Reports and Letters

Specimens from Sandia Cave and Their Possible Significance

During periods of the years 1936, 1937, 1938, 1939, and 1940 a cave in the Sandia Mountains near Albuquerque, N.M., was excavated for such evidences of early occupation as it might contain (*1*). This cave, called the Sandia cave, became chiefly notable because one layer within its deposits was identified as Folsom in date and contemporaneous with Folsom campsites at such places as Clovis, N.M. (*2*), and Lindenmeier, Colo. (*3*). Below the Folsom level of Sandia Cave occurred another stratum of human occupation called the Sandia level. Because of its subposition, the Sandia culture, contained in this level, gave promise of being even earlier in date than the Folsom level above, which had previously represented the earliest demonstrable occupation of North America.

In 1948 two specimens of charcoal from fire hearths of the Sandia level of Sandia Cave were submitted by Kirk Bryan of Harvard University to W. F. Libby of the University of Chicago for C^{14} dating. At that time the technique of radioactive dating was in its infancy, and a copious specimen was necessary. From these two samples, tentative dates of 17,000-plus years ago and 20,000-plus years ago, respectively, were derived.

Bryan was emphatic that these dates should not be published at the time, because of the inadequacy of the samples and the possibility of a considerable error. Unfortunately, no additional charcoal had been saved from the Sandia excavation for further testing.

Recent runs of ivory material from the same Sandia level tested by H. R. Crane at the University of Michigan have tended to corroborate the earlier dating and have given a more exact determination of the probable time of the first Sandia Cave occupation.

Specimen No. 1 submitted to the Michigan laboratory was derived from the Sandia level of the cave near meter No. 8 from the entrance. This specimen is apparently mammoth ivory and represents a fragment near the point of a large tusk.

The second specimen submitted to the Michigan laboratory is probably from a different tusk, since it occurred near meter No. 17, well within the cave. This fragment was associated with two long bones that have been identified as those of a mastodon and so may represent a piece of ivory from that mammal.

It may be mentioned that both mammoth and mastodon occurred in the Sandia level of Sandia Cave. Many bony splinters were representative of these two kinds of elephants, with the mammoth definitely in the majority. Butchering techniques apparently included the bringing back of large segments of these animals to the cave. The meat was cut from the bones, as is indicated by occasional scars on the bone surfaces. Subsequently the bones were cracked and broken lengthwise to extract the marrow. Many bone fragments had been so thoroughly broken in this manner that they were identifiable only as those of some elephant.

More difficult to explain was the presence of both tusks and teeth in the cave assemblage. It would seem that at least occasionally the Sandia hunters brought back to the cave portions of the heads and skulls of these ponderous animals. The ivory may have served as material from which tools and weapons were manufactured, although none such were actually found in the Sandia level. In the Folsom level above, a pointed ivory implement was recovered. At the Clovis Site at Clovis, N.M., ivory foreshafts were found associated with the Clovis variation of the Folsom culture.

The mammoth and occasional mastodon teeth in the Sandia Cave are more difficult to explain, since these were apparently never used and would appear to be useless impedimenta to the prehistoric hunters. It is interesting to note that mammoth teeth occur very commonly at the Clovis Site and also are present at the Sandia level of another site that has been recently excavated near Lucy, N.M. We may only suppose that these ancient hunters dragged back elephant skulls to their camping places to cut out the brains or such fragments of flesh as might adhere to the bones.

Although carnivores of the late Wisconsin period undoubtedly laired in the Sandia Cave intermittently with human occupation, it seems improbable that fragments of ivory and teeth would be attributable to these mammals. Meat-eating animals would scarcely be expected to carry portions of elephants' skulls from the place of the kill into the cave.

We are forced to conclude, therefore, that human beings brought into the cave the elephant ivory specimens that the Michigan laboratory has dated. Because of the split long bones of both mammoth and mastodon present at the Sandia level, it seems patent as well that the Sandia hunters killed both of these varieties of elephants and brought portions of the kills back to the cave. There have been suggestions in other early sites that perhaps the Paleo-Indian acted as an antiquarian at times. If the Sandia hunters had brought back to the cave fragments of tusks of some older, already fossilized specimens, the dating of these specimens would be of little value. In the case of the elephant ivory recently dated, there is every evidence that these were fresh kills and contemporaneous with the time of the human occupation with which they were found.

In addition to the aforementioned evidence that the C^{14} dates revealed by Crane's measurements actually represent a true chronology of the Sandia hunter culture, there is further corroboration. In the Sandia Cave there was a definite sequence of wet and dry strata with associated human occupation levels corresponding to the dry periods. The topmost level of the Sandia Cave is a dry accumulation of recent origin. Archeological finds associated with this level are Pueblo an in date and represent sporadic occupations of only the last few centuries. Beneath this uppermost, recent level lies a layer of calcium carbonate in the form of a crust definitely deposited under wet conditions.

Beneath the calcium carbonate crust lies the Folsom cultural level of the cave. Cultural materials from this occupational level are typically Folsom in nature and close to the classic variety of the original Folsom Site, or the Folsom camp at Lindenmeier, Colo. Although no definite fire hearths are found in this Folsom level, enough charcoal was derived from the debris for a single inadequate C^{14} run at the University of Chicago Institute for Nuclear studies. This run seemed to indicate a comparable antiquity with the Folsom camp near Lubbock, Tex., which yielded a C^{14} date of 9883 years before the present with a possible error of 350 years. It must be emphasized, however, that the C^{14} dating of the Folsom level of Sandia Cave was inadequate and the co-relation of this Folsom material with other cultures of the same variety has been done for the most part on typological grounds. This Folsom level represents a dry period of the cave when human occupation was possible.

Below the Folsom occupation stratum

is a sterile level of yellow ochre that is laminated and water-laid. This represents a period when human occupation was undesirable or at least not present.

The Sandia cultural level lies below the yellow ochre level and again represents a dry period. Two charcoal lenses or fire hearths were found in the Sandia level, and it was from these that the original C^{14} datings were made. The cultural material of the Sandia level is, of course, distinct and earlier by its very subposition beneath the Folsom stratum and the superimposed yellow ochre. Below the Sandia level is a sterile layer of clay representative of another wet period immediately following the formation of the cave itself in the Pennsylvania limestone.

Bryan was able to relate the wet and dry sequences in the Sandia Cave with exterior glacial happenings in the vicinity. On this evidence he was able to postulate that the Sandia People may have entered North America in the pre-Mankato interstadial or, as it is called in the Colorado-New Mexico area, the pre-Corral Creek or W_2-W_3 interstadial (*4*). From this evidence Bryan argued that Sandia hunters may have occupied Sandia Cave as early as 25,000 years before the present day. Bryan made this estimate before any C^{14} dates were available. Unfortunately, his untimely death prevented his ever knowing that his estimate had been remarkably accurate.

The geologic correlation of the wet and dry levels of the Sandia Cave seems to corroborate the evidence of archeological stratigraphy. The C^{14} dates recently measured by Crane logically fit in with a pattern already established by other data. We may only assume that human beings such as those who left the Sandia culture as evidence of their presence were already established in the American Southwest at least 25,000 years before our time.

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Antiquity of the Sandia Culture: Carbon-14 Measurements

In 1952 Frank Hibben of the University of New Mexico submitted to us two fragments of mammoth tusk that came from the Sandia level of Sandia Cave in New Mexico in association with evidence of human habitation. In 1954 he submitted a third fragment. The Sandia level at which the tusk fragments were found was below the Folsom level of the cave. The Folsom level had been dated by C^{14} on a previous and inadequate sample of ivory fragments at about 11,000 years. The figure of about 11,000 years has so far seemed to represent, in American anthropology, a rather sharp cutoff beyond which little is known. Sandia material, therefore, occupies a position of unusual importance, and it will be of great interest to investigate thoroughly every bit of available material and to make available the results in detail. Our C^{14} measurements on the tusk material are presented here (*1*).

The radiocarbon dating method used at the University of Michigan employs a Geiger counter into which a gaseous, CO_2 sample is introduced. The method has the advantage, for the present investigation, that the amount of carbon sample required is very much smaller than that required in the method that employs a solid carbon sample. Only about 700 mg of carbon in the form of CO_2 are required to fill the counter, and a sample of raw material containing 2 g of carbon is usually sufficient (In our previous work, using carbon black samples, we required about 100 g of raw material.) The small weight of carbon that suffices for the present method made it possible to prepare, from the available Sandia tusk material, sufficiently large samples of CO_2 that were derived entirely from the *organic* (*2*) constituents of the tusk. This was a safeguard against the most likely source of extraneous carbon, namely, water-deposited carbonates.

The method of preparation of a CO_2 sample from the tusk material was, briefly, as follows. The tusk was broken up into small bits and heated in a closed iron vessel to a dull-red heat, in order to carbonize (char) the organic constituents. It was then treated with dilute hydrochloric acid to dissolve the carbonates and other acid-soluble compounds. After this treatment, finely divided carbon black remained, which was then washed and dried. The weight of the carbon residue was about 7 percent of the weight of the tusk material. The carbon was then burned to CO_2, and the CO_2 was purified in the usual way, which consists of absorption in ammonia, precipitation as $CaCO_3$, washing and re-evolution by HCl.

The tusk material received in 1952 was carried through the chemical process in two batches, each yielding enough CO_2 for two counter runs. The first two runs were compared with runs that had been made, both before and afterward, on tank CO_2, which had been standardized against CO_2 made from lampblack (petroleum origin) according to our standard procedure of preparation.

After carefully assessing the degree of consistency in the results that we had been obtaining, over a period of several months, on many different counter fillings of CO_2 of identical origin (both the tank CO_2 and the modern wood CO_2 were used) and other factors, we were confident in saying that the Sandia tusk was *at least* 20,000 years old. Actually, the counting rate obtained from the Sandia sample was the same as the average of the counting rates obtained from petroleum carbon, so the 20,000-year figure was merely a limit that expressed, conservatively, the limits of error.

The CO_2 from the second batch of the 1952 material was used in a new series of runs. In these runs the comparison was made directly against CO_2 samples prepared from dead carbon, and special care was taken to prepare and handle all the samples, both the dead carbon and the Sandia material, in exactly the same way. In this way the intermediate step of comparison with tank CO_2 was elimi-

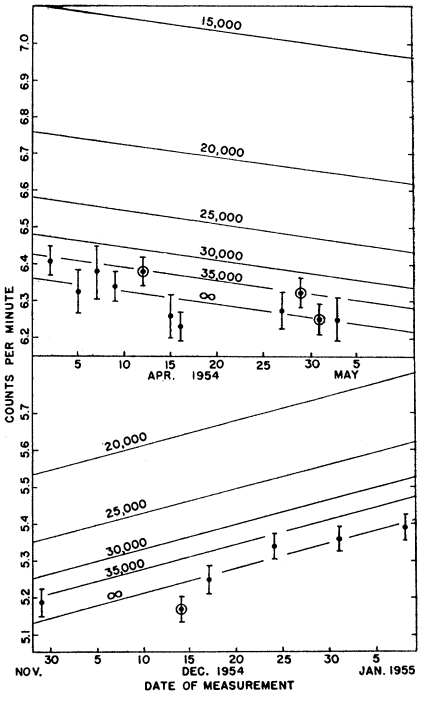

Fig. 1. C^{14} measurements on tusk material from the Sandia level compared with a number of measurements on samples of dead carbon. The Sandia measurements are identified by circles. The sloping lines correspond to the ages indicated. The vertical line through each point represents the standard deviation, based on the number of counts alone.