was appointed president of North Georgia Agricultural College at Dahlonega.

DR. GEORGE A. BAITSELL has been promoted to an associate professorship of biology at Yale University.

DR. MARGARET L. CAMMACK, instructor in biochemistry at Columbia University, has been appointed associate professor of home economics at the University of Arizona. Dr. Cammack will have charge of nutrition work.

DR. EDWARD P. PHELPS, formerly of Cornell University, has been appointed associate professor of chemistry at Marshall College.

DR. CARL R. FELLERS, associate professor of food preservation at the University of Washington, has been appointed research professor of horticultural products at the Massachusetts Agricultural College and Experiment Station.

DR. H. ROGERS, professor of experimental pathology at the University of Paris, has been appointed to the chair of physiology in the university.

## DISCUSSION AND CORRESPONDENCE

### THE MUSIC OF THE AMERICAN INDIANS

A RECENT article in SCIENCE directed attention to the similarity of Chinese and Indian languages. Certain peculiarities of the music of the American Indians may be interesting in this connection. The peculiarities were observed among the Papago and Makah, in my study of Indian music for the Bureau of American Ethnology, and resemble the music of certain regions of Europe and Africa. Three of these unusual peculiarities will be described.

Among the Papago of southern Arizona I heard a high *drone* sung by two or three women, during part of a song. The occasion was a dance held by the Indians on Christmas night, more than seventy miles from a town and near the Mexican border. When recording songs among the Makah on Cape Flattery I asked whether they used this drone. The reply was: "Makah women sometimes sing the drone if they are not sure of a song and are asked to help in the singing, but the Quileute women do it a great deal and call it the 'metal pitch' because it is like a piece of metal which can give only one pitch." George Kennan noted this drone and wrote of it as follows: "In some parts of European Russia, and all over the eastern Caucasus, in the wild recesses of the mountains where the native music had not felt the modifying influence of European culture, I heard songs with this peculiar droning accompaniment." He states that the drone was usually the initial tone of the melody and suggests that it may have been sustained in order to enable the singers to return to the original pitch when repeating the song. A further suggestion is that the drone of the bagpipe may have been an imitation of the vocal drone. Among the American Indian tribes cited the drone appeared to be an embellishment to the singing and the ability to give it was regarded as a musical accomplishment. So far as known, this peculiarity has not been noted by other students of Indian music, and I have not found it among other than these tribes. Inquiry has not been made among the Indians of California. If they also have the drone, and if it reduces in importance from the north toward the south, this peculiarity may have an interesting bearing upon the migration of early Americans.

A resemblance was found between certain very old Papago songs and certain Arab songs which I obtained from Arabs of the Sahara Desert who were temporarily in this country with a Garden of Allah company. The resemblance was noted between songs of the desert journeying of Elder Brother (Montezuma) and the songs of the Arabs when travelling across the desert on their camels, loaded with bags of coffee. These groups of songs have a peculiar swaying rhythm in a slow tempo, difficult to describe but different from other melodies and strongly contrasted with songs of other tribes. Is this a similar reaction to the environment?

A curious resemblance between a custom of the Yogi in India a tradition of the Papago was found in the description of a song. It was said that Elder Brother and his people went to the place now known as Casa Grande, drove out the former inhabitants and tore down their houses. A man named Sivarimaha and his daughter lived in the structure known as the Casa Grande ruin. When Elder Brother came to that place he found the man on top of his house, standing on one foot with the other foot on his knee. It was believed that the man had some mysterious power and that he could not be killed while he remained in that position. His daughter stood on both feet. The death of the man was accomplished by means of a song. In the Yoga philosophy, before students undertake the "Asana positions," they are taught fourteen postures for balancing the body. The first posture requires the student to lift up the right foot with the left hand and stand on the left foot. Later he assumes the posture without the aid of the hand. Is it possible that beneath this narrative there lay, originally, an idea that the contradictory rhythm of the song destroyed the power given the man by his posture?

In the rhythmic songs of the Indian medicine men when treating the sick we find a coincidence with the mantras concerning which it is said (in the Yoga philosophy): "They are combinations of letters producing a sound, and that sound has a certain rhythmic

vibration which is reflected in the body. . . . The Greeks and Romans also knew of the power of words in this respect."

The music of any people is more than their melodies. It preserves many beliefs and customs that would otherwise be lost. In this lies the field of cooperation between the study of primitive music and other branches of ethnology.

FRANCES DENSMORE

RED WING, MINNESOTA

## A METHOD OF ESTIMATING POST-GLACIAL TIME

AMONG the problems met in the study of the Post-Pleistocene is one concerning the time period involved. The solution of the problem is important in many ways. Geologists are more keenly aware of the events which have occurred in this period than in any other. Hence close estimates of the length of time involved will contribute to a more accurate geological conception of the absolute rapidity of various physiographic processes.

Several estimates of the length of post-glacial time are commonly known. Taylor,[1] following Lyell, Spencer and others, estimated the period occupied on the recession of Niagara Falls. DeGeer[2] reached his conclusions from his studies of varied clays. Other estimates have been based on the erosion of the pedestals beneath erratics and on the comparative weathering of drift materials of different ages. The variation in these estimates emphasizes the importance of additional methods of calculating the Post-Pleistocene time interval.

At Yellow Springs, Ohio, there is located a chalybeate spring which has built at its point of issuance in the Cedarville (Niagaran) limestone a large mound of ferriferous travertine which extends some hundred yards into the Yellow Springs Creek valley. The valley lies nearly north and south and is located within the most extended moraines of the Wisconsin glaciation; not, however, within the terminal moraines of the last Wisconsin invasion. The ice moved from a northwesterly direction; the deposit is located on the east side of the valley—hence, it is reasonable to suppose that any preglacial deposit would have been removed by ice abrasion. The erosion by the enlarged streams from the melting ice, one of which occupied the valley, undoubtedly aided in eliminating previous and contemporaneous travertine deposits.

[1] Taylor, F. B., Niagara Falls Folio, United States Geological Survey Folio, No. 190, 1913.

[2] DeGeer, Gerard, "A geochronology of the last 12,000 years," Cong. Int. Geol. Compte Rendu, XI, 1910, pp. 241–253, 1912.

Theoretically, the volume of the present deposit divided by the rate of accumulation should yield the length of time of accumulation as a quotient. The method, as will be readily recognized, involves several complex factors, chief of which are variations in spring flow and in amount of solid material deposited, each influenced in turn by rainfall, temperature and variations in the subsurface spring channels.

Accurate observations extended over a considerable period of rainfall, spring flow, air and water temperatures, together with studies of the differences in quantity of solids in solution at different points within the area of deposition, should provide a basis for a reasonable estimate of the present rate of deposition. A careful collection of the encrusted vegetation should provide an index of climatic variation, which in turn influenced the rate of deposition in the past.

A detailed instrumental survey of the bedrock structure has already revealed the presence of a small flexure, or possibly a fault, which undoubtedly explains the location of the spring and leads also to the conclusion that the spring has been relatively permanent.

The first estimates of the age of the Yellow Spring travertine mound must be regarded as purely tentative. The figures obtained, namely 20,000 to 30,000 years, are intermediate between those given by Taylor and DeGeer. Since trustworthy results of the study of the spring deposit must await the passing of some months, and possibly years, of observation it seemed worth while to publish this method of estimating post-glacial time. It is undoubtedly applicable to many similar travertine deposits. The study of a number of them, in various situations relative to morainal deposits, should contribute materially to the knowledge of the length of the Recent epoch.

A. C. SWINNERTON

ANTIOCH COLLEGE,
YELLOW SPRINGS, OHIO

## LUMINESCENCE IN SPONGES

CASES of luminescence in sponges have several times been recorded. Noll (*Zool. Anz.*, 1879, p. 402) described luminescent larvae of *Reniera*, which had been reared in a table aquarium. The light was manifested upon a slight mechanical disturbance in the water of the aquarium. He states that the light is produced by a luminous fluid accumulated in the body of the larva, but the observation is too crude to be of much value. Since the aquarium had contained several other animal organisms, such as annelids, crabs, etc., and at the same time, it is quite doubtful if the luminous larvae really belong to the sponge. Pagenstecher (*Allg. Zool.*, Bd. 4, 1881, p. 14) and Peron