of the breccia were slightly eroded by wave action during the deposition of the green shale in the surrounding water, but the leveling had not proceeded far when the Devonian age came to a close; the entire region was depressed, and the Louisiana limestone (formerly known as the Lithographic limestone), or basal member of the Kinderhook Group, was laid down over the breccia. It is usually a regularly bedded, dark gray limestone, everywhere perfectly conformable to the green shale, but over the distributed area it is irregularly bedded and slightly arched, but soon succeeded, by thickening in the hollows and thinning over the prominences, in leveling off the ancient sea bottom. The Lower Carboniferous strata are here locally unconformable with the Devonian. We have thus seen that the thinning of the green shale over the area of disturbance fixes the time of said disturbance at the period between the deposition of Nos. 1 and 2 or the shaley limestone and the green shale. From a general resemblance between the shaley limestone of this region and portions of the Cedar valley limestone of Iowa, and from the fact that this peculiar mode of brecciation obtained in both regions, I wish to suggest that the light brown or gray, amorphous, shaley limestone of southwestern Missouri may be the equivalent of the Cedar valley limestone of central Iowa.

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CURRENT NOTES ON PHYSIOGRAPHY (X.)

LEY'S CLOUDLAND.

This long expected work (Stanford, London, 1894. 208 p.) is an effort to establish a classification and terminology of clouds on a genetic basis. While such a plan has much to commend it, and must eventually be adopted in fully developed form, its presentation now is perhaps premature; for there is yet much to learn regarding the origin of certain cloud forms, and much difference of opinion still prevails on the subject. Four chief classes are recognized in Ley's scheme: clouds of radiation, such as ground fogs; of inversion, such as cumulus, dependent on overturnings in an unstable atmosphere; of interfret, such as waving stratiform clouds formed at the contact of layers of different temperature; and of inclination, such as pendent cirrus wisps, caused by the settlement of particles from one atmospheric stratum into another. The illustrations, reproduced from photographs by Clayden, are for the most part excellent. The chief deficiency of the work is the absence of comparative tables, by which the terms proposed by Ley may be translated into those adopted by the International Meteorological Congress. In a number of passages exceptions must be taken to the manner of physical explanation of cloud formation, especially to statements concerning the relation of water and ice particles in cumulus and cirrus clouds, and to the repeated implication that the liberation of latent heat in the condensation of vapor actually warms the air. The chapters on the theory of atmospheric currents and on the prevailing winds of the globe are hardly relevant to the rest of the book and add little value to it. Remembering that the author has devoted years of observation to cloud study, and that latterly his work has been much interrupted by ill health, it is doubly a regret that his book cannot be more highly commended.

BUREAU CENTRAL MÉTÉOROLOGIQUE.

The latest series of *Annales* of this important Bureau contain as usual a volume of memoirs in which, besides the statistical studies of thunder storms in France by Fron and several reports of magnetism, there are essays by Angot on the advance of vegetation and the migration of birds in France for ten years, 1881–1890, and on the meteor-

ological observations on the Eiffel tower during 1892; and by Durand-Gréville on squalls and thunderstorms. Nearly all the features of the advance of vegetation exhibit the accelerating influence of the Mediterranean and the retarding influence of the Bay of Biscay. The records of the Eiffel tower are chiefly interesting in showing inversions of nocturnal temperature in the means of all the months, and consequently in proving a distinct variation in the diurnal values of the vertical temperature gradient in the lower atmosphere; as well as a change of the time of maximum wind velocity from afternoon at surface stations to night at the top of the tower. Durand-Gréville's essay is illustrated by an excellent chart of the distribution of pressure during an extended squall that occurred on August 27, 1890; the isobars being drawn for every millimeter, and showing a sharp N-like double bend at the place of the squall.

WINTER STORMS IN THE NORTH SEA.

THE famous Christmas storm of 1821, which led Brandes and Dove to their early statements concerning the system of storm winds, finds a modern parallel in a storm of December 22–23, 1894, described by Köppen in the *Annalen der Hydrographie*, edited by the Naval Observatory at Hamburg, and published in Berlin. On the morning of December 22 the storm center, with a pressure of 715 mm., lay just east of Scotland; on the evening, with a pressure of 725, the center lay just west of Denmark. The whirling courses of the winds are well illustrated; a southerly gale crossed the Baltic, while a northerly gale raged on the North sea; violent east winds blew off the coast of Norway, and westerly gales were recorded in northern Germany. Disastrous storm floods were felt at many points on the coast, and salty rain fell at many points in England. Other storms were felt a week earlier and later; but, apropos of this apparent periodicity, Köppen remarks that thus far all efforts to establish weekly, monthly or longer weather cycles have, without exception, failed, and that, while the faint and easily obliterated traces of such periods have a certain scientific interest, they have not yet a practical value. The *Annalen der Hydrographie* is a characteristic German journal, in which a serious and scientific style of work is carried into the accounts of foreign coasts and harbors, as reported by officers of the marine. It frequently contains articles and reviews of interest on winds, tides and currents.

ELEVATION AS A CAUSE OF GLACIATION.

IT is probable that no one questions the sufficiency of elevation to account for glaciation, if other things, such as external controls of climate, remain unchanged; but there are serious difficulties in the way of accepting the thesis maintained by Upham (latest expressed in Bull. Geol. Soc. Amer., vi., 1895, 343–352) to the effect that the glacial sheets of northeastern America and northwestern Europe were caused by and hence were coincident in time with the elevation that permitted the erosion of the deep marginal valleys of the continents. Upham cites the case of the Sogne fiord, on the west coast of Norway with a maximum sounding of 4,080 feet, as a measure of the epirogenic uplift which at its culmination caused the glaciation of northern Europe. The difficulty here is that while a comparatively long period of elevation must be postulated for the excavation of the valley of Sogne fiord, and while climatic change would respond immediately to elevation, yet glacial conditions are not known to have occured until the erosive effects of elevation were practically completed. The steepness of the fiord walls indicates that the elevation was not slowly progressive, but was rather promptly completed and steadily maintained; being in this unlike

the elevation by which the erosion of the flaring and benched valleys of the northern Alps has been allowed. The problem involved in the relation of elevation and glaciation would therefore seem to be not the simple one of immediate cause and effect, but on the other hand the difficult one of why the apparently competent cause should not have at once had its expected effect; why glaciation should have waited so long after elevation, not attaining its maximum until a time of depression.

FORESTS AND TORRENTS.

THE much-debated problem of the influence of forests on rainfall remains unproved, after all that has been said and done; but the influence of forests on torrents admits of no question. The soil is washed from the deforested slopes and the torrents spread it over the valleys, greatly to the injury of both high and low land. The Shenandoah Valley, for example, one of the most beautiful and productive farming districts in our country, is suffering along its margin from the encroachments of gravels and sands washed from the enclosing deforested ridges. Those who wish to present this matter to forestry meetings in popular and impressive form will find an abundance of illustrative material with references to European literature on the subject in an essay by Toula: *Ueber Wildbach-Verheerungen and die Mittel ihnen vorzubeugen* (Schr. Vereins zur Verbreitung naturw. Kenntnisse in Wien, xxxii., 1892, 499–622, with forty-one views from photographs). W. M. DAVIS.

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NOTES ON AGRICULTURE (III.)

THE EXPERIMENT STATION RECORD.

THE Experiment Station Record, a monthly (practically) published from the office of Experiment Stations of the U. S. Department of Agriculture gives under the heads of Chemistry, Botany, Zoölogy, Meteorology, Soils, Fertilizers, Field crops, Horticulture, Forestry, Seeds, Weeds, Diseases of Plants, Entomology, Foods, Veterinary Science, Dairying, Technology, Statistics and Miscellaneous, the progress made in these various branches in the Experiment Stations of our country. The recent work in Agricultural Science in foreign countries is also briefly summarized.

From the last issue of the Record, just received, the reader is first of all informed as to the amounts of the appropriations made by Congress for the U. S. Department of Agriculture for the year ending June 30, 1896. The total amount is $2,578,750, which includes $720,000 for the Experiment Stations established under the act of Congress of March 2, 1887. There will be two new divisions in the U. S. Division of Agriculture, namely, that of Agrostology, which contemplates 'field and laboratory investigation relating to the natural history, geographical distribution and use of the various grasses and forage plants,' and that of Soils.

Among reports of agricultural science in foreign lands is a paper upon 'Agricultural Investigations in Switzerland,' by Dr. Grete, director of the Swiss Station at Zurich. In 1878 a Station for control of fertilizers and feeding stuffs was established, and recently its work has been extended to include culture tests of soils. There is a Seed Control Station which at the present time has eight workers besides the director, and tests by germination thousands of samples of seeds.

Under the head of chemistry the Record gives the new methods of obtaining solutions in soil analyses and the determination of phosphoric acid. The department of Botany contains a review of Professor Scribner's 'Grasses' of Tennessee, which is a valuable contribution to the Agrostology of the whole country. 'Notes on Maize,' by Dr. Sturtevant, contains generalizations upon the