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THE SMOKE SIGNAL

The names of Mr. and Mrs. Claude Gettys were inadvertently omitted from the list of members who participated in the Medicine Wheel project. We're sorry.

A recent news item from the community of Hulett mentions the death of Mrs. John McKean, Sr., on her 87th birthday, October 2. She and her husband had homesteaded on the Belle Fourche river where the Keyhole dam reservoir now lie, and it was on their ranch where Dr. Mulloy discovered the particular stylized projectile point which he named the McKean point and which is now recognized as a specific type in archaeological nomenclature.

Several of our members have been taking advantage of the nice weather on the Saturdays of October by doing further exploratory work at Kaufmann Cave. Ray Bentzen, Don Grey, and Elizabeth Carlson excavated all day on the 18th. Ray and Don, assisted by Louis Allen, continued the work on the 25th, and again on November 1. If the weather remains favorable, they plan to work there again on the 8th. Several more fine artifacts have been recovered along with many more bones of various animals, and more charcoal.

The October issue of SCIENCE DIGEST contained a 5-page article on the Medicine Wheel, written by a Chicagoan who made a single visit to the wheel last June. He assembled what information he could from various Chamber of Commerce brochures and let his imagination run wild for the rest. The article was so packed with errors that your president wrote a letter to the editor correcting no less than seventeen obvious errors. As yet, the editor has failed to reply.

Archaeological Dating by Radiocarbon Methods

Don Grey

At one time, during the Middle Ages in Europe, it was common for men to spend a great deal of time hunting for some method of changing some of the commoner metals into gold. They were, of course, not very successful. We know now that they were dealing with the wrong part of the atom. The chemical procedures they tried affected only the surface of the atom, so to speak, while it is the very innermost part that determines what kind of material the atom represents. Much more powerful methods were needed, and it was not until 1932 that men were able to penetrate to the nucleus of the atom and cause it to change its nature.

While man struggled to understand the tiniest building block of the elements of which we, and all other objects, are composed, nature had long been changing atoms from one kind to another. Certain elements are radioactive, and spontaneously change from one kind to another, giving off radiation in the process. This type of change was discovered in 1895. After 1932, man knew that by bombarding atoms from the outside with high speed fragments of other atoms this same type of change could be caused pretty much at will. In the middle 1940's several researchers began to suspect that nature had been far ahead of them again. High speed particles are continually reaching the earth from outer space. These are called cosmic rays, and they had been known of for some time. Scientists began to wonder if these rays did not produce some atom-changing effects on the atomosphere when they struck.

Investigation proved that cosmic rays did indeed produce some changes. One of those changes consisted in converting nitrogen atoms to carbon atoms of a type that was radioactive. That is, the type of carbon atoms that was produced would spontaneously give off radiation and convert back to a nitrogen atom. Some time was required for this spontaneous change to take place. On the average, with a number of these radioactive carbon atoms present, half of them would revert to nitrogen in about 5568 years. In another 5568 years half of the remaining atoms would change, and so on, until the last atoms disappeared.

The aspect of this situation that makes it important to the archaeologist is that first of all, all life on the earth is made up of chemicals built from carbon atoms. Furthermore, every living thing is constantly taking in new carbon so long as it lives. Secondly, the radioactive carbon being produced in the atmosphere is uniformly distributed over the earth, so that every living thing is exposed to an equal proportion of it. Every living organism contains some of this radioactive carbon, and in fact, every living thing contains the same percentage of this material. As some of the atoms disintegrate, they will be replaced by new carbon being taken in by the life-form in the way of food. Thus a balance is maintained which lasts as long as the organism lives.

As soon as an organism dies, it ceases to take in new carbon, but the old carbon continues to disintegrate at the rate of 50% every 5568 years. This rate is not affected by heat, cold or other chemical actions. If an archaeologist should pick up a remnant of the material at a later time, he need only measure how much of the radioactive carbon is left in order to determine how long it has been since the organism died.

There are a great many problems in connection with the use of radiocarbon dating for archaeological purposes. First, there are simply the technical problems involved in counting the amount of remaining radioactivity. Only one atom in 650,000,000,000,000,000, of the atoms of carbon in a living organism is of the radioactive type. This represents a very difficult technical problem in detection. The apparatus must be extremely sensitive.

From the archaeological point of view there are even more important problems. First, it should be noted that the date obtained is the date of the death of the specimen. A piece of wood found in an archaeological site may have died many years before it was put to use by ancient man. The date thus obtained is really a maximum date, and should be used thus in dating archaeological specimens. Secondly, many things can happen to carbon-bearing material after it dies. Wood and bone, for example may be attacked by bacteria and caused to decay. Now these bacteria are living organisms and are constantly taking in radioactive carbon. As the dead bacteria are added to the specimen, there will be an increase in the amount of radioactive carbon in the specimen. This will tend to make the date of the specimen too late, or make its apparent age too young. Another occurrence which has the opposite effect, is contact with limestone. Limestone has very ancient carbon in it. A mixture of this with the carbon of the specimen tends to produce too old a date. Limestone usually is not too troublesome because it can usually be separated from the specimen by chemical means.

Needless to say, carbon dating is of value to the archaeologist only in proportion to the care that he uses in obtaining the specimen and in relating it to the culture he is trying to date. Unless the field worker exercises the utmost care to be sure that the carbon obtained for dating is really associated with the culture in question, the date obtained is worse than useless.

Probably the best carbon specimen for dating purposes is well-charred wood or charcoal that has been in a completely dry, lifeless environment since its deposition. Such an environment might obtain in the interior of a desert cave. This specimen is most likely to be correct because charcoal is not used as a good by any type of bacteria. In a dry environ no plants are liable to grow which might send their rootlets through the carbon and thus contaminate the sample. Samples from wet environs are always somewhat suspect because of the likelihood of sufficiently compact nature, then perhaps the interior portions of the lumps might be used with some degree of confidence even if the specimen has come from a damp environ.

It is appartent that, while radiocarbon dating affords valuable archaeological information when properly used, it does have its limitations and is not the answer to all of the archaeologists' dating problems. Even so, if used with discrimination, it is one of the most valuable tools the archaeologist has at his disposal today, and has already made great contributions to absolute dating.

The college library has a very definitive book on radiocarbon dating which treats of the subject very thoroughly.