of other extinct animals. The dating was partly the work of the anatomist who found that parts of the skull were those of a creature neither ape nor man, but who might be the ancestor of modern man. It is believed the child lived in his limestone cave a million or more years ago.

Fluorine Aids Dating

Unfortunately for the purposes of anthropologists, bone, unless it has been burned in some prehistoric campfire or conflagration, is not a good material for the radiocarbon method of dating. That is because bones lying in the ground for many years are extremely likely to be damaged by the elements and to be changed in their chemical make-up.

Anthropologists make the most of this fact and rely on these same chemical changes to date long-buried bones. Organic matter is lost to the soil, which in turn contributes minerals. Most ground water contains fluorine. Fluorine ions combine with the hydroxyapatite crystals of the bone to form fluorapatite. A measure of the amount of fluorapatite is therefore another way of dating. It was by the fluorine method that Natchez Man was found to be an ancient American some 11,000 years old.

Condition of the bones showed that the German mass grave contained the dead of the war of 1870.

When an archaeologist comes upon a stone tool, a bit of pottery, or some other specimen of man's handiwork imbedded in the earth, he is very careful to make adequate records of its location before he attempts to dig it out. The ground is first

photographed, showing the specimen in place. An overall photograph is made of the site. The depth from the surface is measured. Any other material occurring in the same layer is carefully recorded.

If his photographs, even with the use of color filters, fail to show up the boundaries of the various strata, the archaeologist marks the limits artificially. Perhaps he scratches a line with his trowel. Perhaps he stretches a string along the line of demarkation.

Then he can call on the geologist to give him a date for his find. It will be a rough date, most likely. And perhaps he must be content with information as to which of a number of finds at the same site are the oldest. If Clovis points are found buried far below Folsom points, the archaeologist can feel sure that the Clovis point is much older.

The stratigraphical method is one of the most widely used ways of dating ancient finds. It has its drawbacks, however, and depends a great deal on the wisdom of the archaeologist using it.

Sometimes an article may be found in a certain level of soil or rock without belonging there at all. Men have long had a way of digging holes and burying treasures. Even dogs and wild animals root in the ground and may bury a bone or other object far below the level where it belongs naturally.

And sometimes movement of the earth itself will mix up the layers in a confusing manner.

There is another way by which the earth marks off the years to form a geo-calendar. As the glacial ice moved northward, the summer melting of the ice each year left behind a layer of silt and clay much as the melting of a city's snow in the spring deposits a layer of slippery goo on the streets. With successive freezes of the glacial ice and spring meltings, layer after layer were laid down. The layers of sediment are known to geologists by the Swedish word "varve."

Counting varves gives archaeologists a way of noting the passing years. Unfortunately, in America there are two drawbacks to use of the varve calendar. In the first place, no one knows precisely in what year the first or last varve was laid down, so the varve calendar is left floating in time.

Also, in America at least, it seldom happens that any archaeological material is found deposited in a varve layer.

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GENERAL SCIENCE

International Language

➤ THE "AVERAGE" language of the western world, Interlingua, is being introduced into scientific and technical publications as a workable and economical solution to the problems of international communication.

SCIENCE SERVICE has received a one year grant from the International Auxiliary Language Association (IALA) to handle introduction, translation and teaching of this "common denominator" language to science and technology editors and other interested persons.

Based on the principal western languages, Interlingua with its simplified uninflected grammar and universal vocabulary is read virtually without study by anyone who normally reads scientific and medical journals. A grammar and Interlingua-English dictionary has been published under Dr. Alexander Gode's editorship.

Already, two scientific journals published exclusively in Interlingua have entered their second year. SCIENTIA INTERNATIONAL is a monthly review of science, put out by SCIENCE SERVICE. *Spectroscopia Molecular,* a journal of spectroscopy, is edited by Prof. Forrest F. Cleveland, Spectroscopy Laboratory, Illinois Institute of Technology, Chicago 16, Ill.

One of the most important aids of Interlingua to science editors will be the use of a single Interlingua summary in place of several summaries in different languages for each of the scientific papers. Thus Interlingua will give both practical and economical advantages over older methods of abstracting.

The *Quarterly Bulletin of Sea View Hospital,* a journal of tuberculosis and chronic pulmonary diseases, now employs Interlingua summaries with each of its scientific papers. Before, the Bulletin used Spanish abstracts along with its English papers, but switched to Interlingua to reach a greater international audience. This journal is edited by Dr. Harold D. Wainerdi, Sea View Hospital, West New Brighton, Staten Island 14, N. Y.

SCIENCE SERVICE'S Interlingua Division has set up shop at 80 E. 11th St., New York 3, N. Y., with Dr. Alexander Gode and Hugh Blair as staff. The Interlingua Division will offer translation service to medical and other journals in preparing Interlingua versions of summaries, abstracts, papers, etc., for publication.

Further details about Interlingua can be obtained from Dr. Gode in the New York office, or from Watson Davis, director, SCIENCE SERVICE, 1719 N St., N. W., Washington 6, D. C.

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CHEMISTRY

Impurity Virtue In Some Materials

➤ IMPURITY IS a virtue in some industrial and scientific materials. At a meeting of chemists and physicists in Schenectady, N. Y., it was revealed that some amounts of extraneous materials are useful in:

Transistors, the tiny devices that substitute for vacuum tubes.

Fluorescent lights, paints and television tubes.

Photographic film.

So far about 43 important impurities in phosphors, used in fluorescent lights, have been catalogued.

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CHEMISTRY

New Detergents Clean Up Radioactive A-Dust

➤ SCRUBBING UP after an atomic blast is made practical by the discovery announced in Paris that certain of the newer cleaning agents trap and remove fission products in radioactive dust.

Phosphorus-containing scouring compounds have the ability to sequester, or grab and hold, rare-earth elements, which are among the most abundant fission products. This action removes nearly 99% of the invisible but menacing radioactive particles, according to tests reported to the 26th International Congress of Industrial Chemistry by Dr. Foster D. Snell, president of the chemical consulting firm of Foster D. Snell, Inc., New York.

Chemical elements from yttrium through europium are the materials found among the fission products after atomic bomb explosions. Phosphorus-type detergents remove these from surfaces commonly found in the home, Dr. Snell reported. Plaster, however, is better cleaned with water alone.

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