

existing coasts is all that is necessary to prove how absurd is the idea that the 'formation' of a given area has any necessary connection with the horizon or time-place in the geological column indicated by a given fauna. The two categories are, in a broad sense, incompatible, one indicating merely local physical and dynamic conditions, and the other the stage of evolution of the organic assembly inhabiting an area probably with entirely different boundaries.

Mr. E. O. Ulrich expressed his belief that the idea that faunas required a long time to migrate from place to place is an unjustifiable assumption. The migration of the Paleozoic faunas, which included mostly shallow water organisms, was limited to zones adjacent to the shore line. The Paleozoic continent had much less relief than the present surface and the adjacent water basins were shallow, thus favoring rapid migration. With slight relief a small amount of tilting would cause rapid submergence of large areas with immediate migration of marine life. Therefore, it would result that like fossil faunas indicate at least essential contemporaneity. The case cited as illustrating such geologic conditions with the rapid spread of a fauna was that afforded by the western and southern formations of the Richmond group in the uppermost Ordovician.

Mr. Ulrich stated that his working hypothesis is that one slowly modifying fauna existed continuously on the outer border of the continent while another occupied, on the whole, much shallower and frequently changing basins upon the surface of the continent. On account of the comparatively unstable conditions prevailing there the epicontinental fauna was subjected to many vicissitudes not shared by the outer fauna. Hence considerable and often very great modifications of its character, both local and widespread, took place much more frequently than in the outer fauna. When conditions were favorable, faunas of the inner basins were, in some cases, replenished, or in others, perhaps only slightly modified by accessions from the outer faunas.

Special emphasis was put by David White, the next speaker, on the relative insignificance of the time, as measured by sedimentation, re-

quired by those faunal migrations which are not marked by changes in the composition of the fauna and recognizable mutations of the species. The interval between the two great Pleistocene ice invasions was ample for the migration of the flora and even the formation of peats in the thin deposits of interglacial clays. Between the retreat of the last ice sheet and the restoration of the faunal and floral equilibrium, as we now find it, the interval, as measured in sediments, is geologically not macroscopic. The practical contemporaneity, in the geological sense, of an identical fauna in the various parts of its distributional province is shown by the general agreement and harmony in these parts between the marine invertebrates and the other contemporaneously characteristic classes of organisms, including marine vertebrates, land plants and land vertebrates, whose directions and routes of distribution varied widely. A plea was added for a closer study and a more scrupulous characterization of species, taking into account not only the contemporaneous variation of the organism, but also especially the variations or mutations occurring within the duration of the specific type, some of these mutations being of the most restricted vertical range, and consequently of greatest stratigraphic value.

GEORGE OTIS SMITH,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE WESTERN SIERRA MADRE MOUNTAINS.

TO THE EDITOR OF SCIENCE: The geographical and geological expedition organized by Col. W. C. Greene for the study of the western Sierra Madre Mountains of Mexico has accomplished half of the journey proposed. The party, consisting of Professor Robert T. Hill, Messrs. John Seward and F. H. Fayant and the writer, which left New York February 4, was delayed on its journey to El Paso by blizzards in Canada and the central states and exceptional cold weather in Texas. News of heavy snowfall in the mountains caused farther delay in El Paso, which was utilized by the party for a run across the arid region along the Mexican boundary as far as Naco, Arizona, and thence to Cananea, Soñora. The

route followed, that of the El Paso and Southwestern Railway, is particularly instructive as giving an excellent section of the mesa and the terraces bordering the Rio Grande. One is strongly impressed with the evidence of disintegration of rocks due to the great diurnal changes of the temperature, the work of wind and of sheet-flood erosion, the production of 'calichi' or local tufaceous limestone by capillary concentration of carbonate of lime, and other phenomena too numerous to mention. The railroad traverses several 'bolsens' or pocket deserts and the accompanying volcanic cones and basaltic flows. The Chiricahua Mountains of Arizona are the northern extension of the western Sierra Madres. The bolsens contain underground watercourses, and this important fact has led the Phelps-Dodge Company to establish the town of Douglas beside the Mexican boundary in a large bolsen lying east of their copper mines at Bisbee. Comparatively shallow wells supply abundant water for the great smelters of the Phelps-Dodge and Calumet-Arizona copper companies. The Phelps-Dodge Company gave our party the courtesy of a special train for the purpose of studying and photographing the phenomena of the mesa for thirty miles along the El Paso and Southwestern Railway.

On Tuesday, February 14, the party left El Paso and went southwestward into Chihuahua over the Rio Grande, Sierra Madre and Pacific Railway to the present terminus of the road at Nuevas Casas Grandes. Fifteen miles from El Paso the road reaches the top of the mesa, and from there onward excellent studies were made and photographs taken of the vast llanos, the peculiar moving sand hills known as 'los Medanos,' the lost mountains, and the remarkable shallow lagunas, or periodical lakes, without outlet, which receive the drainage from the Sierra Madre summits and form the final settling pans for the wind- and water-driven debris from the disintegrating mountains. From Lake Guzman, the largest of these lagunas, our route ascended the San Miguel River, first through wide basin-like valleys, then through deep, rugged, tortuous cañons, until finally its head waters were reached on the undulating plains of the great

Sierra Madre plateau more than 7,000 feet above the sea, and 3,000 feet above the arid plateau containing Lake Guzman.

At Casas Grandes our party was shown the great prehistoric ruins which gave the town its name, by F. Mateus, the jefe politico of the district, and at Colonia Juarez we were hospitably entertained by Mr. Ivins, the president of the prosperous colony of American Mormons located there. At San Diego we were guests at one of the great haciendas of Gen. Luis Terrazas, governor of the state of Chihuahua. For three days we traversed land belonging to the same proprietor and were brought into close realization of the tremendous influence of the hacienda, or estate owners, upon sociological conditions in Mexico. For 300 miles eastward to the Conchas River nearly every square mile of land is the property of Governor Terrazas, and he is probably one of the greatest individual landholders in the world.

From the terminus of the railway at Nuevas Casas Grandes southward the journey has been made on horseback and with pack train, and the route thus far covered aggregates 160 miles. Most valuable studies have been made of the remarkable igneous phenomena observed *en route*; a collection of the rocks has been made for the American Museum of Natural History, and photographs have been made illustrating every phase of the physiography, geology and vegetation of the region traversed.

After leaving the impressive cañon of the San Miguel our journey lay across the high plateau for about fifty miles to the new town of Dedrick, consisting of one habitable log house and several others in process of construction in the midst of the great forest of long-leaved yellow pine which characterizes the plateaus and peaks from 7,000 to 8,000 feet in elevation. Immediately west of Dedrick the plateau is scored by the great cañon, ten miles wide and nearly a mile deep, of the Yaqui River, here known as the Aros. This streamway is one of the most stupendous scenic features imaginable, and in beauty and grandeur rivals the famous Grand Cañon of the Colorado. Guaynopita is a little mining camp on the mountainside, four hundred feet

above the river and about thirty-five miles by trail west of Dedrick. The journey hither across and through the cañon has revealed a remarkable physiographic and geologic story which the party considers well worth the hardships of the journey and which will be made the subject of special papers. The region is full of archeological interest, too, through the ruins of cliff dwellers and other prehistoric peoples. In the Rio Chico branch of this cañon there is a set embracing thirty-seven houses.

From Guaynopita our course lies southward through the complex of cañons tributary to the great cañon of the Yaqui and out on to the plateau as far as Ocampo, where the famous ancient mine of Jesus Maria is located. Thence we turn back to Miñaca and there begin the long railway journey to New York.

EDMUND OTIS HOVEY.

THE METRIC SYSTEM AGAIN.

TO THE EDITOR OF SCIENCE: For the benefit of those who are clamoring for the adoption of the metric system, I desire to give an illustration of the beautiful simplicity of the system of units in vogue in the United States and Great Britain. Any of our units of measurement would answer the purpose, for they all partake of the same delightful elasticity of value. Let us take the collection of units of measure commonly denominated the gallon. In order that we may comprehend the relation of these various units to each other it is desirable to have some fixed unit as a means of comparison. As the cubic inch in use in America is not the same as that of Great Britain, and as it is desirable to use some unit of capacity that has only one value, we shall be compelled, much against our wishes, to use the liter as a unit in which to express the volume of the various members of the gallon family.

Gallon No. 1.—3.78543 liters. This gallon is variously denominated in the literature of metrology as the liquid (metric), liquid (national), metric (U. S.), Winchester, wine, and dry (metric). It is said to contain 231 American cubic inches. It is stated also that this gallon is generally used by American hydraulic

engineers. It is a little difficult to be certain on this point, however, for many authors fail to state the volume of the gallon they use, in liters, and do not state whether American or British inches are meant.

Gallon No. 2.—4.4070 liters. This is the dry (national), or dry (U. S., or Br.), according to the Standard Dictionary. It is supposed to be used a good deal by tradesmen, and is sometimes referred to as a half peck. Whether it is used in England is a little difficult to ascertain, because of failure of writers to mention its volume in any fixed unit.

Gallon No. 3.—4.54346 liters. British (Mendenhall), liquid (U. S., or Br.), or Imperial gallon.

Gallon No. 4.—4.6209 liters. Legal standard dry gallon in Wisconsin and Connecticut; legal standard for ale, beer and milk in New Hampshire and Minnesota. Used in these states by tradesmen in *buying* these commodities. Also a legal standard in Maine.

Gallon No. 5.—‘Proof’ gallon. “This has the volume of a wine gallon containing one half its volume of nearly pure alcohol at 60° F.” The number of proof gallons in a quantity of distilled liquor is found by multiplying the per cent. of proof (= twice the per cent. of alcohol present) by the number of wine gallons. Used by gaugers in assessing internal revenue tax on spirits.

I have not taken the time to verify all the references in parentheses above. Indeed, I was unable to do so with the ordinary reference books available to the student. It seemed, too, that in treating so simple and easily understood a subject, that it might be well to content myself with the above references, in order to show how simple the whole matter is, and what a delightful and satisfactory system we have, especially when exact measurements are needed. It is also probable that the careful reader will be stimulated by this hurried and incomplete account to investigate the subject further.

W. J. SPILLMAN.

NEW AMERICAN OSTRACODA.

TO THE EDITOR OF SCIENCE: In collections of ostracod crustaceans made near Greeley,