their immense size and their unique characteristics, which render them of especial value as museum exhibits.

Localities along the southern coast of the Province of Buenos Aires were selected as offering the best prospect of securing good specimens of the great Pampean mammals. The motor equipment, which had been stored since the first expedition, was again brought into use. The coastwise exposures from Bahia Blanca to Miramar were gone over. Some collecting was done on the beaches as exposed at low tide, along the low sea-cliffs and among sand dunes near the shore, where small areas had been denuded by wind erosion. More favorable collecting grounds were found along the banks of certain rivers, whose channels have, in their lower courses, cut through the entire Pampean formation. These steep banks, swept clear of débris by floods in every period of high waters, offered the most favorable opportunity for discovering specimens.

From these localities a collection of sixty-two specimens was secured. Among the number is more than half of an articulated skeleton, including head, of the greatest of the ground sloths, *Megatherium americanum*. Excellent articulated skeletons of the intermediate-sized sloths, *Scelidotherium* and *Glossotherium*, good specimens of the great saber-tooth tiger and of the Argentine mastodon, and various specimens of fossil horses, llamas and rodents were also secured.

This work held the expedition in the south until the close of the southern summer. In May the party again moved northward to continue collecting in the Pleistocene valley-deposits of Bolivia. Dr. Stahlecker, who found it necessary to return to Germany at this time, was replaced by Sr. Jose Strucco. A new force of camp men and helpers also was employed.

As soon as preliminaries had been arranged, the party pushed on from Tarija into the small, isolated valley of Patcaya. There a formation of valley sediments similar to that of Tarija was found. Quarters were established for the winter and collecting was begun among the arroyos and thornbushes of this mountain district. The prize specimen here secured was an articulated skeleton, almost entire, of the mountain species of the great sloth, *Megatherium tarijensis*. Specimens of the equally large sloth, *Lestodon*, rewarded prolonged excavations in an old stream-channel. Two articulated skeletons of *Glossotherium* compensated for months of patient search through bush-lands. Various specimens of the Andean horse and of camels and llamas added to the sum total of the winter's collection.

By the end of September, 1927, collecting by the second expedition was terminated. Shipments were made during the succeeding month. The party then returned to Chicago by way of Peru and the western coast.

The results of the two expeditions may be summed up as follows: Representative collections of fossil mammals were made from the Eocene, Oligocene, Early Miocene, Pliocene and the Earlier and Later Pleistocene of Argentina and Bolivia. During this work the Field Museum parties examined most of the formations of Argentina and Bolivia which have yielded fossil mammals. Collections were made from no less than twenty-two different localities, several of which were first made known by the labors of these expeditions. Fossil invertebrates were collected from Cambrian, from Miocene and from Pliocene formations. A rare collection of fossil cones, twigs and branches of the genus *Araucaria* was made from fossil trees found *in situ* near Cerro Madre y Higa, of the province of Santa Cruz. Small collections of recent mammals, birds and reptiles were made; also collections of flowering plants from the provinces of Chubut and Catamarca. Studies of stratigraphy in the several fossil-bearing localities were carried on and a number of geological sections were prepared. A series of some twelve hundred photographs were made for the purpose of recording the work of the expedition, as well as to illustrate subjects of more general interest.

Through the courtesy of the Argentine and the Bolivian governments, all these collections, excepting a certain number of duplicated specimens, were permitted to be exported to the United States. The various shipments, totaling nearly three thousand specimens of fossil mammals, birds, reptiles, mollusks and plants, have safely arrived at the Field Museum. The preparation and the study of these collections will require a period of years. A number of specialists in various lines have been invited to assist in this task.

ELMER S. RIGGS
FIELD MUSEUM OF NATURAL HISTORY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

MAKING A CORRECT MECHANICAL ANALYSIS OF SOILS IN FIFTEEN MINUTES

IN previous communications the use of the hydrometer method has been proposed as a rapid and simple method for the study of soils.[1] A very comprehensive study has been made to ascertain if the method could be used for making a mechanical analysis of soils. It has been discovered that if the soil particles are grouped into three main groups—sand, silt and clay or colloids—these three groups can be determined by

[1] *Soil Science*, No. 5, 1927; No. 4, 1927; SCIENCE, July, 1927.

the hydrometer method rather remarkably correct in only fifteen minutes by making only two readings, one at the end of one minute and the other at the end of fifteen minutes. In making these studies about thirty different soils were obtained from the United States Bureau of Soils whose complete mechanical analysis was known. It was found that the percentage of material that settles out at the end of one minute in the regular hydrometer method is almost exactly the same as the percentage of all the combined sands obtained by the mechanical analysis method. If the percentage of material that settles out at the end of fifteen minutes minus the sand which settles out at the end of one minute is considered to be silt, and if the material that still stays in suspension at the end of fifteen minutes is considered to be clay or colloids, it was found that the mechanical analysis and hydrometer methods agreed quite closely in the soils whose silt content was composed mostly of the coarser size—in the neighborhood of .05 mm and disagreed rather widely in the soils whose silt content was composed of the finest size —in the neighborhood of .005 mm. This is as should be expected because recent studies go to show that the finer silt has practically the same characteristics as the clay and should be classed, therefore, with the clay, while the coarser silt does not possess the same characteristics. The hydrometer method, therefore, includes in its clay or colloidal determination the finer silt but not the coarser silt, consequently the hydrometer method would agree with the mechanical-analysis method in soils with the coarse silt content but not with the finer silt content. In other words, the hydrometer and mechanical-analysis methods agree almost perfectly in the determination of the combined sands, coarser silt and clay. Where they do disagree is in the finer silt. The mechanical analysis classes this fine silt with the coarse silt, where the hydrometer method classes this fine silt with the clay, because it has more of the characteristics of clay. Hence there is no serious and radical disagreement between the two methods.

If it is desired to determine only the total sand and the total silt and clay, these determinations can be made by the hydrometer method in only one minute and will be very correct.

With the aid of Stokes's law, the hydrometer method can also be used to make a very detailed mechanical analysis of soils.

Although the method may appear too ideal to be true, yet all facts point such to be the case. Indeed, the method appears to be a rather remarkable and unique means of studying soils quickly, simply and accurately. For all general and practical purposes this method gives nearly all the information that is necessary and essential regarding the physical composition of soils. And in many cases such information seems to be more true than that of the mechanical-analysis method.

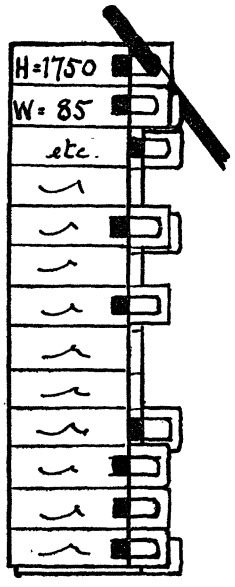
Finally, it must be stated that the criticisms which Joseph and Keen have made in *Soil Science* regarding the hydrometer method are not justified and do not apply to the method as is shown elsewhere.

GEORGE JOHN BOUYOUCOS
MICHIGAN AGRICULTURAL EXPERIMENT STATION

A SIMPLE METHOD OF PICKING UP CORRELATIONS[1]

IN dealing with a long series of systematic observations on individuals, as in the routine work of the Constitution Clinic in the Presbyterian Hospital—besides the opportunity of working out the type characteristics of any group under investigation—there is the possibility of finding a large number of correlations. If there are n observations on each subject or patient, there are n $(n-1)/2$ correlations of the first order. A fair estimate of the significant correlations can be obtained by means of the home-made sorting machine to be described.

The observations on one individual are recorded on a long card about 5 cm. high in vertically ruled spaces



1 cm. wide. Each observation is then compared with some given criterion and classified as plus or minus, yes or no. If the observation is plus, a clip is attached in the appropriate position along the top of the

[1] From the department of medicine of the College of Physicians and Surgeons of Columbia University and the Presbyterian Hospital, New York.