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University of Arizona Radiocarbon Dates

Edward N. Wise and Dick Shutler, Jr.

The Carbon-14 Age Determination Laboratory of the University of Arizona is operated by the anthropology department under the direction of Emil W. Haury, with the technical supervision of one of us (E. N. W.). A steering committee of the university (*1*) was appointed to approve the acceptance of submitted samples, to assign them a relative priority, and to examine critically and approve for publication the dates obtained by the laboratory.

The work of the Carbon-14 Age Determination Laboratory is an integral part of the geochronology-dendrochronology program of the university. Students in this program obtain laboratory experience by observing all the chemical and physical operations performed during the dating of a sample.

The laboratory was constructed in 1953 with the aid of a grant from the Research Corporation. The solid-carbon method developed by Willard F. Libby and his co-workers (*2*) is used for dating samples. Trial runs were made in the spring of 1954, and the laboratory was ready for calibration and dating runs in 1955. The solid-carbon method has been retained, for the majority of our samples are not more than 20,000 years old, and we have not experienced the radioactive contamination reported by other radiocarbon-dating laboratories. Fallout from the Nevada atomic-weapon test site apparently passes to the north of our laboratory.

The elemental carbon is prepared in essentially the same manner as that described by Libby, except for a modification suggested by Ballario and his coworkers (*3*). The modification concerns the omission of the steps in which carbon dioxide is condensed with liquid nitrogen. In the combustion train, the traps cooled with liquid nitrogen are replaced by a two-stage absorption train containing ammonium hydroxide, which absorbs the carbon dioxide directly. A water aspirator is attached to the end of the train to remove unabsorbed gases, such as excess oxygen. After precipitation and purification of the sample as calcium carbonate, carbon dioxide is evolved by the addition of hydrochloric acid. The carbon dioxide is thoroughly dried and directly reduced to elemental carbon with magnesium turnings. The elimination of the steps in which liquid nitrogen is used speeds up the preparation of samples and simplifies the control of the chemical processes involved in absorption and reduction. No deleterious effect on samples due to the omission of the use of liquid nitrogen was noted.

The problem of smooth and continuous chemical reaction during the reduction step, which gave trouble during our trial runs, was solved by heating the magnesium turnings in the steel reduction tube under high vacuum for several

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minutes prior to the admission of the carbon dioxide. Reduction was then easily initiated by local heating of the reduction tube to a bright red heat with a gas-air torch, and reduction always proceeded smoothly to completion.

The dates of the samples we have measured are listed in Table 1 (*4*).

The statistical error is derived by the method described by Libby (*2*). The figures for standard deviation attached to the dates are in some instances larger than the purely statistical error. This adjustment was made to reflect more correctly our estimate of other factors involved in the precision of an assay. This follows the practice of other laboratories such as that at the University of Michigan (*5*). Possible errors resulting from the processing procedure and sample material have been adequately discussed elsewhere by Libby (*2*) and Crane (*5*).

References and Notes

1. The steering committee is composed of Emil W. Haury, chairman, Edwin B. Kurtz, John F. Lance, David L. Patrick, Terah L. Smiley, J. E. Treat, and Edward N. Wise.
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Table 1. Radiocarbon dates obtained on archeological samples by the black-carbon method. All ages are given in radiocarbon years before the present. The year of assay is given in parentheses below the radiocarbon age. Specific locations of the samples collected in Arizona are given by the archeological site survey system of the Arizona State Museum.

Description	Sample No.	Age
Naco mammoth site, Ariz. FF:9:1, Cochise County (*6*). Fragmented charcoal in clay matrix surrounding Columbian mammoth bones. The two samples were combined and measured. Collected by E. W. Haury *et al.*; submitted by E. W. Haury, University of Arizona.	A-9, A-10	9250 ± 300 (1957)
Point of Pines Ciénega site, Ariz. W:10: 112, No. 2, layer D-1, Graham County (*7*). Fragmented charcoal from hearth, pine-oak. Layer D is composed of moist, dense, dark gray clay. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-19	4310 ± 160 (1955)
Point of Pines Ciénega site, Ariz. W:10: 112, Graham County. Highly fragmented charcoal in matrix of bed D-1, over area 3 m in diameter. The two samples were combined and measured. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-21, A-22	3980 ± 160 (1956)
Point of Pines Ciénega site, Ariz. W:10: 112, No. 9, Graham County. Carbonaceous material, directly above bones in cremation 36. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-26	3280 ± 200 (1957)
Point of Pines Ciénega site, Ariz. W:10: 112, No. 10, pit 6, Graham County. Charred, waterlogged pine branch. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-27	3070 ± 150 (1956)
Point of Pines Ciénega site, Ariz. W:10: 112, Graham County. Finely divided carbonaceous material associated with cremations in pit 3, bed C-2. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-28	2515 ± 300 (1956)
Point of Pines Ciénega site, Ariz. W:10: 112, No. 6, Graham County. Scattered charcoal fragments in D-1 layer, which is composed of moist, dark gray clay. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-29	4400 ± 150 (1956)
Lehner mammoth site, Ariz. EE:12:1, No. 1, Cochise County. Charcoal fragments mixed with sand from hearth No. 2. Collected by W. W. Wasley, University of Arizona; submitted by E. W. Haury.	A-30	8330 ± 450 (1956)
Lehner mammoth site, Ariz. EE:12:1, test No. 1, G17-G18, Cochise County. Carbonaceous material from black swamp soil layer above hearths, bone bed, and artifacts. Collected by W. W. Wasley; submitted by E. W. Haury.	A-31	6877 ± 450 6356 ± 450 (1956)
Lehner mammoth site, Ariz. EE:12:1, Cochise County. Charcoal fragments mixed with sand from hearth No. 2. Collected by W. W. Wasley; submitted by E. W. Haury.	A-32	7022 ± 450 (1956)
Lehner mammoth site, Ariz. EE:12:1, test No. 1, G17-G18, Cochise County. Carbonaceous material from black swamp soil above hearths, bone bed, and artifacts. Collected by W. W. Wasley; submitted by E. W. Haury.	A-33	7133 ± 350 (1956)
Lehner mammoth site, Ariz. EE:12:1, Cochise County. Charcoal and sand collected from hearth No. 1, 15 cm below black swamp soil. Collected by W. W. Wasley; submitted by E. W. Haury.	A-34	7205 ± 450 (1956)
Lehner mammoth site, Ariz. EE:12:1, Cochise County. Charcoal and sand collected from hearth No. 2, sample 4. Collected by W. W. Wasley; submitted by E. W. Haury.	A-40a A-40b	12,000 ± 450 10,900 ± 450 (1957)
Stick figurine site, NA5686, surface features 7 and 11, Coconino County, Ariz. Reeds, south side of Grand Canyon, about 4 mi from El Tovar Hotel in Cremation Canyon. Collected and submitted by Douglas W. Schwartz, University of Kentucky.	A-47	3100 ± 110 (1957)
Point of Pines Ciénega site, Ariz. W:10: 112, Graham County. Charcoal from pit 7, cremation 42. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-48	2150 ± 200 (1956)
Point of Pines Ciénega site, Ariz. W:10: 112, Graham County. Wood, rotten and wet, from bed C-3, the deposit in which pit 8 was cut. Sample A-53 was a re-run of sample A-49. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-49 A-53	2610 ± 200 2080 ± 200 (1956)
Point of Pines Ciénega site, Ariz. W:10: 112, Graham County. Charred wood, wet, material from pit 8. Sample A-52 was a re-run of sample A-50. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-50 A-52	3250 ± 200 3025 ± 200
Point of Pines Ciénega site, Ariz. W:10: 112, Graham County. Wood, rotten and wet, from bed C-3, the deposit in which pit 8 was cut. Collected by E. W. Haury *et al.*; submitted by E. W. Haury.	A-51	3380 ± 200 (1956)
Cedar from ship of Maarko Sestios. It is thought that the ship sank off the Island of Grand Congloue, near Marseille, France, about middle of second century before Christ. Submitted by Ferdinand L. Lallemand, archeologist at the Office français de Recherches sous Marines, Marseille, France.	A-66	2295 ± 110 (1957)
Double Adobe site, Ariz. FF:10:1, Cochise County. Charred wood from trench No. 2, east end, in river sand, in association with artifacts of the Sulphur Spring stage. Collected and submitted by E. B. Sayles, Arizona State Museum.	A-67	8200 ± 260 (1957)

Description	Sample No.	Age
Arizona EE:12:2, Cochise County. Charcoal, on San Pedro River about ¼ mile south of Hereford, Fort Huachucha Road, in erosion channel with artifacts tentatively identified with Chiricahua stage of Cochise culture. Collected by E. B. Sayles and Ernst Antevs; submitted by E. B. Sayles.	A-68	2850 ± 200 (1957)
Arizona EE:8:13, Cochise County. Sample from Murray Springs, about 1 mi west of Lewis Spring on San Pedro River, collected from heavily carbonaceous earth, about 500 ft northeast of an old ranch house at the forks of drainage, about 3 ft below the surface; the sample was overlain by fine silt in which Cochise-type artifacts occur. Overlies clay containing elephant bones (exposed in main drainage). Collected and submitted by E. B. Sayles.	A-69	8250 ± 200
Arizona CC:12:4, Cochise County. Carbonaceous material collected on San Simon Creek about ¼ mi north of the railroad bridge east of San Simon in erosion channel; probably Chiricahua stage. Collected by Ernst Antevs and E. B. Sayles; submitted by E. B. Sayles.	A-70	7000 ± 265 (1957)
Arizona EE:2:30, test 1, pit 1, Santa Cruz County. Charcoal, Matty Canyon, San Pedro stage, Cochise culture. Collected by Dick Shutler, Jr., and Alexander J. Lindsay; submitted by E. W. Haury.	A-74	1950 ± 200 (1957)

Horatio Hackett Newman, Pioneer in Human Genetics

Following the rediscovery of Mendel's principles in 1900, the science of genetics grew rapidly. Several species of plant and animal proved very early to be especially favorable for study. Among these were the fruit fly, *Drosophila melanogaster,* and corn, *Zea mays.* Very soon a solid foundation was laid for the development of the genetics of all plant and animal species, including the human species.

Developing simultaneously with this young science of genetics was Horatio Hackett Newman. Born in Alabama in 1875 and showing very early an interest in biology, he could hardly help becoming excited about the wonders of genetics that were then being rapidly revealed. By 1905 he had received his doctor's degree in zoology from the University of Chicago. After several years of teaching zoology at the University of Michigan and later at the University of Texas, he returned to the University of Chicago to become a member of its faculty. Newman, F. R. Lillie, and C. M. Child formed a triumvirate that gained or maintained for the zoology department of the University of Chicago a national and international reputation of first rank.

Very early in his career in zoology Newman developed an interest in plural births. He studied and published extensively on the embryological phenomenon of armadillos, in which all the members of each litter of four or six, depending upon the species, are invariably of the same sex and are invariably developed from a single fertilized egg. As time went on Newman gradually shifted his interest to human plural births, not so much because they interested him as a subject per se as because he recognized in them a powerful natural tool with which to evaluate the relative contribution of variations in heredity and environment to the occurrence of observed variations in human characteristics—especially mental characteristics.

Newman published six books and numerous articles. Particularly widely used in colleges and universities throughout the United States, and to some extent in foreign countries, was his book entitled *Evolution, Genetics and Eugenics.* Most outstanding, however, was his book, or monograph, called *Twins,* which he published in 1937 in collaboration with his University of Chicago colleagues Frank N. Freeman and Karl J. Holzinger. This book is a study of the psychology and heredity of about 50 sets of identical and 50 sets of fraternal twins, reared together, and of 21 sets of twins reared apart from infancy or early childhood. It is a study which has probably been quoted more often than any other in connection with the inheritance of human mental variations.

Newman was unusually modest and retiring. As a result of this he did not compete well. He was not interested in details if they did not contribute to broad principles. Yet, he was exceptionally tolerant of those who, in his opinion, picked pebbles and lacked interest in, or were incapable of contributing to, the building of castles. Following his retirement, in 1940, from the University of Chicago, he lived a quiet life at Clearwater, Florida, until the time of his death, in the summer of 1957.

Newman was one of the outstanding pioneers in the development of the science of human genetics in America and, therefore, throughout the world.

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