Iowa Hospital, Iowa City, to take up the teaching of nutrition at the University of California.

DR. WILLIAM E. BLATZ has been appointed instructor in psychology at the University of Chicago.

LEOPOLDO B. UICHANCO, Sc.D. (Harvard), has resumed his former work in the University of the Philippines, where he has been appointed assistant professor of entomology at the College of Agriculture, Los Baños, P. I. Dr. Uichanco had been on leave for about three years, as a traveling fellow of the University of the Philippines in the United States, spending the larger portion of this period in post-graduate work at the Bussey Institution of Harvard University.

DISCUSSION AND CORRESPONDENCE

WEATHERING UNDER CONSTANT CONDITIONS

DURING the past summer the writer visited a number of the paleolithic caves of southern France and northern Spain, and there had an opportunity to study the effects of weathering upon rocks and upon the works of man where conditions have apparently remained unchanged during a time which is variously estimated at from 18,000 to 30,000 years.

Every geologist from his own observations and reading can give many examples of rapid weathering, such as that on the western front of the Amiens Cathedral probably not an original stone placed there by the builders in the fifteenth century can be found;[1] that the outside stones of Westminster Abbey have been renewed five times over; that the stone of which the British Houses of Parliament are built has crumbled so rapidly that already it has been necessary to replace many of the stone ornaments with cast iron.

On the other hand, so many objects showing almost no evidence of weathering have been taken from tombs in Egypt where they were buried for many centuries that little surprise was evinced when the Metropolitan Museum Expedition of 1919-1920,[2] announced the discovery at Thebes, in the chamber of the tomb of a man of great wealth, of a large number of remarkably preserved small wooden models illustrating the daily life of his household: brewers making beer, cooks making bread, boats with their boatmen, cattle fattening in their stable. These wooden models, which are "practically as perfect as the day they were made," were carved and stored away about 4,000 years ago, but so little have they been affected by the agents of the weather that even the finger and thumb prints of the men who carried the figures up to the tomb are preserved as well as fly specks on the models and spider-webs with dead spiders still in them.

It is perhaps because of the many archeological discoveries in arid countries that we have become accustomed to think of the agents of the weather as working slowly only where there is little or no moisture, but the wonderfully preserved paintings, engravings and clay models which are to be seen in the moist caves of southern France and northern Spain, and which antedate the works of the Egyptians by thousands of years, compel a modification of these views.

When the polychrome paintings on the ceilings of the great chamber of the cave of Altamira, near Santander, Spain, were discovered, careful observers doubted their authenticity because they showed so little evidence of great antiquity: the paint is so fresh that it can easily be rubbed off with the finger, the colors are probably nearly as bright as when first laid on, and there is no conspicuous flaking of the surface. Notwithstanding their modern appearance it is generally agreed that the paintings were made by paleolithic artists thousands of years before the pyramids were built or Babylon founded.

In the cave of Combarrelles and in other caves in the Dordogne region of southern France the same absence of conspicuous weath-

[1] J. W. Gregory, "Geology of To-day," page 91.

[2] *Bull. Metropolitan Museum of Art*, XV, December, 1920, pp. 12-40.

ering is marked: the only obvious change in the engravings made by paleolithic artists is that the incisions have taken on the buff color of the rock and are no longer white as when first made.

In the cavern of Tuc D'Audoubert on the estate of Count de Begouen, near St. Girons, in the Pyrenees, is an even more remarkable example of lack of disintegration. In this cave are the clay models of bison which are in nearly as perfect condition as when made. A clay model is almost a synonym for the ephemeral for the reason that a short exposure to ordinary air causes it to dry and crack, and excessive moisture causes it to collapse. These models of bison are in fact slightly cracked but with this exception are unchanged. It is possible that the cracks were formed within the first few weeks after the figures were modeled and that none has developed in the 18,000 to 30,000 years that have followed. This seems incredible, but the proof of very great age appears to be well established.

The conditions under which the art of paleolithic man has been preserved almost unchanged for thousands of years are to be found in the uniform temperature, lack of sunlight, and absence of circulating ground water. Although the rock in the Altamira cave is saturated there has been slight movement of the ground water and consequently little solution or deposition has been possible. In the cave of Tuc d'Audoubert there is now some solution and the composition of the water which drips from the roof of the cave has changed slightly as is shown in some of the stalagmites which after being built by lime deposited from the water now have crater-like depressions in their summits showing that the water is at present under-saturated. It is probable, however, that the moisture content of the air has remained constant and that, because of this, the clay models have not disintegrated. The remarkable preservation of the Egyptian wooden models to which reference has been made is due to uniform temperature, lack of sunlight and absence of moisture.

The explanation of such remarkable preservation therefore involves no new principle as it is due to uniform temperature, absence of sunlight, and non-circulation of ground water. These are, indeed, the conditions under which, deep down in the rocks, the skeletons of the vertebrates of the past are preserved.

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[3] Comte de Begouen: "Les Statues d'Argile prehistoriques de la Caverne du Tuc D'Audoubert (Ariège). *Comptes rendus des séances de L'Académie des Inscriptions et Belles Lettres*, 1912, p. 532.

[4] Macallister, R. S.: "A Text-book of European Archæology," Vol. 1, 1921, p. 481.

THE BEGINNINGS OF AMERICAN GEOLOGY

TO THE EDITOR OF SCIENCE: In his letter, "The Beginnings of American Geology" (SCIENCE, October 27, 1922), Dr. Marcus Benjamin (doubtless quite unintentionally) makes a statement which is not only unsupported by facts but which most unjustly reflects upon the character and career of a distinguished American geologist, a president of the Geological Society of America, and also of the American Association for the Advancement of Science, and, I think, the most unselfish, modest and self-effacing man of science I have ever known.

As in these days whatever appears "in print" is likely to become material for the future historian it seems worth while to correct the erroneous statement.

In his reference to Dr. Newberry's connection with the Geological Survey of Ohio there occurs the phrase "owing to the changes in political administration in Ohio he (Newberry) found himself displaced by a subordinate."

Neither of the two statements incorporated in this sentence is true.

No one who had the good fortune to know Dr. Edward Orton, who was Newberry's successor as director of the survey, will be willing to admit that there is the slightest foundation for what is implied in the last phrase; and those who are familiar with the history of that period of the survey know that Dr. Newberry's failure to continue as its head was not due to a change in political administration in Ohio.

During twelve of the sixteen years covering the entire period in which Dr. Newberry may be supposed to have had any sort of connec-