approximately eight hundred specimens, some of the species being now extinct.

THE U. S. Coast and Geodetic Survey has erected a new building at the seaward end of the 1,200-foot pier of the Scripps Institution of Oceanography at La Jolla. It is forty-five by ten feet and is part of a general program of improving the recording tide-gauge stations. Dr. G. F. McEwen, official tidal observer of the U. S. Coast and Geodetic Survey at the Scripps Institution, has been put in charge of construction. In addition to the instruments used in the tidal work, the building will contain equipment for routine observations of meteorological and hydrographic conditions, and for biological studies.

BY a cooperative agreement recently concluded between the U. S. Department of Agriculture and the Iowa State College, the statistical laboratory of the college will undertake to perform important services for and with the department, and to this purpose it is increasing both staff and equipment. Provision is made for the addition to the staff, of which Professor G. W. Snedecor is director, of a professor of mathematical statistics, an instructor, four graduate assistants, two collaborators and a sufficient number of clerical assistants. The purpose of the enlarged laboratory is research in the statistics of agriculture and associated statistical theory. One project is the study of the relation between weather and crop yield. Weather conditions to be considered are change and range of temperature, rainfall, wind. Partial census methods—whose investigation is of great concern to the laboratory—are used for the estimation of acreage and condition of the crop, for the sake of early prediction of yield. In the study of weather prediction, the Massachusetts Institute of Technology is cooperating. Products to be given early consideration are corn, wheat (with the aid of Kansas State College) and cotton. By the study of sampling techniques it is hoped to be able to learn significant economic and social facts of rural life more efficiently and reliably. A further topic of investigation is the analysis of time series.

DURING the recent crisis in Great Britain the aeroplane of 1903 in which the Wright Brothers made their first flight, which has been exhibited on loan in the Science Museum, South Kensington, for the past ten years, was removed to a place of safety in the vaults of the museum.

DISCUSSION

THE HISTORY OF MATHEMATICS FORTY YEARS AGO

IN 1898 the publication of the now widely used "Encyklopädie der mathematischen Wissenschaften" was begun. The first article thereof relates to arithmetic and includes a considerable number of historical statements relating to this subject. It may be assumed that these statements represent about the highest mathematical attainments at the time when they appeared, since this is the most extensive recent mathematical encyclopedia, and more than 200 scholars of various countries cooperated in its preparation. Hence it may be of interest to compare the views contained in some of these statements with those which are now current with a view towards noting progress along various mathematical lines during the last forty years. In particular, the historical statements may be of wide interest, since they can be readily understood and relate to the early training of almost all educated people.

Since note 18 on page 12 of Volume 1 contains an especially large number of statements which have been disproved since their appearance therein we begin with several of these assertions. This note relates to negative numbers and in the third sentence thereof it is asserted that the first traces of these numbers appear in the works of the noted Indian mathematician Bhaskara (born in 1114) who distinguished between the positive and the negative square root of a number. It is now well known that, on the contrary, even the Indian mathematicians used negative numbers more than 500 years earlier and that, in particular, Brahmagupta (born in 598) placed a dot above a number to indicate that it is negative. It is therefore far from correct to say that the first traces of negative numbers appear in the work of Bhaskara. In the following sentence of the given note it is asserted that the Arabs recognized negative roots of equations, which is also now well known to be untrue.[1]

The last sentence of the given note contains two misstatements relating to R. Descartes (1596–1650). The first of these is that the actual calculating with negative numbers begins with R. Descartes, while it is now commonly known that such calculatings are posterior to R. Descartes as is also stated in the corresponding note (149) of the French edition of this encyclopedia, page 35 (1904). The said second misstatement in the sentence is that R. Descartes gave to the same letter sometimes a positive value and sometimes a negative value, while, on the contrary, R. Descartes always assumed that a letter represents only a positive number when it is assumed to have a numerical value. It is, however, true that by placing a dot before a letter R. Descartes implied that either a positive or a negative number may be assigned to the letter.

[1] *Cf.* Tropfke, "Geschichte der Elementar-Mathematik," Volume 2, page 97, 1933.

Although note 24 (page 21) of the article in question involves comparatively few incorrect assertions it contains one which is so extremely bad that the note as a whole is perhaps even worse than the note 18 to which we have referred. In the former it is stated that the sexagesimal system of the ancient Babylonian astronomers involved 59 different numerical symbols. This would correspond to the 9 different digits in our decimal system, but there is no historical evidence that such a complex early system ever existed. It is now well known that the ancient Babylonian sexagesimal system was partly based on the number 10 and that the numbers up to 60 were represented with respect to this smaller base.[2]

It is not implied that all the historical notes in the widely used encyclopedia noted in the opening sentence of this article are in need of radical revision. On the contrary, the majority of them are still reliable, especially those which relate to the more advanced parts of our subject. It may, however, be of interest that some of these notes which relate to the most elementary parts of our subject should now be used with great caution, since historical progress during the last decade or two has been especially rapid with respect to school mathematics, where it might have been least expected. In particular, the history of negative numbers as it is presented in some of our general histories of mathematics is very misleading notwithstanding the fundamental rôle of these numbers in various developments relating to school mathematics. It is questionable whether in any other large field of mathematics the progress during the last forty years has been more profound than in its history.

G. A. MILLER

UNIVERSITY OF ILLINOIS

MEDITERRANEAN SEDIMENTS AND PLEISTOCENE SEA LEVELS[1]

THE magnitude of the sea level changes during the glacial stages of the Pleistocene are of interest not alone for their bearing on the origin of submarine canyons but also, among other things, for their effect on migrations of animals and plants. Antevs[2] and Daly[3] have independently suggested that the sea level was lowered 80 to 90 meters during the last glacial stage, whereas Shepard[4] has suggested that it was lowered perhaps as much as 900 meters.

An independent test of the hypothesis that sea level was lowered several hundred meters would probably be furnished by a study of the sediments in the western deep basin of the Mediterranean Sea. Long cores of these sediments, like the cores that Dr. C. S. Piggot obtained in 1936 from the North Atlantic, would probably make available the sedimentary record of post-Pleistocene time and part of the last glacial epoch.[5] Such records should be conclusive on the question of great lowering of ocean level because the unusual configuration of the Mediterranean Sea floor and the geographic setting make the hydrography not only peculiar but also sensitive to changes of ocean level and of climate.

Lowering the ocean level about 320 meters or more would profoundly alter the hydrography, and this would be reflected in the deep basins by the formation of varved sediment moderately rich in organic matter like that now forming in the Black Sea.

Lowering the ocean level considerably less than 320 meters, say 80 or 90 meters, would not give rise to varved sediment in the western of the two deep basins, though the glacial climate alone would probably give rise to varves in the eastern deep basin.

Lowering the ocean level 80 or 90 meters would affect the regimen of sedimentation less decisively, yet it seems that the effect should nevertheless be distinguishable, as is outlined below.

In order to show how these conclusions are reached it will be necessary to consider the present hydrography of the Mediterranean and the probable hydrography that existed during the last glacial stage when both the climate and the ocean level were different. A high sill at the Strait of Gibraltar separates the Mediterranean from the Atlantic and a comparable sill at the Sicily Straits divides the Mediterranean into two deep basins (Fig. 1). Over the crest of the sill at Gibraltar the deepest water is approximately 320 meters. In the Sicily Straits the deepest channel across the crest of the sill is 450 meters. These constrictions in the longitudinal profile have a significant bearing on the hydrography.

At present the Mediterranean Sea loses more water by evaporation than it receives from its tributary streams and from the overflow of the Black Sea. In consequence its level is maintained by influx of sea water from the Atlantic. The loss of water by evaporation is greatest in the eastern Mediterranean, so that the Atlantic water, with salinity of about 36 parts per thousand, drifting eastward becomes progressively more saline until near the Syrian coast it reaches a

[2] *Cf.* O. Neugebauer, "Vorlesungen über Geschichte der Antiken Mathematischen Wissenschaften," Volume 1, page 4, 1934.

[1] Published with the permission of the Director, Geological Survey, U. S. Department of the Interior.

[2] E. Antevs, *Amer. Geog. Soc. Research Ser.*, No. 17, p. 81, 1928.

[3] R. A. Daly, *Bull. Geol. Soc. Amer.*, 40: 724–725, 1929.

[4] F. P. Shepard, SCIENCE, 83: 484, May 22, 1936.

[5] C. S. Piggot, *Bul. Geol. Soc. Amer.*, 47: 675–684, 1936; W. H. Bradley, M. N. Bramlette, J. A. Cushman and others, *Am. Geophys. Union Trans.*, eighteenth annual meeting, pp. 224–226, 1937.