mammoth. Continued labor recovered from the bed of gravel below a large part of the skeleton, all beautifully preserved. This aroused a great deal of excitement in that region. While the curiosity of the people was at white heat, a showman bought the skeleton for a thousand dollars, and put it under canvas for public exhibition. I afterward met this gentleman, who offered the specimen, securely packed for transportation at San Francisco, for a few hundred dollars. I wrote to Professor E. D. Cope, in whose employ I was, giving him all the particulars, and address of the possessor, whose name I have now forgotten. On the strength of the information given me by the surgeon, I resolved to conduct an expedition to the Pine Creek region. I left Fort Walla Walla sometime in January, 1878. At Moscow, Idaho, I secured the services of Joe Huff, who furnished a team and wagon. We pressed on through Colfax to Pine Creek (it heads in the high hills not far from where we came to it, at a stockade that had been built to protect the settlers from Indians a few years before; we made our permanent camp here), and spent most of our time until April, when we started for the John Day region, in eastern Oregon. The mouth of the spring we explored was only two feet above the creek. To add to our discomfort, it rained nearly every day; but with unfailing enthusiasm we bailed mud and water week after week. The larger we got the excavation, the more water to bail out. In enlarging the pit we found the walls of the spring were composed first of a thick bed of peat, then a stratum of compact yellow clay, then gravel, in which the bones were deposited, about twelve feet below the surface. In spite of our strenuous labors, we were only rewarded with the discovery of a number of fine skulls of the buffalo. In one we found a flint arrow-point and bones of the skeleton. The farmer-fossil-hunters had been more fortunate. The so-called 'mud-springs' in this region often cover acres of swamp land along the upper reaches of Pine Creek. They usually have a circular outline, and are full of thick mud; in wet weather they are in a state resembling ebullition. In very dry weather they are covered with a crust of dried mud that is cracked in all directions. These crusts not being strong enough to support much weight, they become death traps to the animals that attempt to cross them. Many of the farmers' animals were lost in them. On March 1, 1878, I met Mr. Copeland for the first time. He told me he had taken nine specimens of the mammoth from the swamp on his ranch. These, as I remember, he had deposited in a college in Forest Grove, Oregon. He discovered a flint spear-point in the gravel above the mammoth bones, associated with charred and partly petrified wood that bore the marks of tools upon it, also deer, buffalo and bird bones. On March 2 we went with Mr. Copeland to see the springs on the Donahue brothers' ranch up Pine Creek. Here the swamp covered seven or eight acres, and the owners had made large excavations. I was told they had recovered a large number of elephant remains. I found on the dump a few elephant bones, with those of the buffalo, deer, etc. I do not remember what became of the specimens discovered by these gentlemen. Although I did not actually find elephant bones mingled with the buffalo we found so common in our spring, I never doubted, from what I saw and heard at the other excavations in the immediate neighborhood, and where the collectors went through the same kind of peat, clay and gravel as we had gone through, that man, the buffalo, elephant and many existing species once lived together in eastern Washington. It seems to me these swamps should receive careful attention from paleontologists. A systematic series of explorations here may give valuable information of early man and the animals with whom he associated.

The skull of *Elephas Columbi* above referred to is now in the collection of the American Museum of Natural History, with other fossils of the Cope collection.

Charles H. Sternberg.

HERBARIA FORMATIONUM COLORADENSIUM; F. E. ET E. S. CLEMENTS.

One of the phases of botany now in active advance both in this country and abroad is

ecological plant-geography, or phytogeography, the study of the ecology of the vegetation of particular regions. It aims to elucidate the factors determining not only the adaptations of species (*vegetation forms*) to their habitats, but also their association into groups (*formations* [*societies*], *associations*, etc.) constituting the plant-life of any region, a subject of the greatest educational and popular, as well as scientific, interest. Such investigation is still so new as to exhibit many of the crudities of youth, and its methods and terminology are yet undifferentiated; but the field is attractive and promises rich results to a truly scientific attack. In this country there are three active centers of phytogeographical study, the universities of Nebraska, Chicago and Minnesota. Under the auspices of the botanical seminar of the University of Nebraska, Drs. Pound and Clements have published a volume, 'The Phytogeography of Nebraska' (Second ed., 1900) which represents the most extensive and thorough ecological study, from a scientific standpoint, of the vegetation of a particular region which has been attempted in this country. And now one of the authors, Dr. Clements, has taken the lead in a work of another kind which is likely to be much followed in the near future, namely, the preparation of sets of herbarium specimens, supplemented by photographs, to illustrate by these two most accurate of available methods the phytogeography of an important region in the Rocky Mountains, and he has placed a number of these sets at the disposal of other institutions and students.

This collection consists of herbarium specimens of standard size and most excellent preservation illustrating some 533 species of prominent Colorado mountain-plants, supplemented by 101 photographs 6 x 8 inches, the great majority of which leave nothing to be desired in the clearness of illustration of their subject and in artistic photographic excellence. They are selected to show either individual prominent plants (the vegetation forms), or associations of these (facies) or the larger groups occupying characteristic situations (formations), while a few illustrate special features of reforestation, etc. Equally important with specimens and photographs are the labels, of which a specimen taken at random reads thus:

HERBARIA FORMATIONUM COLORADENSIUM

F. E. et E. S. CLEMENTS.

93. *Gentiana affinis* Griseb.

Herba rhizomatica endemica, Minn-NM-Nev-BC., species principalis aspectus autumnalis Pinus ponderosa-flexilis-xero-hylio.
Crystal Park 2600 m. 4 Septembris 1901.

The labels thus give, in addition to the more usual information, a short characterization of the vegetation form and a mention of its place in a particular formation, *e. g., the Pinus ponderosa and flexilis dry forest.* The labels thus embody Dr. Clements's new proposals for phytogeographical nomenclature, an extremely carefully and judiciously elaborated system which the author has since published in Engler's 'Botanische Jahrbücher' (Beiblatt No. 70, 1902). His system consists essentially of the naming of formations by combining the genus (and species) names of the prominent vegetation forms with terms from Latin and Greek roots precisely descriptive of the habitats. It is of course yet too early to permit of any prediction as to how widely the system will be followed, but there can be no doubt that it is much the most serious attack upon this important problem that has yet been made, and not only must future workers take account of it, but it is very likely to form the foundation of the permanent system. In this admirable collection Dr. Clements thus characterizes some sixteen formations, and shows the place in each of the various vegetation forms, while a set of check-labels makes the classification easy and plain. When one examines these specimens in close comparison with the photographs, bringing the two into correlation by use of the labels, he has the means of obtaining the most accurate and vivid impression of the vegetation of this region that can possibly be obtained without an actual visit. For this reason it is altogether likely that the method will be extensively used in the future in the description and illustration of the phytogeography of the different regions of the earth, both as a means

of preserving phytogeographical data for convenient reference, and also for various educational purposes. In this Dr. Clements is the pioneer, and deserves our congratulations upon the success of this first attempt.

It is understood that twenty-four sets (the price of which was very moderate) were prepared, of which all or nearly all have been taken, about a third of them by institutions abroad.

W. F. Ganong.

NOTE ON NEGATIVE DIGITS.

In the common scale of notation 2873 stands for $2000+800+70+3$. The same number might be represented by $3\bar{1}33$ which is intended to mean $3000-100-30+3$. It might also be written $3\bar{1}2\bar{7}$ or $29\bar{3}3$, and, indeed, a great variety of ways might easily be found, but the form $3\bar{1}33$ is most advantageous in that the absolute values of the digits are the smallest possible. It is clear that any number may be written so that all its digits shall be less than six in absolute value. In fact, we may replace 9 by $1,\bar{1}$ by $\bar{2}$, 7 by $\bar{3}$ and 6 by $\bar{4}$, leaving the others unchanged. This amounts to replacing the digit K by $10-K$, so that we must add one unit to the adjacent digit on the left. We have then the following rules for changing any digit from plus to minus and from minus to plus:

1. *To change a digit from plus to minus, subtract it from* 10 *and add* 1 *to the digit on the left.*

2. *To change a digit from minus to plus, subtract it from* 10 *and subtract* 1 *from the digit on the left.*

In practice one begins on the right and changes successively those digits which are greater than 5. Thus to change 82755637 the 7 on the right goes into $\bar{3}$ and the 3 becomes a 4, the 6 changes to $\bar{4}$ and the 5 adjacent to it becomes 6, which goes into $\bar{4}$ and makes the second 5 a 6. This goes in turn into $\bar{4}$ and changes 7 to 8 or $\bar{2}$ and the 2 becomes 3. The last digit on the left becomes $\bar{2}$, which changes the digit next to it on the left (namely 0) to 1. The whole process then gives

$$1\ \bar{2}\ 3\ \bar{2}\ \bar{4}\ \bar{4}\ \bar{4}\ 4\ \bar{3}.$$

The reverse process is carried out similarly, and half an hour's practice will enable one to make the change from one notation to the other with little effort of the mind.

The new notation is of little value in addition or subtraction and is entirely useless in division. In multiplication its value, however, can hardly be overestimated. The advantage in using it is twofold. The digits are all less than 6 and there is twice the chance of repeated digits in the multiplier. Thus, in the ordinary method of multiplication, if one has obtained the partial product corresponding to a digit 3 in the multiplier, one obtains the partial product corresponding to a digit $\bar{3}$ by changing the signs of all the digits in the first partial product. In the short method of multiplication given in Science, July 11, 1902, it is difficult to deal with large digits. Thus, to find the product of 987593×86759 by that method would be a difficult and fatiguing task. Changing to negative digits, however, one finds the product can be written out with perfect ease, thus:

$$\begin{array}{r} 1\ 0\ \bar{1}\ \bar{2}\ \bar{4}\ \bar{1}\ 3 \\ 1\ \bar{1}\ \bar{3}\ \bar{2}\ 4\ \bar{1} \\ \hline 1\ \bar{1}\ \bar{4}\ \bar{3}\ 3\ 2\ 4\ 1\ 1\ 2 \\ 1\ 0\ 1\ 7\ \bar{1}\ \bar{1}\ \bar{3} \\ \hline 8\ 5\ 6\ 8\ 2\ 5\ 8\ 1\ 0\ 8\ 7 \end{array}$$

D. N. Lehmer.

University of California,
October, 1902.

MUSEUM NOTES.

Part X., Volume II., of the *Annals of the South African Museum* is devoted to a continuation of 'The Moths of South Africa,' by G. F. Hampson. The present instalment, comprising nearly two hundred pages, deals entirely with the large family Noctuidæ, and gives keys to the subfamilies, genera and species. The descriptions are very full and include a great number of new species; the greater number of types are in the British Museum, but the location of all others is noted.

Part II. of the *Memoirs of the Carnegie Museum* contains a detailed description of the osteology of 'Oligocene Canidæ,' by J. B. Hatcher, including *Daphnœus felinus, Pro-*