THURSDAY, MAY 29, 1902.

THE SUPPLEMENT TO THE ENCYCLOPÆDIA BRITANNICA.

Encyclopaedia Britannica. Vol. xxv. Pp. xiii + 786. (Aachen to Australia.) Edited by Sir Donald Mackenzie Wallace, K.C.I.E., K.C.V.O., A. T. Hadley, President of Yale University, and Hugh Chisholm, B.A. (London and Edinburgh: A. and C. Black; London: The *Times* Office, 1902.)

THE critical student familiar with the ninth edition of the "Encyclopædia Britannica" would have no difficulty in detecting a change of intellectual attitude upon examining the volume before us. When the articles were prepared for the ninth edition, in the seventies and eighties of last century, scholastic traditions had a greater influence in determining the point of view than they have to-day. The result was that early periods of history and early developments of the arts and sciences received far more attention than modern views and methods. The significance of the present was disregarded in the contemplation of the past, while the promise of the future was mostly left out of consideration altogether. This retrospective spirit pervaded very many of the articles, and may be said to represent the characteristic style of a generation educated upon literary ideals. Knowledge was regarded as a structure to be observed in various aspects—as material for philosophy—rather than as something to which continual additions should be made, which alter the character of the whole edifice.

Many changes have occurred during the quarter of a century which has elapsed since a large part of the ninth edition was written. The centre of gravity of the intellectual world has for some years been changing its position, and is now much closer to science than it was, though the humanities have not ceased to exert their influence against the movement. There is still a strong disposition to resent any attempt to disturb a balance which has been preserved for so long. Science is considered as a useful servant, which adds to the comforts of life by the practical applications to which it leads, but the pursuit of natural knowledge is not usually considered so dignified and inspiring, or worthy of honour, as art, or literature, or music. In fact, science in England is a drudge to be tolerated, but her pretensions to a position upon the councils of State, or to rank among essential subjects in education, are scarcely countenanced. A man ignorant of the elements of science, and contemptuous of the value of the study of nature in the formation of character, may, even in these days, arrogate to himself the right to define its limits; and he may depend upon the support of all who wish to preserve the old studies from the influence of the progressive school. It is the familiar story of conflict between old and new knowledge, or, to use another simile, between ancient and modern faiths. The priests of the traditional shrine look with disdain upon the altar erected to science, and warn orthodox worshippers against its influence. But mental developments create new attitudes of mind, and unless the guardians of ancient views adapt themselves to new circumstances, they are in opposition to the whole spirit of progress.

In the new volume of our national encyclopædia, it is satisfactory to observe the change that has occurred to bring the work in touch with current scientific results and opinions. The articles upon scientific subjects are numerous, as well as being substantial statements upon the state of various branches of natural knowledge—from the points of view both of the student and the practical man. Among the subjects dealt with are every important country or region with names between Aachen and Australia; in addition to accumulators, acetylene, achromatic objectives, acid and alkali manufacture, acoustics, Adams, adulteration, aëronautics, æther, agriculture, agricultural machinery, air-gun, Airy, algæ, algebra, algebraic forms, alloys, aluminium, amphibia, amphioxus, anatomy, angiosperms, antelope, anthozoa, anthropology, anthropometry, appendicitis, aquarium, aqueduct, arachnida, argon, armour, assaying, astronomy and atmospheric electricity.

It will easily be understood that adequate notice of these contributions could not be given in a review; so all we can do is to describe a few of the subjects surveyed.

The ten pages devoted to "Accumulators" contain a clear account of the principles and structure of several typical cells. In an excellent section on the setting up, forming and discharge of cells (p. 29), the word "hygrometer" is an obvious mistake for "hydrometer." Failures, their remedy and avoidance, are illustrated from a number of charge and discharge curves from actual experiments. The chemical reactions receive due attention, and, finally, the uses of cells in central station work and trams are shortly discussed. It is, however, surprising to find no mention of Salomon's work in the references to the literature of the subject.

Under "Acetylene," a concise account of the stability of the gas under various conditions is followed by a short description of the "ingot" and "run" methods of making carbide, a good *résumé* on the purification of the gas, and a few words upon generators and burners, which might with advantage have been extended.

A short article on "Achromatic Lenses" mentions the recent success of Jena glass and Abbe's experiments.

Under "Acid and Alkali Manufacture," in addition to the well-worn description of sulphuric acid plant, we find an interesting account of the "contact" method for producing SO_3, followed by some details upon the condensation of hydrochloric acid from the salt cake process, and subsequently some valuable judicial statements upon the position of the Leblanc process and the inroads of electrolytic methods.

Under the heading "Acoustics," we have an investigation of the change in form of sound waves of finite amplitude, effects of temperature and wind, short descriptions of König's tuning fork, McLeod and Clark's stroboscopic methods and Lord Rayleigh's phonic wheel, the electrically maintained tuning fork, sensitive flames and jets. Brief investigations are given of Fourier's theorem and the methods of determining the specific heat ratio of air from the velocity of sound. The section on combination tones is of special interest in connection with recent researches.

The article on "Aëronautics" is of especial interest in connection with modern experiments, both on the

propulsion of balloons and on flight proper. It is illustrated by excellent photographs of both Zeppelin's and Santos Dumont's machines, and contains valuable statistical information in the form of tables, which will enable the reader to compare at a glance the means employed and the results achieved in attempts to navigate the air both by the *plus léger* and the *plus lourd* methods. A remarkable result shown by the tables is the very great advance made in increasing the weight sustained per horse-power in the gliding experiments under gravity made by Lilienthal, Pilcher and Chanute, though the writer of the article expresses the opinion that the substitution of an artificial motor would reduce these results by one-half. Another table gives the resistance of surfaces at different incidences, calculated for planes by Duchemin's formula and for curved wings from Lilienthal's investigations; and among other features we notice illustrated accounts of Chanute's gliding machines, Langley's and Hargreaves' aërodromes, and Ader's "Avion." With such information the reader will have little difficulty in forming a correct estimate of the present state of aërial navigation.

It is difficult to summarise briefly the contents of the important article on "Æther." The necessity for assuming the existence of an æther, the differences between æther and matter, the question as to whether the æther is in motion and the dynamical theories of the æther form the chief themes of the article. At the present time "æther" has become an every-day word, but few who use it have much idea of what it means. The present article is clear and authoritative, and if it does not answer the unanswerable question, "What is æther?" it does much to place this question on a sound and scientific basis.

The article "Agriculture" deals, in two separate chapters, with the changes that the past quarter century has witnessed in British and American agriculture, and its most remarkable feature is the contrast which these two chapters present. The first begins with the observation that the period 1875–1900 was a "fateful" one for the "greatest British industry," and in the opening pages shows that floods and stock diseases characterised the first, and drought the last decade of this period; that for every 100 acres under wheat in 1875 there were but fifty-four in 1900; that wheat worth 45*s.* per quarter in the former year was worth 27*s.* in the latter, and that two Royal Commissions investigated the distressed condition of the British farmer. Passing from this melancholy narrative to the chapter on agriculture in the States, we find the American writer revelling in the resources of his country. Between 1875 and 1897 the States farmer took possession of as much new land as would cover all France and Germany.

"Since 1870 the production of nearly all farm crops increased more rapidly than the population, the most absolute proof of the prosperity of the people."

As a result of better implements and better tillage, the yield of wheat is gradually increasing, and will, it is believed, continue to increase. Much land is yet available for wheat-growing, and the idea that a generation hence Americans will cease exporting wheat is regarded as quite erroneous.

The illustrations of British live stock are excellent, and the specimens the photos of which are given prove that "depression" has not yet succeeded in wresting from our breeders the preeminent position they held when the ninth edition was published. We are proud of our draught horses and we congratulate ourselves on their increase; but so different is the American standpoint that the writer almost apologises for their presence.

"Until the use of more and cheaper motors becomes possible, farm animals must increase with farming operations."

It is significant in this connection that all the illustrations of animals are British and all the illustrations of machines American. Some of the implements shown are popular in this country, and some of them are largely manufactured here, but though the workmanship is British the ideas are exclusively American.

Agricultural education and research are actively carried on in the States; on research alone nearly 700 workers are engaged. The English writer describes the work done at Rothamsted, "the greatest and the oldest of experiment stations"; but Lawes and Gilbert are dead and there is no mention of progress. Are we standing still? The writer of the article "Agricultural Machinery" prefaces his chapter by remarking that Americans, as implement makers, have gone "far ahead" of their rivals in the United Kingdom, and "the following article is accordingly written from an American standpoint." The volume does not inspire much hope, but hope and work we must if the next edition of the "Encyclopædia Britannica" is to deal with agriculture from a *British* point of view.

Among the contributions on botanical subjects, the article on the "Algæ" is eminently satisfactory, not only as regards the array of facts, but also as incorporating the results of recent researches and the modifications in arrangement derived therefrom. The connection of the Cyanophyceæ with the Schizomycetes and the relationship of the Diatomaceæ to the Peridiniaceæ are pointed out. Evidence for and against alternation of generations is fairly weighed up, while on polymorphism the conservative view of Klebs is maintained. The physiological principles underlying "Anatomy" are clearly brought out in dealing with non-vascular plants. But when the writer elaborates the stelar conception in connection with vascular plants these principles fall into the background. A tolerably safe course is steered through stelar difficulties, but no attempt is made to separate purely topographical changes from those of a morphological nature. The "Angiosperms" are treated almost entirely from the physiological point of view. Autotrophic plants are described as geophytes, aërophytes and hydrophytes. The author's views on phylogenetic relationships would have been extremely interesting, but discretion overrules speculation. The systems of Bentham-Hooker and Engler-Prantl are merely outlined, while van Tieghem's novel classification is shortly criticised.

The article upon "Universal Algebra" gives in three pages a summary account of the various special algebras which have been invented by modern analysts. Such, for instance, are Hamilton's calculus of quaternions, Grassmann's extensive calculus, and the barycentric calculus of Möbius. The article on "Algebraic Forms"

occupies thirty-seven pages, and is divided into sections dealing respectively with determinants and elimination, symmetric functions, binary and other forms, enumerative functions with their generators, and the theory of restricted substitutions. For the first time, perhaps, the methods of the English school have been discussed, in the same work, in conjunction with the symbolic calculus of Aronhold and Clebsch. Each method has its own special advantages, and the comparative study of both is very instructive. A good deal of space is devoted to Gordan's important theory of transvectants and their reduction, and to Stroh's recent extension of symbolic methods. Many parts of the article illustrate the value of the partition analysis as developed by MacMahon; what he calls "the theorem of expressibility," and the correspondence which he establishes between differential operation and partition operators, are real and fruitful contributions to mathematical science. This article is valuable, not only as a record of known facts, but also as suggesting new fields of research. The section on determinants contains little, if anything, that is not in the text-books; if this had been suppressed, and some other topics treated at greater length, it would have been an advantage.

"Astronomy" occupies twenty-eight pages, which contain a general account of some recent developments relating to the solar system, gravitational and theoretical astronomy, and the sidereal universe. In the section upon the planets, descriptions are given of progress in such subjects as the rotation periods of Mercury and Venus, the markings on Mars, the minor planet Eros, new satellites of Jupiter and Saturn, and Keeler's proof of the discrete constitution of Saturn's rings. The view that the dark regions on Mars are not oceans, as was formerly supposed, but the solid surface of the planet, is accepted, and also that which regards the canals or channels as not being physically continuous formations, but optical effects produced by more or less irregular differences in the minute shadings and colour tints on the surface of the planet.

In the section on gravitational and theoretical astronomy, the chief advances recorded relate to apparent deviations from the law of gravitation exemplified by motions of the planetary perihelia and inequalities of the moon's mean motion, and variation of latitude. The application of photography to celestial portraiture is briefly dealt with in the section on the fixed stars, and it is suggested that what is now required is a photographic survey of the heavens with the view of determining all the stars which have an appreciable parallax. Special attention is given to the structure of the sidereal universe and to systems of stars and clusters, but very little is said of spectroscopic advances in either connection. As progress in astronomy during the last quarter of a century means to a large extent progress in astrophysics, which depends almost entirely upon the spectroscope for its development, we assume that spectroscopic astronomy will be dealt with separately. The article certainly does not convey an accurate or adequate view of the physical and chemical aspects of the science, and it must be supplemented by one on celestial spectroscopy if the complete work is to be regarded as worthy of the intentions of the editors.

To everyone familiar with astronomical progress during the past quarter of a century, the article will be disappointing; for it is more of the nature of an essay than a contribution to an encyclopædia. What is required in an encyclopædic article upon any science is a concise and unbiassed summary of work and results, otherwise the contribution is misplaced. Measured by this standard, the article on astronomy fails entirely of its purpose, for it is both prolix and incomplete. Many small text-books contain far better statements of the position of astronomical science than is here given, because the authors have been to the trouble to become acquainted with the literature of the subject. This, however, has evidently not been done by the writer of the article under notice, and the result is a contribution which will give readers very imperfect ideas as to progress made since the contribution for the ninth edition was written. The new edition of the encyclopædia afforded an opportunity for giving a view of the vast amount of new material which has been accumulated by astronomers from unlooked-for sources, but instead of this inspiring survey we have a superficial essay upon a few points which have appealed to the writer. The article should have been a record of all essential advances of the science, whereas it is more remarkable for what is omitted than for what is included.

Few articles in the ninth edition of the encyclopædia could have required more extensive revision and addition than those devoted to zoological subjects. How great was the need for such revision, and how marked has been the progress in zoological discovery since the appearance of the former edition, is manifest by the articles in the volume under notice, which include the subjects "Amphibia," "Amphioxus," "Anatomy," "Anthropology," "Arachnida" and "Arthropoda." Some of these are in great part practically new treatises, while others, such as the one on anthropology, confine themselves to the additions necessary to bring their predecessors up to date. The change of view that has taken place with regard to the relationships of the lower vertebrates will be manifest when the new and the old articles on amphibia are contrasted, while the advance in our knowledge of the structure of the extinct representatives of the latter is apparent by the amount of space allotted to this portion of the subject. The article on Amphioxus is entirely new, and occupies nearly four pages.

The discoveries of modern histological methods of investigation are fully recorded under the heading of "Anatomy," while the Pithecanthropus is alluded to under "Anthropology," and Mr. Henry's method of classifying finger-prints receives mention in the article "Anthropometry." The Funafuti boring and the inferences to be drawn therefrom are discussed in some detail under "Anthozoa"; while in "Arachnida," Prof. Ray Lankester adduces a long string of facts to show that the nearest living relatives of kingcrabs and trilobites are scorpions rather than crustaceans. Several of the authors had by no means an easy task before them in bringing up to date the work of their predecessors, but they all seem to have done their parts in a highly satisfactory manner.

Finally, we may say that an earnest endeavour has been made by the editors to produce a work which represents the

advances of science since the ninth edition was prepared, in so far as they come within the purview of the present volume. Whether considered as one volume of a supplement to the ninth edition or as a statement of the position of many scientific subjects, the work is a worthy addition to our national literature.

PRACTICAL PHYSIOLOGY.

Directions for Class Work in Practical Physiology. Elementary Physiology of Muscle and Nerve and of the Vascular and Nervous Systems. By E. A. Schäfer, LL.D., F.R.S. Pp. 76. (London: Longmans, Green and Co., 1901.) Price 3*s.* net.

THE contents of this book are well-nigh sufficiently indicated by its subsidiary title, and it is inconceivable that in dealing with the elementary aspects of the subjects named its distinguished author could go wrong. He informs us that his directions are based upon an experience of many years in University College, London, and that they deal "only with such elementary exercises as can readily be worked out by even a large class."

There are twelve chapters in all, and the most distinctive feature of the book is the manner in which the student, having been given concise instructions as to the nature and mode of utilisation of apparatus, and of preparation of the organic object to be studied, is left to "notice" or observe for himself the nature of the effect of this or that operation. A most wholesome procedure—a method of the kind which must be always begotten of a lengthy teaching experience such as the author proclaims.

Of the twelve chapters, the first opens with a description of the "voltaic element" and of the Daniell cell, the rationale of the replacement of the former by the latter being clearly explained. The Grove and Leclanché cells, with the chief types of the latter, are in turn considered; and, with adequate descriptions of electrodes, keys, rheochords, the induction coil and their uses, and a section on unipolar induction, the chapter closes. Chapters ii. and iii. are devoted to nerve-muscle preparations, the sartorius being utilised for the demonstration of the independent irritability of muscle and nerve, and the hyoglossus for that of the "latent period." The effects of heat and cold, of fatigue, the action of curari and veratrin, are in due course considered and clearly set forth; and in chapters v., vi. and vii. the effects of successive stimulation, leading up to tetanus and the muscle sound, the rate of the nervous impulse, the effects of CO_2 and the "electrotonus" phenomenon, are simply described, Ritter's and Pfluger's laws being incidentally laid down.

Chapter viii. deals with secondary contraction and the use of the capillary electrometer and galvanometer. The two chapters which follow are devoted to the heart, cardiac nerves, and the use of the plethysmograph; and the two which conclude the work deal with the chief vascular and respiratory mechanisms in man, with reflex action and its time limitations, as determinable by the use of the Wallerian lever apparatus.

There are in all forty-five simple text-illustrations, thirty-eight of apparatus and seven of dissections of the common frog. The book is well worthy its aim, and Prof. Schäfer, clearly of a mind to give the elementary student little and good, has done that functionary a great service.

There are, in addition to the seventy-six printed pages, twenty-six which are blank; but whether, according to the bookbinder's custom, these are intended to give stability to an otherwise thin volume, or whether they are for the convenience of the student in making annotations, we are not informed. As matters now progress, however, in electrophysiology, it would seem that ere long one or two of these blank pages may be destined to bear a thirteenth chapter, since the Eastern mind, coming fresh and untrammelled to the work, is showing us that under a mechanical stimulus phenomena of electrical response akin to those until recently demonstrated only for the higher animals and the sensitive plants, appear to be at least also obtainable from vegetable organisms at large—a result which points to the conclusion that in these well-known phenomena we are dealing with a fundamental property of protoplasm, and calls for immediate investigation of the unicellular organisms, in the study of which the clue to all that is physiological has ever to be sought.

OUR BOOK SHELF.

The Elements of Physical Chemistry. By J. Livingston R. Morgan, Ph.D. Second edition. Pp. x + 352. (New York: Wiley and Son; London: Chapman and Hall, Ltd., 1902.) Price 2 dollars.

TO write a book the object of which is to present the elements of the entire subject of physical chemistry, together with the important and but little known applications of it to the other branches of chemistry, within the scope of 322 small pages is by no means an easy task. The author has, however, succeeded in presenting within these limits a very readable account of the subject.

To the reader familiar with the works on physical chemistry and electrochemistry published by German authors during the last ten years, a close likeness between these and the present volume is at once apparent. The author, as a matter of fact, in his preface states that no claims of originality are made for the major portion of the text.

It is doubtful whether a text-book which is obviously intended for the use of comparatively elementary chemical students should be so replete with mathematical formulæ. For a beginner, a more descriptive method of treatment of the subject would have been, in the opinion of the reviewer, more satisfactory.

The subject-matter is divided into ten chapters, the first being devoted to introductory remarks on the subject of energy and methods of determining atomic weights; then follow sections on the gaseous, liquid and solid states, solution, thermochemistry, chemical change, phases and electrochemistry, the last chapter containing a series of 156 problems bearing upon the subject-matter of the text. This last chapter is a most welcome innovation. For the beginner, the very numerous and abstract formulæ of physical chemistry have but a vague significance; only when these formulæ have been applied to concrete cases do they become properly understood by the student. Ample scope for exercise in the application of these formulæ is provided by the last chapter, although perhaps in a few cases the problems are not very happily chosen.

Thermochemistry and the phase rule are treated of in a superficial manner, only five pages being devoted to the consideration of the latter. In a future edition it is hoped that the author will see fit to deal with the important work which has been done on transition tem-

peratures and the formation and decomposition of double salts. Although the present volume is a second edition of the work, yet the text is not free from misstatements. On p. 87 we are told that "when liquids mix in all proportions . . . then it is possible to make a complete separation of the constituents by a fractional distillation, provided the vapour pressures of the two differ," a statement which is afterwards contradicted by examples which are given of the different types of liquid mixtures. On p. 210 we are told that the ferrous ion is greenish-black in colour, and on p. 260 that all binary organic acids satisfy the dilution law of Ostwald. Misprints are also not uncommon and authors' names are not always correctly spelt, "Tammen" for "Tammann" and "Pebel" for "Pebal" being instances.

If, however, the defects here alluded to are remedied in the next edition, the book will, without doubt, serve as a very useful aid to students of physical chemistry.

H. M. D.

Practical Botany for Beginners. By F. O. Bower, Sc.D., F.R.S., and Dr. T. Gwynne-Vaughan, M.A. Pp. xi + 307. (London: Macmillan and Co., Ltd., 1902.) Price 3*s.* 6*d.*

THIS excellent little book, written by Prof. Bower in 1894, appears in a second edition after being subjected to careful revision. Mr. Gwynne-Vaughan now shares with Prof. Bower the author's responsibility. The more prominent changes are the adoption of the nomenclature introduced with the stelar conception and a more elaborate description of grosser morphological features. The number of seeds described is increased to eight Dicotyledons and three Monocotyledons, and more than twenty flowers are taken as types of these two groups. The main types remain the same, except that the elm gives place to the lime. Other additions are the stems of Ricinus, *Veronica Beccabunga* (aquatic Dicotyledon), *Elodea Canadensis* (aquatic Monocotyledon), and leaves of Ligustrum, Hedera, Deschampsia and Phormium. The paragraphs on reserve and transitory materials have been considerably added to and improved, so that suitable material and the necessary tests are given for demonstrating the presence of starch, proteids and various sugars in the vegetative parts and in seeds. Exception may be taken to certain types chosen—for instance, Marchantia and Fucus—but obviously the general occurrence of these has weighed with the authors in their choice. Passing to methods of manipulation, glycerine and chlor-zinc iodine are almost exclusively recommended as mounting media; in several cases, notably Pinus, double staining and mounting in Canada balsam would give better results, while mounting in water avoids undue swelling of the walls of phloem cells such as follows the use of glycerine and Schulze's solution.

The book is already so well known that it is unnecessary to emphasise the careful arrangement of subject and the clear descriptions which characterise it.

Quelques réflexions sur la mécanique suivies d'une première leçon de Dynamique. Par Émile Picard, Mem. Inst. France. Pp. 56. (Paris: Gauthier Villars, 1902.)

THE first part is based on a report drawn up by M. Picard in connection with the Paris Exhibition of 1900 dealing with modern views on the principles of mechanics and in particular on the "energetic" method, and the dynamical system of Hertz. The second part consists of the first lecture given by M. Picard, since 1894, in his course on general mechanics, introducing the elementary principles of dynamics. It differs somewhat from the conventional treatment, and in this country Newton's third law will probably be regarded as constituting a less artificial definition of *mass* than is used by M. Picard.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Volcanic Eruption in Java, Brilliant Sunset Glows in 1901, and probable Glows from the Eruption in Martinique.

THE brilliant sky glows and sunsets following the eruption of Krakatoa, near Java, on August 26 and 27, 1883, threw a flood of light on the movements of the upper atmosphere in a way which was probably not otherwise possible. Up to that time it had been supposed generally by meteorologists that the air forming the trade winds ascended at the equator and turning toward the poles became a south-westerly current in the northern hemisphere and a north-westerly current in the southern hemisphere flowing over the trades. After the explosion eruption of Krakatoa, the large mass of observations gathered by the committee of the Royal Society and the admirable discussion of the optical phenomena by Russell and Archibald ("The Eruption of Krakatoa and Subsequent Phenomena," London, 1888) brought out the following facts:—

(1) The haze, sky glows and brilliant sunsets progressed from east to west three times around the world within the tropics at a rate of about seventy-five miles an hour.

(2) They spread northward and southward from 20° N. and 20° S. very slowly, taking from September 2 to about October 7 for the conspicuous phenomena to spread from 20° N. to 35° N. in America, a velocity of about one-half a degree a day, or one mile an hour.

(3) Above 35° latitude the progressive motion was rapid and apparently from the south-west in the northern hemisphere and from the north-west in the southern hemisphere.

There are two other important conclusions which I think may be drawn from the data, and these are:—

(1) The atmosphere between 20° N. and 20° S. moved with a nearly uniform velocity from the east; otherwise it would have been impossible to trace the movement of the dust cloud around the world three times, because a very slight difference in velocity or direction at different latitudes would very soon have destroyed the individuality of the cloud, whereas Russell's lines of first appearance are nearly parallel with each other between 20° N. and 20° S.

(2) There are frequent temporary disturbances in this region by which the air is carried rapidly outward in narrow belts into extratropical regions. One of these disturbances was shown on August 27, when the dust was carried rapidly to Japan, another on August 28, when dust was carried to South Africa, and another on September 1, when dust was carried to Santiago, Chili.

The movement of the atmosphere above the tropics established by this investigation differed so from that supposed to exist by meteorologists that it was sought to explain it as a temporary movement and not representative of average conditions. But Abercromby was so much impressed by the phenomena that he began to gather observations of the movements of cirrus within the tropics. These are published in the volumes of NATURE between 1887 and 1890. Hildebrandsson has pursued the subject farther, and his results show that in the equatorial regions between 20° N. and 20° S. the prevailing movement of the cirrus is from the east. North and south of these latitudes the directions change to a movement from the west. It is probable that between these two opposing belts of wind there is a nearly calm zone across which the air movesf very slowly from the equator.

These facts are dwelt on in order to show the importance of such observations preliminary to calling attention to recent sky glows and volcanic eruptions.

In the autumn of 1901, Mr. Rotch, Mr. Sweetland and myself noticed independently that the sunsets were more brilliant than usual at Blue Hill (lat. 42° 13′ N., long. 71° 7′ W.), and the following notes were entered in the records of the Observatory:—"October 7.—Since about September 20 the sunsets on clear days, including to-day, have shown unusually bright colours, a bright red predominating and lasting near the horizon for three-quarters of an hour or longer; November 2, a very brilliant sunset, red prevailing, and the colours continued for about forty-five

minutes after sunset; November 3, a brilliant orange sunset after a very clear day."

These observations were recalled by the receipt within a few days of a pamphlet from Mr. T. F. Claxton on "The Recent Sunset and Sky Glows." This paper was presented to the Mauritius Meteorological Society on August 27, 1901.

The first few paragraphs are as follows:—

"The gorgeous sunsets and sky glows of the past three months recall those vivid displays of 1883 and 1884 which were associated with the disastrous volcanic eruptions at Krakatoa, in the Straits of Sunda, and it is not surprising to learn that toward the end of May of this year similar, though less serious, eruptions occurred in about the same locality, according to the following cablegram which appeared in the *Daily Graphic*:—

"'Batavia, *May* 23, 1901.—The volcano of Keloet is in eruption. It is reported that there has been great loss of life among the natives. District of Kediri enveloped in total darkness.'"

The sunset glows at Blue Hill followed this eruption, and the sky glows at Mauritius after about the same interval as similar but more brilliant glows in these latitudes followed the eruption of Krakatoa. It would be extremely interesting to know if there are observations at intervening places. We should be glad to receive notes of such at the Blue Hill Observatory, Hyde Park, Mass., U.S.

I wish also to call attention to the recent violent volcanic eruption in the island of Martinique, and suggest that observers be on the watch for the earliest optical phenomena. We should be glad to receive notices of such observations. There were some marked barograph undulations at Blue Hill on the morning of May 7 which are perhaps connected with this volcanic eruption. HENRY HELM CLAYTON.

Blue Hill Observatory, Hyde Park, Mass., May 10.

A Method of Showing the Invisibility of Transparent Objects under Uniform Illumination.

As is well known, a perfectly transparent object is visible only in virtue of a variable illumination. This condition might be approximately realised, as Lord Rayleigh points out in his article on "Optics" in the "Encyclopædia Britannica," on the top of a high monument in a dense fog. It is doubtful, however, if the experiment would be very successful even under these conditions, as the observer's body screens the light in certain directions, making the illumination far from uniform. The following method I have found to give very good results:—

The inside of a hollow sphere of metal, which can be separated into two cups, is thickly coated with Balmain's luminous paint. A small hole, not much larger than the pupil of the eye, enables the observer to view the interior and any objects within the sphere. I used for the sphere one of the metal floats which are used as automatic regulators in water tanks, and which can be obtained from any plumber. The float was made in two parts, which were easily separated by melting the solder. It is rather difficult to get a good uniform layer of the paint. Several coats are required, and even then it is apt to appear streaky in the dark. I am inclined to think that a better plan would be to mix the dry powder with boiled down Canada balsam, which will harden on cooling, and coat the outside of two glass hemispherical evaporating dishes with the hot mixture. The lips of the dishes would make the eye-hole. This mixture I have found produces much more uniform surfaces, and I am employing it at the present time in some experiments in infra-red photography.

If the inner surface is exposed to sunlight, and a transparent object such as a glass or crystal ball, a thick lens or a cut glass decanter stopper is put in the interior, it will be found to be practically invisible when viewed through a small hole, for light of equal intensity is incident in every direction. I have found that a large stopper with many facets does not quite disappear, some of the edge facets appearing darker than the diffused blue glow which fills the interior of the ball. This I believe to be due to the fact that the light reaching the eye from these facets by refraction happens to have undergone several internal reflections and suffered a loss by absorption owing to a long path through the glass. The luminosity of the interior of the sphere is not quite uniform, however, and this may be sufficient to explain the appearance of these facets. The observation is best made in a darkened room, the eye being brought close up to the small aperture.

Since writing the above I have tried the balsam mixture on the outside of hemispherical glass dishes. It is, however, better to scratch a small hole in the paint than to attempt to use the lips of the dish as an aperture, as in the latter case the line of union, which is always slightly darker than the rest of the surface, cuts directly across the field of view, which is a disadvantageous arrangement. R. W. WOOD.

Johns Hopkins University, Baltimore.

Misuse of Coal.

THE tone of Prof. Perry's letter in reply to Mr. Rosenhain is so acquiescent that it may seem to diminish the force of his original contention as to the national misuse of our stock of coal. There are two considerations which ought to be stated in reply to the plea that men may learn to grow their fuel as they go on, by a proper cultivation of the best vegetation.

The first is this. The soil will not long continue to yield food if it be asked to provide fuel also. About three years ago Sir W. Crookes devoted his address, as president of the British Association, to the consideration of the present position of the world's food-supply question, and arrived at the conclusion that the outlook was not far from a gloomy one.

In that conclusion he was but echoing Malthus, though with much better data and a more complete record as to what were in Malthus' day unexplored countries.

If examination of the food-yielding powers of the soil leads to such a result, it is evident that to add an additional demand for fuel will seriously injure both. Even though Malthus and Sir W. Crookes be only partially right, enough is left to prevent us getting any long-lived satisfaction by growing fuel. There remains the possibility of "intensive" cultivation, and this may be one form of the new engine Prof. Perry asked scientific men to look for. Already Lord Rayleigh has made a bold attempt to make this economically possible by preparing nitric acid from the air. Perhaps with the resources Prof. Perry asked for, Lord Rayleigh might succeed.

The second point is this. Prof. Perry's concern was mainly for British resources. The economic life of a large proportion of our people is bound up with an economic advantage in fuel and other minerals. Every scientific discovery which raises the efficiency of transformation from coal fuel to mechanical power helps to defer the day in which England's mineral endowment will no longer be exceptional. The moment that oil or other natural fuel can compete with coal in the open markets, our prosperity must begin to decline. Similarly, if fuel can be grown to compete with coal, we lose position, simply because we cannot expect to grow so easily and well as many other countries.

The motive impelling towards a constant search for improved efficiency in the use of coal is therefore doubly strong on our people and Government. Any improvement would be helpful to the whole world; for us it would defer a calamity, possibly for a very long time. W. HIBBERT.

101 Goldhurst Terrace, N.W., May 20.

The Conservation of Weight and the Laws of Thermodynamics.

IN NATURE of May 15, Lord Rayleigh uses the laws of thermodynamics to prove the conservation of weight.

In regard to the doctrine of the conservation of energy (the first law of thermodynamics) the following statement is made in Maxwell's "Theory of Heat," p. 145, tenth edition: "The evidence which we have of the doctrine is nearly if not quite as complete as that of the conservation of matter."

Taking this passage to imply that the two doctrines, conservation of weight and of energy, are to be held true as far as experiment has proved them true, and no farther, the question arises—To what extent have the laws of conservation been proved?

The experiments of Landolt (1893) and of Heydweiller (1901) show that the conservation of weight holds, in the cases investigated by them, to one part in one hundred thousand. The accuracy of the law to one part in a million is left under suspicion.

Energy being more difficult to measure than weight, it is unlikely that the conservation of energy has been proved to one part in one hundred thousand. At the present time, would not Maxwell say, "The evidence which we have of the conservation of energy is not as complete as that of the conservation of weight"?

From the laws of thermodynamics it can be shown, doubtless, that the conservation of weight is absolutely true, but this only on the assumption that the conservation of energy is absolutely true. Again, granted it can be shown that the conservation of weight is true in the same degree as the conservation of energy, yet these proofs will remain of strictly mathematical interest so long as our knowledge of the conservation of energy remains of a lower order of accuracy than that of the conservation of weight.

It seems natural for the human mind to state scientific laws in absolute terms. Nevertheless, in most cases it is proved that the accuracy of the laws is limited. If a scientific law is believed in outside the limits of proof, the law is no longer a matter of knowledge—it has become an article of faith. These are platitudes; they have point only because scientific men state the laws of conservation in absolute terms, and hold these laws as articles of faith. A. N. M.

University College, Liverpool.

A Solar Halo.

IN a letter to NATURE of May 1 (p. 5) a description is given of a remarkable lunar halo seen at Yerkes Observatory. A solar halo of almost identical character is reported in the meteorological returns for April from Sule Skerry Lighthouse off the north coast of Scotland. The following note and sketch are appended by Mr. N. A. Macintosh, the lightkeeper, to his report:—

"A curious phenomenon was observed in the sky on the 28th. At 12.30 p.m. there was a perfect ring or halo right round

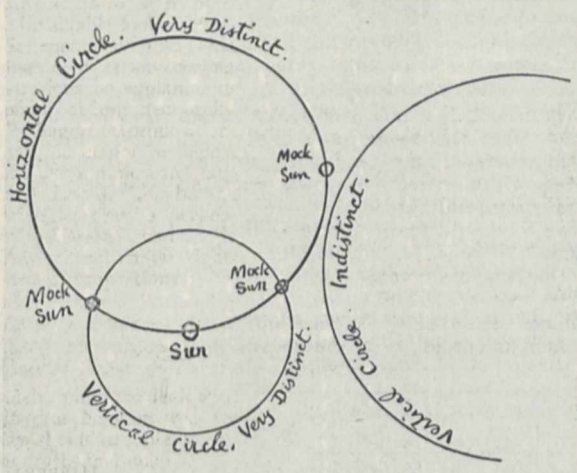

FIG. 1.—Solar Halo, April 28.

the top of the sky with the sun in its southern edge. At right angles to it, and round the sun, was another ring with two 'mock suns' where it bisected the larger ring. These 'mock suns' showed prismatic colours, but about due east on the edge of the larger ring there was a 'mock sun' pure white. In the south-eastern sky there was an indistinct half-circle from the horizon up to the horizontal circle which showed prismatic colours, whilst the others were colourless. At the time there was haze all over the sky, but the sun shone very clearly. It lasted till 1.30 p.m."

The position of Sule Skerry is lat. 59° 6′ N., long. 4° 20′ W., and as the sun is about 14° north of the equator on April 28, its elevation at local noon, about which time the halo was first seen, would be practically 45°. Hence the "horizontal circle" the centre of which is at the zenith would have a radius of 45°. Evidently, therefore, from Mr. Mackintosh's sketch the "vertical circle" is the ordinary halo of 22° radius. The "horizontal circle" is also well known, though not so often seen as the halo; it is due to the reflection of the sun's light from the vertical faces of the ice-crystals. The coloured mock suns where the two halos intersect are also well known, but with the sun as high as 45° they would be expected to lie a little outside the 22° halo on the white circle. The other mock sun on the eastern side of the horizontal white circle is more rare; it may coincide with the point where a larger halo cuts the horizontal circle, but the laws determining the formation of this halo and its exact position are not known, and portions of it have been seen on only three or four occasions of which we have any record.

The last item in the sketch, the coloured semicircle rising from the south-eastern horizon to almost touch the horizontal circle, I am unable to suggest any explanation for. The sketch is evidently reversed, as in it this and the white mock sun are shown on the western side. In recording observations of coloured halos, mock suns, &c., it would greatly add to their values if notes were made of the arrangement of the colours, such as "red inside, blue outside halo," "red next sun, blue away from it," and *vice versâ*. R. T. OMOND.

Scottish Meteorological Society, Edinburgh, May 17.

Mathematical Training.

IN view of the great influence which Schopenhauer has exerted on German thought, I referred to his chapter on mathematics, and find that half a century ago he was even more sweeping in his condemnation of the methods of Euclid than are some of your present correspondents. He mentions that the exact sciences are confined to those dealing with time, space and causality, or without being too precise as regards names, the exact sciences are arithmetic, geometry and logic. Schopenhauer's view is that each of these sciences is independent of the other, and he illustrates this by saying that mathematically it is just as self-evident that two parallel lines cannot meet as it is logically self-evident that an impossibility is not possible. He strongly objects to our aping the Greeks and basing mathematics on logic, and I feel sure that he would consider that mathematics were being degraded by the excuse so often given for teaching it at all, that "Euclid is an invaluable logical training." If I understand him correctly, Schopenhauer holds that any mathematical proposition is as self-evident as any correct logical sequence, and only requires illustrations or explanations (not proofs) to make this clear to our somewhat imperfect brain. This he might have illustrated by the Pythagorean proposition, which can be shown to be correct without the elaborate logical scaffolding used by Euclid, provided that one's mind can grasp the proportionality of similar triangles. Let a, b, c be the lengths of the sides of a right-angled triangle, draw a perpendicular from the apex intersecting the hypothenuse c, and divide it into two lengths d and e. We then have three similar right-angled triangles and the following two sets of proportions:—

$$\frac{c}{a} = \frac{a}{e} \text{ and } \frac{c}{b} = \frac{b}{d},$$

from which it follows that $a^2 = c \cdot e$ and $b^2 = c \cdot d$, and as $d + e = c$, we have $a^2 + b^2 = c^2$.

Most other propositions, if not self-evident, might be dealt with in the same way; and if we were as gifted as Newton was, we would, as he did, wonder why anybody should trouble to demonstrate the, to him, quite self-evident truths in Euclid.

In our public schools we are taught classics, not because of the logic they contain, for it is often wrong, but because they exercise our memory (and, I fear, cripple our reasoning powers), and we teach mathematics, not to improve our knowledge of space, but to improve our logic and sometimes also to improve our memory. Naturally our views about space are often hazy, and our reasoning powers, which receive no direct training, are not infrequently stunted, or rather compelled to work in narrow grooves. C. E. STROMEYER.

Lancefield, West Didsbury, May 12.

Influence of Light upon Plant Assimilation.

I HAVE for some time been endeavouring to devise a simple and cheap apparatus for demonstrating the effect of red and blue light respectively upon the assimilatory power and nyctitropic movements of plants. The apparatus usually supplied by the dealers for this purpose consists of a double-walled bell-jar into which a solution of potassium bichromate or of ammoniacal copper sulphate may be poured. This is a rather expensive piece of apparatus for school use, especially if a large one is required. I have not been able to find a blue or red glass that absorbs blue or red light only. I have tried home-made glass cells about a foot square and a quarter of an inch internal diameter, but could not prevent leakage. Perhaps some reader of NATURE could help me. Is there a transparent coloured paper or some kind of coloured membrane that would serve the purpose? E. E. HENNESEY.

Bigods School, Dunmow, Essex, May 19.

THE FARMERS' YEARS.

II.

CARNAC AND ITS ENVIRONS.

IT has long been known that the stones which compose the prehistoric remains in Brittany are generally similar in size and shape to those at Stonehenge, but in one respect there is a vast difference. Instead of a few, arranged in circles, as at Stonehenge, we have an enormous multitude of the so-called menhirs arranged in many parallel lines for great distances.

The literature which has been devoted to them is very considerable, but the authors of it, for the most part, have taken little or no pains to master the few elementary principles which are necessary to regard the monuments from the point of view of orientation.

It is consoling to know that this cannot be said of the last published contribution to our knowledge of this region, which we owe to Monsieur F. Gaillard, a member of the Paris Anthropological Society and of the Polymathic Society of Morbihan at Plouharnel.[1]

M. Gaillard is a firm believer in the orientation theory and accepts the view that a very considerable number of the alignments are solstitial. But although he gives the correct azimuths for the solstitial points and also figures showing the values of the obliquity of the ecliptic as far as 2200 B.C., his observations are not sufficiently precise to enable a final conclusion to be drawn, and his method of fixing the alignments and the selection of the index menhir is difficult to gather from his memoir and the small plans which accompany it, which deal with compass bearings only.

All the same, those interested in such researches owe a debt of gratitude to M. Gaillard for his laborious efforts to increase our knowledge, and will sympathise with him at the manner in which his conclusions were treated by the Paris anthropologists. One of them, apparently thinking that the place of sun rising is affected by the precession of the equinoxes, used this convincing argument:—"Si, à l'origine les alignments étaient orientés, comme le pense M. Gaillard, ils ne le pourraient plus être aujourdhui; au contraire, s'ils le sont actuellement, on peut affirmer qu'ils ne l'étaient pas alors!"

M. Gaillard is not only convinced of the solstitial orientation of the avenues, but finds the same result in the case of the dolmens.

I cannot find any reference in the text to any orientations dealing with the farmers' years, that is with amplitudes of about 24° N. and S. of the E. and W. points; but in diagrams on pp. 78 and 127 I find both avenue and dolmen alignments, which within the limits of accuracy apparently employed may perhaps with justice be referred to them; but observations of greater accuracy must be made, and details of the heights of the horizon at the various points given, before anything certain can be said about them.

I append a reproduction of one of M. Gaillard's plans, which will give an idea of his use of the index menhir. It shows the cromlech and alignments at Le Ménec. The line A—Soleil runs across the stone alignments and is fixed from A by the menhir B, but there does not seem any good reason for selecting B except that it appears to fall in the line of the solstitial azimuth according to M. Gaillard. But if we take this azimuth as N. 54° E., then we find the alignments to have an azimuth roughly of N. 66° E., which gives us the amplitude of 24° N. marking the place of sunrise at the beginning of the May and August years, and the alignments may have dealt principally with those times of the year.

I esteem it a most fortunate thing that while I have been casting about as to the best way of getting more accurate data, Lieutenant Devoir, of the French Navy, and therefore fully equipped with all the astronomical knowledge necessary, who resides at Brest and has been studying the prehistoric monuments in his neighbourhood for many years, has been good enough to write me a long letter giving me the results of his work in that region, in which the problems seem to be simpler than further south; for while in the vicinity of Carnac the menhirs were erected in groups numbering five or six thousand, near Brest they are much more restricted in number.

Lieut. Devoir, by his many well-planned and completely accurate observations, has put the solstitial orientation beyond question, and, further, has made a most important observation which establishes that the May and August sunrises were also provided for by a system of alignments. He permits me to make the following extracts from his letter:—

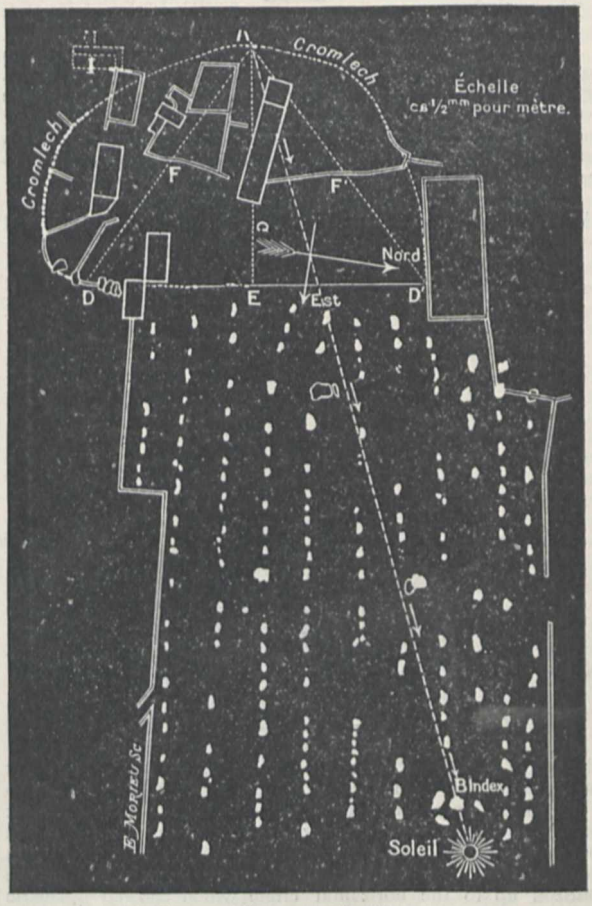

FIG. 1.—Alignments at Le Ménec.

"It is about twelve years ago that I remarked in the west part of the Department of Morbihan (near Lorient) the parallelism of the lines marked out by monuments of all sorts, and frequently oriented to the N.E., or rather between N. 50° E. and N. 55° E. I had ascertained, moreover, the existence of lines perpendicular to the first named, the right angle being very well measured.

"The plans, which refer to the cantons of Ploudalmézeau and of St. Renan (district of Brest) and of Crozon (district of Chateaulin), have been made on a plane-table; the orientations are exact to one or two degrees.

[1] "L'Astronomie Prehistorique." Published in "Les Sciences Populaires, revue mensuelle internationales," and issued separately by the administration des "Sciences populaires," 15 Rue Lebrun, Paris.

"In the cantons of Ploudalmézeau and of St. Renan, the monuments are generally simple; seven menhirs are visible of enormous dimensions, remarkable by the polish of their surface and the regularity of their section. The roughnesses hardly ever reach a centimetre; the sections are more often ovals, sometimes rectangles with the angles rounded or terminated by semicircles. In the canton of Crozon the monuments are, on the contrary, complex; we find a cromlech with an avenue leading to it of a length of 800 metres, another of 300 metres. Unfortunately, the rocks employed (sandstone and schist from Plungastel and Crozon) have resisted less well than the granulite from the north part of the Department. The monuments are for the most part in a very bad condition; the whole must, nevertheless, formerly have been comparable with that of Carnac-Leomariaquer.

"For the two regions, granitic and schistose, the results of the observations are identical.

"The monuments lie along lines oriented S. 54° W. → N. 54° E. (54° = azimuth at the solstices for L = 48° 30′ and *i* = 23° 30′) and N. 54° W. → S. 54° E. Some of them determine lines perpendicular to the meridian.

"One menhir (A), 6m. 90 in height and 9m. 20 in circumference, erected in the small island of Melon (canton of Ploudalmézeau, latitude 48° 29′ 05″) a few metres from a tumulus surrounded by the ruins of a cromlech (B and C), has the section such that the faces 1 and 2, parallel and remarkably plane, are oriented N. 54° E. (Figs. 2 and 3.)

"At 1300 metres in the same azimuth there is a line of three large menhirs (D, E, F) of which one (E) is overthrown. The direction of the line passes exactly by the menhir A. Prolonged towards the N.E. it meets at 3k. 700m. an overturned block of 2m. 50 in height, which is without doubt a menhir; towards the S.-W. it passes a little to the south some lines of the island Molène. . . . (Fig. 4.)

"There exists in the neighbourhood other groups, forming also lines of the same orientation and that of the winter solstice. It is advisable to remark that orientations well determined for the solstices are much less so for the equinoxes, which is natural, the rising amplitude varying very rapidly at this time of year.

"The same general dispositions are to be found in the complex monuments of the peninsula of Crozon. I take for example the alignments of Lagatjar. Two parallel lines of menhirs, G G′ H H′, are oriented to S. 54° E. and cut perpendicularly by a third line, I I′. There existed less than fifty years ago a menhir at K, 6 metres high, which is to-day broken and overturned. This mégalith, known in the country by the name of 'pierre

B A C

FIG. 3.—Melon Island, showing Menhir (A) and Cromlech (B and C).

FIG. 2.—Menhir (A) on Melon Island.

D E F

FIG. 4.—Menhirs of St. Dourzal, D, E, F.

du Conseil' (a bronze axe was found underneath it) gives with a dolmen situated near Camaret the direction of the sunrise on June 21.

"I have just spoken of the lines perpendicular to the solstitial one; there exists more especially in the complex

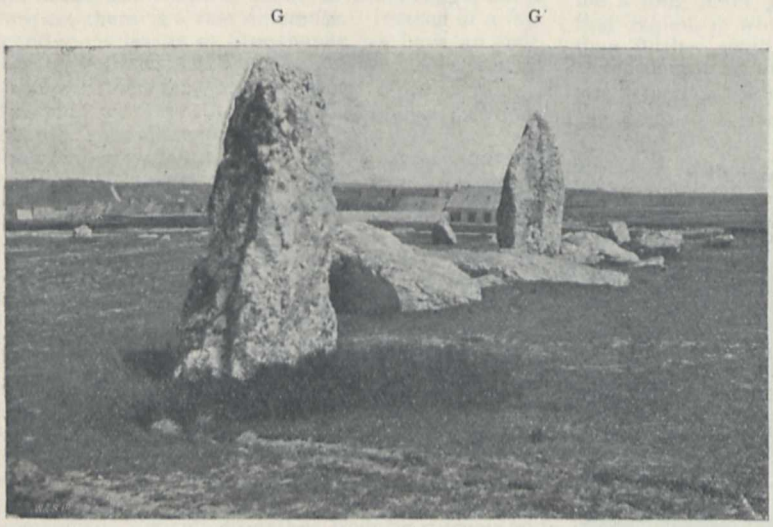

FIG. 5.—Alignment at Lagatjar, G G'.

monuments another particularity which merits attention. Between two monuments, M and N, on a solstitial line, sometimes other menhirs are noticed, the line joining them being inclined 12° to the solstitial line, always towards the east."

I must call particular attention to this important observation of Lieut. Devoir, for it gives us the amplitude 24° N., the direction of sunrise at the beginning of the May and August years. It shows, moreover, that, as at Le Ménec according to M. Gaillard, the solstitial and May-August directions were both provided for at the monuments in the neighbourhood of Brest so carefully studied by Lieut. Devoir.

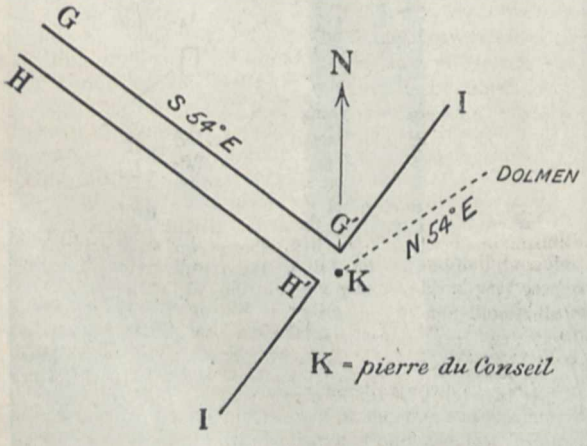

FIG. 6.—Alignments at Lagatjar, showing the pierre du Conseil and the direction of the dolmen. From the pierre du Conseil the dolmen marks the sunrise place at the summer solstice, and the avenue G G' H H' the sunset place on the same day.

I think I have already stated that there is evidence at Stonehenge that the sunrise at the beginning of the May and August years was observed, so that in this we have another point common to the British and Breton monuments.

Lieut. Devoir points out the wonderful regularity of form and the fine polish of many of the menhirs. The one at Kerloas (11 metres high) heads the list in point of size; others in the island of Melon (7 metres), at Kergadion (8 metres and 10 metres), Kerenneur, Kervaon and Kermabion follow suit. He considers them to have been erected at the time of the highest civilisation of the Megalithic peoples. It will be of interest to inquire whether they are generally associated with solstitial alignments. He also states that these regularly formed menhirs do not exist at Carnac, or in the region of Pont l'Abbe, so rich in other remains. It may be, then, that in these localities the May-August worship predominated, and that the index menhirs of M. Gaillard which do not form part of the alignments were erected subsequently.

THE YEARLY FESTIVALS IN EGYPT.

The vague year in Egyptian chronology makes it a very difficult matter to determine the exact Gregorian dates for the ancient Egyptian Festivals, but, fortunately, there is another way of getting at them.

Mr. Roland Mitchell, when compiling his valuable "Egyptian Calendar" (Luzac and Co., 1900), found that the Koptic Calendar really presents to us the old Egyptian year, "which has been in use for thousands of years and has survived all the revolutions."

Of the many festivals included in the Calendar, the great Tanta fair, which is also a Mohammedan feast, "is the most important of all held in Egypt. Religion, commerce and pleasure offer combined attractions." As many as 600,000 or 700,000 often attend this great fair. Mr. Mitchell holds that it is "no doubt the survival of one of the ancient Egyptian national festivals."

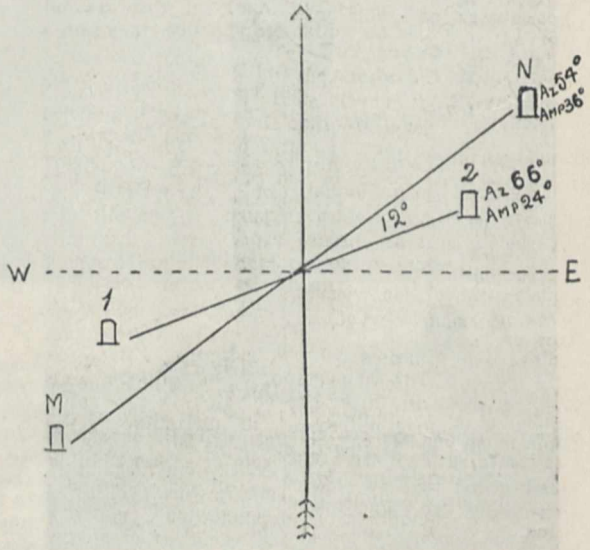

FIG. 7.—Menhirs M, N, on N.E.-S.W. solstitial alignment. Menhirs 1, 2, on May-August years alignment, sunrise May-August, sunset November-February.

It is held so as to end on a Friday, and in 1901 the Friday was August 9!

This naturally suggests that we should look for a feast

in the early part of May. We find the festival of El-Khiḍr and Elias in the middle of the wheat harvest in Lower Egypt; of this we read:—

"El-Khiḍr is a mysterious personage, who, according to learned opinion, was a just man, or saint, the Visīr of Zu'l-Karneyn (who was a great conqueror, contemporary with Ibrahīm—Abraham—and identified in other legends with Alexander the Great, St. George, &c.). El-Khiḍr, it is believed, still lives, and will live until the Day of Judgment. He is clad in green garments, whence probably the name. He is commonly identified with Elias (Elijah), and this confusion seems due to a confusion or similarity of some of the attributes that tradition assigns to both."

"The 'Festival of El-Khiḍr and of Elias,' falling generally on May 6, marks the two-fold division of the year in the Turkish and Armenian Calendars, into the Rūz Kāsim and the Rūz Khiḍr (of 179-80 and 185-6 days respectively)."

This last paragraph is important, as it points to ancient sun worship, Helios being read for Elias; and 179 days from May 6 bring us to November 1. So we find that the modern Turks and Armenians have the old May-November year as well as the ancient Egyptians who celebrated it in the Temple of Min at Thebes.

The traces of the Ptah worship are not so obvious. Finally, it may be stated that the second Tanta fair occurs at the spring equinox, so that the pyramid worship can still be traced in the modern Egyptian Calendar. The proof that this was an exotic is established, I think, by the fact that no important agricultural operations occur at this period in Egypt, while in May we have the harvest, in August and November sowing, going on.

THE NEW YEAR'S OFFERINGS.

In my last article I showed that each year, whenever it began, was, if possible, associated with some fruit of the earth, and that at the winter solstice the chief available vegetable product was the mistletoe.

But about the mistletoe there is this difficulty. Innumerable traditions associate it with the Druids and the oak tree. Undoubtedly the year of the Druids was the solstitial year, so that so far as this goes the association is justified. But as a rule the mistletoe does not grow on oaks. This point has been frequently inquired into, especially by Dr. Henry Ball (*Journal of Botany*, vol. ii. p. 361, 1864), in relation to the growth of the plant in Herefordshire, and by a writer in the *Quarterly Review* (vol. cxiv.), who spoke of the mistletoe "deserting the oak" in modern times and stated, "it is now so rarely found on that tree as to have led to the suggestion that we must look for the mistletoe of the Druids, not in the *Viscum album* of our own trees and orchards, but in the *Loranthus Europaeus* which is frequently found on oaks in the south of Europe."

On this point I consulted two eminent botanical friends, Mr. Murray, of the British Museum, and Prof. Farmer, from whom I have learned that the distribution of *V. album* is in Europe universal except north of Norway and north of Russia; in India in the temperate Himalayas from Kashmir to Nepaul, altitude 3000 to 7000 feet.

The *Viscum aureum*, *Viscum luteum* or *Loranthus Europaeus*, according to Dixon,[1] is a near relation of the familiar mistletoe, and in Italy grows on the oak almost exclusively. There are fifty species of Loranthus in the Indian flora, but *L. Europaeus* does not occur.

In the *Viscum aureum* we have the "golden bough," the oak-borne *Aurum frondens* and *Ramus aureus* of Virgil; and it can easily be imagined that when the Druids reached our shores this would be replaced by the *V. album* growing chiefly on apple trees and not on oaks; indeed, Mr. Davies, in his "Celtic Researches," tells us that the apple was the next sacred tree to the oak, and that apple orchards were planted in the vicinity of the sacred groves. The transplanting of the mistletoe from the apple to the oak tree before the mystic ceremonies began was not beyond the resources of priestcraft.

It must not be forgotten that these ceremonies took place at both solstices—once in June, when the oak was in full leaf, and again in December, when the parasitic plant was better visible in the light of the young moon. Mr. Fraser, in his "Golden Bough" (iii. p. 328), points out that at the summer solstice not only was mistletoe gathered, but many other "magic plants whose evanescent virtues can be secured at this mystic season alone."

It is the ripening of the berries at the winter solstice which secured for the mistletoe the paramount importance the ceremonials connected with it possessed at that time, when the rest of the vegetable world was dormant.

NORMAN LOCKYER.

[1] *Notes and Queries*, Ser. iv. vol. iii. p. 110.

THE RECENT VOLCANIC ERUPTIONS IN THE WEST INDIES.

IN continuation of the articles which have already appeared in NATURE upon the recent volcanic disaster in the West Indies, we are able to give this week some further information upon the character and consequences of the eruptions. Prof. Milne traces the development of the disturbances and uses his intimate knowledge of volcanic and seismic effects to show how they may be interpreted. In addition, we give two separate notes upon the ash ejected during the eruptions, and seismographic records in France on May 6. The nature of the dust ejected from the Soufrière will soon be satisfactorily determined, for last week's West Indian mail brought to this country numbers of packets of the volcanic ash which fell at Barbados, 100 miles *to windward*, during the night of May 7-8. The Imperial Department of Agriculture has despatched specimens to the Natural History Museum, the Geological Society, Prof. Judd, &c.

Arrangements have been made for the small scientific expedition referred to in last week's NATURE, and the members are to sail as we go to press with this number. The expedition consists of Dr. Tempest Anderson, Dr. Flett, and another member of the staff of the Geological Survey. The Colonial Office has promised to assist the Royal Society in defraying the expenses of this expedition.

For convenience, we bring together in diary form the reports of volcanic and other possibly related disturbances which have occurred during the past few days. This record of events is in continuation of those already abridged from dispatches published in the *Times*, *Daily Mail*, *Daily Graphic* and other papers:—

May 18, *Autun* (*France*).—Uneasiness is beginning to be felt in regard to the volcano of St. Pierre-de-Varennes, between Couches-les-Mines and Le Creusot, which has always been considered extinct. Low rumblings have been heard, accompanied by tremblings of the earth, and at 11.30 p.m. similar noises of more than usual loudness caused considerable alarm among the inhabitants of the district.

May 18, *St. Vincent*.—An eruption of the Soufrière occurred between about 8.30 p.m. and midnight, accompanied by thundering noises and incessant electrical discharges.

May 19.—There was a great eruption of Mont Pelée. The volume of lava emitted surpassed that of May 8. It overflowed Grande Rivière and destroyed the buildings and cultivation which were previously untouched.

May 20, *Pointe à Pitre*.—Mont Pelée ejected thick black cloud and hot mud and stones, covering the greater part of Martinique. A heavy pall hung over Fort de France, followed by flashes of light.

May 21, *Fort de France*.—A further eruption of Mont Pelée occurred.

May 22, *Victoria* (*B.C.*).—An explosion occurred in the Crow's Nest coal mines at Fernie, in the Kootenay district.

May 22, *Pointe à Pitre.*—From the new crater on the north side of Mont Pelée the lava is flowing in a broad stream into the sea.

May 24, *Fort de France.*—Mont Pelée emitted a torrent of lava and mud, which rushed down the northern slope and swept away what remained of the town of Basse Pointe. New fissures also opened in the side of the mountain.

May 24, *St. Vincent.*—Rumblings are heard and vapour is still issuing from different points on the Soufrière, and lava is still flowing.

May 24, *Hamburg.*—A fall of so-called "blood rain" occurred in Hamburg and district. It was found that the phenomenon was due to the presence of numerous insects (*Carabus coccinella*), and it is suggested that they were driven with volcanic dust from Martinique.

May 25, *Fort de France.*—Mont Pelée is fairly quiet, although there have been eruptions of ashes which covered the extreme north of the island. The new crater is active.

May 25, *Geneva.*—Grey snow fell in the canton of Lucerne. The heaviest fall was at Langenthal. When it melted, a substance resembling ashes covered the grass.

May 26, *Vienna.*—At noon to-day the seismological apparatus at the observatory of Laibach, Carniola, recorded strong earthquake shocks within a distance of 473 miles.

May 27, *Fort de France.*—A fresh and very violent eruption has taken place. The crater has projected a heavy rain of ashes and gravel over the north of the island. At the same time thick clouds charged with electricity floated in the air.

The fears that existed amongst those who escaped the disasters which took place between May 7 and 10 that volcanic wrath was not expended have been fully realised. Devastation has succeeded devastation, fertile slopes have been doubly buried, new craters have been opened and molten rock yet flows. On Thursday, May 8, at about 11.50 a.m. in our time, Mont Pelée did its worst. La Soufrière commenced earlier, and fought the heavens and all within its reach for several days. Next came a period of comparative tranquillity, Pelée for twelve days and La Soufrière for seven, but the hopes that this created were destined to be rudely shattered by terrific explosions and fresh bombardments. Surely we may now expect, although spasmodic ejections of vapours, ash and lava will yet occur, that these Titans must, by a process of natural exhaustion, sink back to their original quiescent state. But what about the nerve-shaken survivors who yet feel tremblings of the ground and yet breathe fumes wafted downwards from the peaks which dominate their homes?

During the preliminaries which ushered in the great explosion, when the air was filled with noxious exhalations and soft white ash carpeted streets as if the doomed who remained within their houses were to pass away without hearing the hurrying footsteps of those who rushed aimlessly along in their endeavours to escape, *pater nosters* were heard from thousands on their knees. Both men and women lost their reason, a mental paralysis was far-reaching, while the sincerest prayers that were ever offered were accompanied by hysteria.

Many sought refuge in the churches, where sacraments were exposed and services were held. Here, with eyes beyond tears, multitudes with terror graven on their faces confessed and prayed, listened to the exhortations of their pastors and the thunderings of the mountain, awaiting their end. During this reign of terror, which lasted for five long days and nights, no doubt many succumbed.

Then came the final crash, and with a blast of poisonous, suffocating gas, a whirlwind of flame, and beneath a rain of hot ash and blocks of rock, a fair township and its surrounding hamlets which had nestled on Pelée's western strand were seen no more. Only one, we are told, escaped the deadly gas and fire. He was a negro charged with murder, shut up in a subterranean prison. The destruction was even more complete and terrible than that which was accomplished by brimstone and fire in the days of Lot.

When the more violent thunderings ceased, let us consider what next happened amongst the survivors around the desert of desolation. The majority rose from their knees, to be terrified by every puff of steam they saw and to rush from their houses at the slightest tremor of the ground. For years to come, not only will the eruptions in Martinique and St. Vincent form a subject of conversation, but the month of May and the year 1902 will, like the twenty-seventh year of Uzziah, when a mountain near Jerusalem was moved 500 paces and the temple rent in twain, mark a period from which to date events. No doubt survivors are yet pouring into each other's ears fresh tales of horror, whilst grumblings in the distant hills result in delirium and prayers. Many will no doubt sing hymns and devote themselves to religious exercise, and perform acts of penance. Noorthouck, in his "History of London," writing about the effects of earthquakes and referring to that which occurred in the West Indies in 1691, tells us that "such intermittent fits of reformation excited by fear resemble death-bed repentances too much to merit any encomium."

Although Noorthouck's view is sustained by the action of those who had courage to back cupidity by returning to the still smoking débris which represented St. Pierre and rob from corpses, yet those who write the history of this disaster will no doubt find that the shock which the nervous system of survivors sustained has had some lasting effect. By this time, no doubt, not only in the West Indies, but throughout the world, these eruptions have afforded materials for many sermons and moral discourses, and for some time to come a cloud of smoke from the throats of Pelée or the Soufrière will claim a *misericordia* in response.

After the disaster which overtook Jamaica in 1691, we understand that a sentence was interpolated in the Litany as used in that island, whilst the special prayers which have been formulated in consequence of volcanic disturbances are numerous throughout the world. In the history of nations we read that these outbursts have resulted in officially ordered prayers, gifts to temples, special services, the repeal of taxes considered to be unjust, and in many other directions have had a more or less permanent effect upon the social, religious and civil lives of many people.

Those who dwell in countries like our own, where displays of volcanic activity are unknown, possibly think themselves beyond the pale of the emotional influences which they exert. When, however, they call to mind the fact that the vulgar of many nations, to use the words of Buffon, have regarded volcanoes as the mouths of hell, their bellowings to be the cries of the damned and the eruptions the effects of the fury and despair of the wretched prisoners, and add to this the fact that throughout all history equally strange ideas have immediately followed on the heels of unusual displays of volcanic and seismic activity, it is difficult to suppose that any nation can exist that has not suffered or been benefited by these mental aberrations. In Japan we have the myth of the buried cat-fish which shakes the empire, and the effect of this poetical idea is met with in the pictures and art of that empire; whilst parallel stories with their parallel effects are found in many other countries. The strange thing is that these emotional creations seem to spread far beyond the limits of the ashes and the tremblings which produced them, to flourish where the imaginative faculty is the strongest. Although we are without volcanoes, we have only to recall names like Pluto, Vulcan and Poseidon and the line in the Decalogue which tells we are not to make any likeness of that which is in the earth beneath to realise that volcanic activities have had

a marked effect upon our religion, our literature, our pictorial and our glyptic art.

Those who visit the West Indies with the object of extending our knowledge of vulcanology will no doubt collect information bearing on these far-reaching effects, and it is not unlikely that it will be found that the eruptions in the Antilles have done more to stimulate the imaginations of Europeans than those of the negroes who witnessed all that happened.

Another neglected chapter in hypogenic geology to which attention may be directed relates to the effects of volcanic activity on epidemic diseases, a subject which has attracted the attention of many investigators. American and Italian statistics, Dr. Bardswell says,

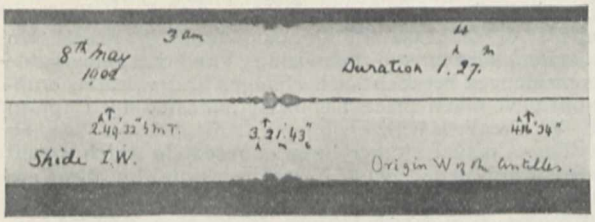

FIG 1.

show that there is "an increased death-rate from malaria, enteric, &c., with a lessened death-rate from phthisis in areas associated with volcanic activity as compared with non-volcanic regions"—a statement, however, not beyond criticism.

No doubt types of neurosis like nausea, disordered sensation, nervous apprehension, insanity, paralysis of the limbs and other kindred troubles will have a sporadic existence, but it does not seem likely that these will be so marked amongst the negroes as amongst the Europeans.

The destruction of water-pipes or the contamination of water supplies by sewage might result in diseases like cholera and typhoid. Although cases of bronchitis have resulted from the inhalation of volcanic gases, diseases arising from these causes are extremely rare.

An ingenious theory, showing the possibility of a relationship between volcanic action and the production of epidemic diseases, is one advocated by Dr. W. G. A. Robertson. He does not assume that poisonous products issue from volcanic vents to render the atmosphere poisonous, or even that these products appreciably affect its constitution. What, however, he does assume is that these gases and vapours may be dilated to an immense extent to produce an atmosphere suitable to the vital activity of unicellular organisms. According to this view, microparasites, which are always present somewhere or other, may be stirred into activity in regions far removed from volcanic centres, to result in diseases which may affect, not only animals, but also plants.

The causes of death in St. Pierre were no doubt manifold. First there was the blast of irritating gas and dust which caused suffocation. In all probability this gas was in the main that of hydrochloric acid derived from the sodium chloride of the sea-water, the infiltration of which is the main cause of all volcanic activity. This gas has been pouring out of Pelée and La Soufrière in the columns of steam during all stages of their eruptions and by this time, no doubt, it exists as a belt round our world, many of the inhabitants of which are breathing exhalations which had their origin in the West Indies.

Many were killed, particularly at La Soufrière, by a rain of hot ashes or by lightning, which played in the darkness of the ashy cloud like fiery serpents.

On May 8, when Pelée burst an opening on its flanks, a whirlwind of fire or a sheet of flame, followed by red-hot ashes, stones and boiling water, swept over St. Pierre and its harbour to seer and scald and fire all that it passed. We have here a phenomenon deserving close attention. If this flame really existed, what was its origin? Mr. F. J. M. Page gave the writer the suggestion that it was the ignition of a "water gas" produced when the water forming the lake in the crater of Mont Pelée was suddenly admitted into the fiery furnace of its interior. The action would be similar to that which takes place when a teaspoonful of water is thrown upon a hot fire; dissociation would take place, an explosion would occur, and the resultant gases would be ignited as a flash. That the inhabitants of a city should be overwhelmed by a wall of fire created by the cool waters of the lake in which they bathed seems incredible, but still, this is at present the only explanation we have for this unparalleled occurrence.

About premonitory signs a correspondent of the *New York Herald* tells us that dumb animals were wiser than man, live stock were uneasy and almost uncontrollable. Cattle lowed in the night, dogs howled, and when driven out showed symptoms of fear. Wild animals disappeared from Mont Pelée. Even snakes crawled away. Birds ceased singing and left the mountain, and a great fear seemed to be upon the island.

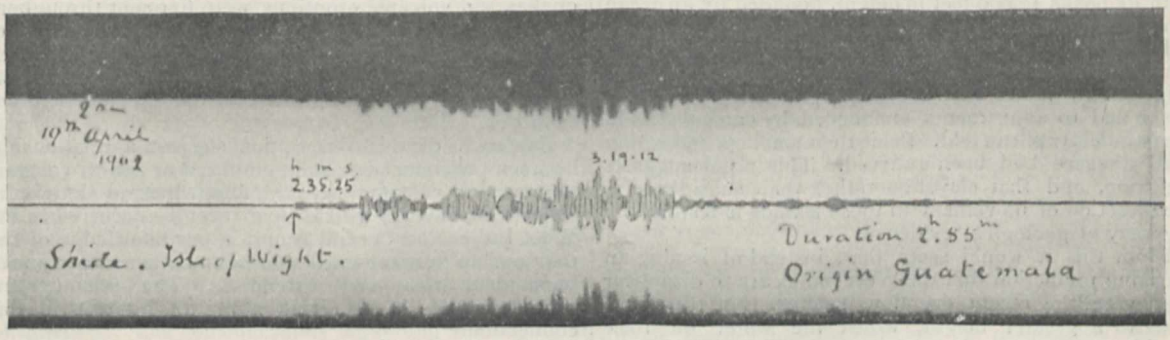

FIG. 2.

Signs like these, which usually are only recognised after a catastrophe has taken place, are by no means peculiar to the Antilles. The late Prof. S. Sekiya, of Tokio, kept pheasants to study their behaviour before an earthquake, and I have had many opportunities of confirming his observations, which show that these birds by their screaming feel the preliminary tremors of an earthquake, to which movements human beings are insensible. This, then, being the case, it does not seem at all unlikely that the creatures living on the slopes of Mont Pelée heard sounds and felt vibrations the occurrence of which was not noticeable by man. Although

Cicero, in the "De Divinatione," says that "God has not predicted so much as the divine intelligence of man" and omitted reference to the intelligence of the lower animals, it seems probable that in certain directions the instinct of brutes is not to be overlooked.

The small earthquakes which frequently precede a volcanic eruption are usually referred to as abortive attempts made by internal forces to establish an opening. But should all such earth shakings be regarded in this manner? It seems likely that some of them may be simply intermittent yieldings in the general process of rock folding, which, when it has sufficiently relaxed its hold upon the imprisoned vapours, allows the same to burst forth as an eruption. Whether before the eruption there were unusual escapes of gas from subterranean sources, whether there had been changes in colour, taste, level or temperature of the water in wells and springs, we have not yet been told.

Neither have we been told of any prophet who boldly came forth and announced the impending danger; but what we do know is that whilst the Governors of the Windward and Leeward Islands are yet striving to allay the fears of terrified inhabitants, thoughtless Cassandras are predicting tornados, new eruptions, and even the sinking of the islands. As we have said before, tornados always occur in these islands between July and October, and volcanic displays usually sink back into quiescence in an intermittent manner. To call attention to what is inevitable in terms suggesting that even greater catastrophes than have yet been experienced are to be expected, may make sensational paragraphs and cheapen property. It can, however, only excite alarm, create panic, trouble the civil administration and accelerate the depopulation of the islands, and therefore prognostications of this character should at least be discouraged. What grounds there are for supposing that the Antilles may sink beneath the ocean is a mystery. Cinder heaps which have risen above the ocean as volcanic islands have by the action of the waves been reduced to shoals, but with the Antilles we are dealing with a fold in the crust of our earth which, if the water was removed from its flanks, would stand up like a chain of mountains 18,000 feet in height. Parallel with this is the fold of the Cordilleras, with its peaks 12,000 feet in height, bounded by an ocean more than 14,000 feet in depth.

It seems that it was an adjustment in this latter fold which took place on April 19, when several towns were ruined and more than 1000 people lost their lives, which led to adjustments announced by earthquakes in the parallel Antillean fold. Pelée then smoked, indicating that pressure had been relieved. This relief suggests elevation, and that elevation rather than subsidence is the direction of movement in these islands is testified by a variety of geological evidence.

From this it would seem that, instead of issuing an alarming prediction that the West Indies are to disappear from view, the recent eruptions suggest that they have risen to a greater height, whilst the water on their Caribbean side may have deepened. Two wrinkles on the face of the world have probably gained in height, whilst the depth of the bounding furrows on their western flanks has probably been increased. As indications of these changes, newspapers state that Richmond in St. Vincent has risen, whilst a French cable ship has found at a certain spot an increase in the depth of water of nearly 500 fathoms.

The public are evidently anxious that volcanic eruptions and seismic disturbances should be predicted, but as districts where these activities prevail are not transparent and we cannot see what is happening beneath our feet, neither are we able to measure the pressures and strains which may be increasing in such regions, the time when a ball rising on a mast will announce impending subterranean disturbances seems very distant. Still, there are directions in which investigations bearing on this point may be pursued. One of these would be to determine whether before a volcanic outburst or after the same there were any unusual changes in level in operation. Lyell remarks that if we reflect upon the dates of the principal oscillations noted near the Bay of Naples, there appears to be a connection between the movements of upheaval and a local development of volcanic heat, whilst periods of depression are concurrent with periods of volcanic quiescence. The part that the horizontal pendulum would play in such an investigation is obvious.

A second line of research would be to determine whether the movements of magnetic needles placed in the vicinity of a volcano show any relationship to its eruptions. We know that many lavas are highly magnetic, and it is not unlikely that physical and chemical changes, together with mechanical displacements of such materials, would result in changes in magnetic elements in their vicinity; and that remarkable coincidences between such changes and volcanic eruptions have taken place has been indicated by Captain E. W. Creak, F.R.S.

There may be other lines of research which would throw light upon subterranean operations, but these are two which might be pursued without great difficulty.

On the Sequence of Events.

From the enormous displacements of ground which have frequently accompanied world-shaking earthquakes, and from the fact that their origins can be traced to districts where we have evidence of secular movements which may be yet in progress, it is not unreasonable to suppose that such earthquakes are announcements that strains have suddenly been relieved in certain orogenic foldings. This relief may be compared to the movement of a key which fires many mines. Not only might volcanic vents beneath which there was excessive pressure burst into activity along the fold, but similar displays might be expected in neighbouring folds. In support of these views attention may be called to the fact that the mountain-making epochs in geological history were periods of intense volcanic activity. From the middle to the end of the eighteenth century, earthquakes and volcanic eruptions were frequent throughout the world. The history of the large earthquakes of Japan shows an approximate coincidence in time between these phenomena and volcanic eruptions, and similar coincidences can be adduced from the registers of other countries.

Evidences of this description suggest a relationship between pronounced seismic efforts in or near a volcanic region and volcanic activity, and when we know the sequence of events which have recently occurred in the West Indies and Central America, our knowledge of the relationship between earthquakes and other subterranean phenomena may be extended. The seismograms reproduced in Figs. 1 and 2 are of interest in this connection.

On April 19 at about half-past two in our time, the Cordilleras of Central America were suddenly relieved of seismic strain, villages and towns were shattered, earthquake waves passed all over our world and all through the same, whilst in the epifocal area we learn that at one town alone 1100 people lost their lives. Whether this widespread disturbance was quickly followed by adjustments in the neighbouring Antillean ridge we are not certain. All that can be gathered from newspapers is to the effect that *about* the end of April many small earthquakes took place and Mont Pelée smoked and rumbled. On May 3 this mountain was in eruption and ashes fell upon St. Pierre. Two days later it ejected a stream of mud and commenced its work of serious destruction. The sea receded 300 feet, and the Puerto Plata and the Dominica-Martinique cables were interrupted. On this

day La Soufrière, ninety miles to the south, gave evidences that it was disturbed, but it was not until 2 p.m. on May 6 that it can be said to have erupted. At 7 a.m. on May 7 the eruption was violent. At noon three craters opened, lava flowed, ashes were driven to a height of eight miles, to fall upon Kingstown, twelve miles distant, whilst the schooner *Ocean Traveller* had to fly to escape destruction from the showers of lapilli. A violent explosion took place at 1.30 p.m., whilst at 3 p.m. the detonations were terrific. One hour later a dust cloud, which apparently had travelled in the teeth of the trades, reached Barbados. Dust or extremely fine ash was falling at or before 5.30, and in three days, when the eruption in St. Vincent moderated, a thin layer of this covered Barbados. The weight of this dust layer, which has already been analysed and is expected to improve the texture of the soil, is estimated at two million tons. This is what La Soufrière, assisted by an upper current of air, effected at a distance of 100 miles eastwards from its crater. It may here be noticed that this mountain commenced its violent outbursts, which extended over three days, before the explosion of Mont Pelée, which happened at 11.50 a.m. on May 8, although Mont Pelée was in eruption some days before La Soufrière.

The *Dies Irae* for St. Vincent was May 7, whilst for Martinique it was on May 8. Other events of considerable significance which happened on May 7, but about which we have as yet but little information, were, first, the St. Lucia-Martinique, the St. Lucia-St. Vincent, the St. Lucia-Grenada and the Guadeloupe-Martinique cables were interrupted; second, at 10 p.m. a very strong earthquake shook St. Vincent; and lastly, in St. Vincent time in the Isle of Wight a seismograph commenced to indicate at 10h. 45m. p.m., the maximum motion being attained at 11.16 p.m. The character of the seismogram is that of a disturbance which originated at a distance from the Isle of Wight of between 60° and 70°. From this it is inferred that the time at which this disturbance originated was about 10.33 p.m.

Now St. Vincent is 60° from Great Britain, but whether the earthquake which took place in that island is identical with that recorded in Britain and represents a suboceanic convulsion which interrupted the cables on that date can only be definitely settled by those who know the hours at which these cables ceased to work.

The suboceanic disturbance which at 6.32 a.m. on December 29, 1897, interrupted the cables off Hayti gave in England a seismogram which was comparatively large. In this case, although the seismogram is small if we for the present assume the disturbance it represents to have originated off St. Vincent, it indicates that the sudden adjustments in the earth's crust accompanying the eruption of La Soufrière were more violent than those which took place around Mont Pelée, from which earthquakes of any magni ude do not seem to have originated. The considerations attending the laying of cables are no doubt numerous, but from the fact that those which have been mentioned for the most part pass along the western side of the Antilles, it cannot be said that they occupy the best position o avoid the effects of submarine convulsions. A comparison of the registers of the interruptions these cables have experienced with those of earthquakes which may have been recorded at many very distant stations would throw great light upon the geological activities in progress beneath the Caribbean Sea.

To turn back to Mont Pelée and La Soufrière, we see that after their paroxysmal efforts, when 2000 lives had been lost in St. Vincent and 40,000 in Martinique, the eruptions at these mountains moderated, but this was only for a time. On May 17 another great eruption took place at La Soufrière, whilst on the 20th Mont Pelée destroyed everything that had remained standing at St. Pierre, and, as if filled with a desire to destroy more life, showered stones and ashes on Fort de France, thirteen miles distant. The northern ends of two islands have now been destroyed and the eruptions continue, whilst in St. Lucia, which lies at a distance of about twenty miles from each of these scenes of destruction and exactly between them, the boiling sulphur springs and volcanoes remain in their normal conditions.

With the great eruptions of Pelée on May 3, 8, 19 and 20 there appear to have been disturbances of sea level, the water either rising or receding. With that of La Soufrière on the 17th, we read that at Château Belair every few hours there were continuous convulsions of the ground, at Kingstown and Georgetown there were sixty shocks in four hours, whilst the village of Wallibou partly sank and that of Richmond rose. All these phenomena, taken in conjunction with the interruption of cables, indicate that the more violent displays of activity were accompanied by adjustments in the neighbouring strata, and it is more likely that such adjustments were the cause rather than the result of the marked phases of activity.

About unusual phenomena which occurred at a distance we have as yet but little information.

On May 11 a geyser or boiling lake in Dominica, some 300 feet in length and 200 feet in breadth, disappeared. The next day some boiling springs at Bath, in Jamaica, became extremely hot. On May 13, and for several days previously, Pico de Colima, a volcano 12,700 feet high, in Mexico, created alarm by belching forth puffs of smoke, whilst at St. Thomas at 4.30 p.m. a slight earthquake was felt. On May 18 an earthquake was felt throughout California. Up to noon on Sunday, May 25, with the exception of what has here been noted, the instruments in the Isle of Wight have been at rest.

J. MILNE.

Volcanic Ash at Barbados.

Volcanic ash fell very thickly at Barbados in the afternoon of May 7, in consequence of the eruption of the Soufrière on St. Vincent, and caused almost total darkness in the afternoon. On the morning of May 8, we learn from the *Barbados Advocate*, kindly sent to us by Sir William Thiselton-Dyer, the streets were found to be covered with this grey dust, and it was estimated that about twenty-two tons per acre fell in twelve hours. The ash lay so thick in the streets that traffic was interfered with, and great difficulty was experienced in clearing it from houses and approaches.

There was a fairly strong east wind prevailing during the whole period, and ordinarily speaking, St. Vincent being to the west of Barbados, it would have been considered impossible that the dust could have travelled in this direction nearly a hundred miles against the wind. But whilst the prevailing direction of the wind was from the east, the upper currents of air travelled from the west, and the phenomenon observed in the eruption of 1812 was repeated in the present. The dust was hurled from the volcano into the upper strata of air and borne eastward against the direction of the surface currents.

According to the official statement in the *Agricultural News*, the quantity of ash that fell varied from three-eighths to half an inch in depth, covering everything with a grey mantle of impalpable dust. By actual measurement it was ascertained that the weight of ash was at the rate of 17·58 tons per acre, probably nearly two million tons being deposited over the whole of Barbados. Prof. d'Albuquerque's preliminary chemical examination led to the conclusion, which was contrary to expectation, that the ash was of no fertilising value, but that it may tend to improve the texture of the surface layers of heavy clay lands. Dr. Longfield Smith's preliminary mineralogical examination disclosed volcanic minerals and volcanic glass, the minerals predominating, and consisting chiefly of silicates of iron and magnesia, also a considerable proportion of quartz and some potash felspar. Under

the microscope the samples of the dust which fell in 1812 and 1902 differed greatly, the 1812 dust being much finer and containing very few mineral crystals, being chiefly composed of fragments of dark brown volcanic glass. During the recent fall it was noticed that the ash at first was rather coarse and of a brownish colour, then it became slightly redder, while the final deposits consisted of a whitish-grey impalpable powder.

From a meteorological standpoint the conveyance of the dust from St. Vincent to Barbados is a subject of great interest, as bearing upon the question of the upper currents. At sea level the trade wind blows almost directly, and freshly, from Barbados to St. Vincent, east to west. The Soufrière became active early in the afternoon of Wednesday, May 7; the dust cloud must have been shot up to an elevation of some miles, where it was caught by a west to east counter current of great velocity, for within two hours, 3.15 p.m., dust was observed to be descending in Barbados, gradually increasing in volume and becoming heavy soon after sundown, the consequent darkness being intense. There was brilliant lightning and violent crashing thunder. It would appear that on this day the upper current had an east-going velocity of more than fifty miles an hour.

It is worthy of mention that at 1.30 p.m. on May 7 there occurred a sudden outburst from one of the oil borings, 900 feet deep, at Turner's Hall, Barbados, dust being thrown up to the height of more than 100 feet into the air. At 3.45 p.m. there was an unusually high tide at Bridgetown, the highest within memory.

Seismographic Records in France.[1]

I received, on May 6, a telegram from M. Kilian, professor of geology at the University of Grenoble, announcing that the Kilian-Paulin seismograph had registered in the morning at 3h. 4m. 49s. Paris time a seismic shock from a north-east direction. The evening papers and those of the next day announced that this shock had been felt again in the north-west of France and along the south Mediterranean coast of Spain. It is in the district of Murthia that the most violent effects were notified.

Another more precise observation as regards time and direction of the shocks has been recorded at Floirac near Bordeaux, north-west direction, time 3h. 5m. 30s.; the passage of the vibrations therefore made themselves felt at Floirac forty-one seconds after those of Grenoble. In supposing them to have a speed of 3 km. a second, the epicentrum must be 123 km. further from Floirac than from Grenoble and also to the south-east of Floirac, to the south-west of Grenoble. These theoretical and hypothetical considerations would place it in the Mediterranean, to the east of Murthia, to the south of Minorca. Wherever it is, it seems to me that the earthquake of May 6 affected the subsidence in a Mediterranean oval, which has cut the south coast of Spain, by marking it with volcanic eruptions (Olot, Columbret, Cartagena, Cap de Gâte). It is interesting to remark that it is equally the result of a subsidence in a Mediterranean oval, that of the Lesser Antilles, that two days after, May 8, there was the terrible catastrophe of Saint-Pierre.

NOTES.

AT the next meeting of the British Association, to be held at Belfast, commencing on September 8, it has been decided to include in Section A a subsection for seismology. The organising committee of this subsection invite cooperation of seismologists, who, it is hoped, if they are not able to attend will be able to send communications for discussion.

A REUTER telegram from Upsala says that a Swedish expedition for taking meridian measurements will leave Tromsö for Spitsbergen on July 26. It will be under the leadership of Dr. P. Rubin and will include, as astronomer, Dr. von Zeipel, and, as cartographer, Lieutenant Duner. The expedition will have as a centre the seven islands to the north of Spitsbergen, and will return to Tromsö on September 10.

MR. J. S. BUDGETT, Balfour student of the University of Cambridge, left England last week for Uganda, *viâ* Mombasa, on a mission from the Zoological Society of London. He will proceed to the south-east corner of the protectorate, and take up a station on the Semliki River, where he will collect mammals and birds, study the fishes, and endeavour to investigate the habits of the okapi in the forest of Mboga. Mr. Budgett, who has already paid two visits to the Gambia, is a practised collector of fishes and an experienced African traveller.

AT the anniversary meeting of the Royal Agricultural Society, held last week, the Prince of Wales was elected president of the Society for the year following the Carlisle meeting this summer.

THE *British Medical Journal* announces that a scientific commission, consisting of Dr. G. C. Low, Dr. C. Christy and Dr. Castelani has been sent to Uganda by the Royal Society for the purpose of investigating sleeping sickness. To Dr. Low and Dr. Christy is entrusted the parasitological part of the investigation, while Dr. Castelani is the bacteriologist of the expedition.

WE learn from the *Victorian Naturalist* that after an absence of rather more than twelve months, the greater part of which was spent among the aboriginals of the northern interior of Australia, Prof. Baldwin Spencer, F.R.S., and Mr. F. J. Gillen returned to Melbourne on March 17. They were in excellent health, and were welcomed home by a number of gentlemen prominent in literary and scientific circles. The explorers have brought back a considerable amount of material, including phonograph and kinematograph records, on which to base an extensive work on the myths, customs, &c., of the various tribes studied.

THE *Times* states that Mr. W. Bruce, who is to lead the Scottish Antarctic expedition, has received intimation, dated January 4, from Prof. von Drygalski, leader of the German South Polar expedition, announcing the arrival of the *Gauss* at Kerguelen. The expedition will, therefore, have made the ice at about the same time as the Swedish and British ships. Von Drygalski has penetrated the Antarctic region at the point of the still hypothetical termination island in order to discover the western side of Victoria land and clear up its possible connection with Kemp and Enderby lands. By taking this route he believes he may be ultimately able to sweep westwards by a high southern latitude into the South Atlantic and emerge by way of South Georgia.

A CORRESPONDENT directs our attention to the announcement that a very fine example of the blue Puya is in flower in the Mexican portion of the temperate house at Kew Gardens, where it is now bearing two stout spikes, three feet high, of beautiful peacock-blue flowers. The plant is a very remarkable one and has rarely flowered in this country, though Messrs. J. Veitch had one in flower in 1868 (*Botanical Magazine*, t. 5732).

THE International Commission for Scientific Ballooning met in Berlin last week in the Sitzungssaal of the Reichstag. We learn from the *Daily Graphic* that Prince Frederick Henry presided in the name of the Kaiser. The War Offices of all the great European Powers except France were represented at the conference. The object of the commission is to combine the study of meteorology with aëronautics, and to induce the various Powers to agree upon some common course of action with regard to the study of aëronautic questions. A paper was read by Mr. Patrick Alexander on the steering by Hertzian waves of flying machines carrying instruments for registering the temperature and moisture of the atmosphere at different altitudes. Mr. Alexander claims that his machines can be sent a distance of fifty miles and steered back to the

[1] Translation of a note by M. Michel Lévy in the *Comptes rendus* of the Paris Academy of Sciences, May 12.

starting point. The foreign deputies, who were the guests of the aëronautical battalion of the German Army, were shown over the headquarters of the battalion, which has the largest balloon house in the world.

THE anniversary meeting of the Royal Geographical Society was held on Monday, and the medals and awards already announced (vol. lxv., p. 471) were distributed. In his opening address, the president referred at some length to the Antarctic expedition, and remarked that they could not hope to receive any news of the *Discovery* until the spring of next year. The question of wintering was left to Captain Scott's discretion, and he was instructed to use his utmost endeavour to explore the region within reach of his winter quarters by sledge travelling in the spring. He intended to endeavour to reach and force through the ice pack on the 175th meridian, and on reaching the open water to make for Cape Adare. The relief ship would have no difficulty in finding the *Discovery* and supplying her with the stores and provisions of which she would be in need if the winter quarters were in Wood Bay or on any part of the coast between that position and Cape Crozier. About 20,000*l.* had been subscribed for the relief expedition, but at least 22,000*l.* would be needed. Turning to the opposite Polar area, the president remarked that the Arctic regions were the scene of the labours of four expeditions. The *Windward* would shortly proceed to Smith Sound to bring back the Peary expedition. Captain Sverdrup in the *Fram* had now been absent three winters, and his exact position was unknown. There were also Mr. Baldwin's expedition with the avowed object of reaching the North Pole by the Franz Josef Land route, and Baron Toll's expedition in the islands to the north of the new Siberian Islands.

THE Nature-Study Exhibition, to be opened at the Gardens of the Royal Botanic Society in Regent's Park on July 23, promises to be of a very interesting and instructive character. The exhibits will be arranged in five groups, the scope of which may be roughly defined as follows:—(1) General information, such as reports and other publications, object-lessons and notes on school gardens, natural history rambles, &c.; (2) pictorial illustrations, including pictures and photographs of work and equipment in school and out; (3) organisation, with schemes of instruction and time-tables; (4) apparatus, including models, specimens, maps and collections of natural objects; (5) work done by pupils, such as notes of observations, nesting-boxes, breeding-cages, &c. The intention is to bring together, so far as possible, the results of nature-study in schools and colleges of all grades, so that teachers and pupils may be given the opportunity of seeing what others are doing, and so obtain inspiration for the further development of their work. University colleges, natural history societies and local museums might usefully affect the trend of nature-study by showing typical collections, or materials and apparatus suitable for study in various branches of natural history in schools. A report will be published, and the following have kindly consented to act as judges:—Mr. A. D. Hall, principal South-Eastern Agricultural College, Wye, Prof. C. Lloyd Morgan, F.R.S., Prof. L. C. Miall, F.R.S., Prof. J. Arthur Thompson and Prof. R. Wallace. The scheme has so far extended beyond the scope originally contemplated that further donations are invited and would be gratefully received by the hon. treasurer, Mr. C. S. Roundell, 7 Sussex Square, Brighton. All particulars may be obtained from the hon. secretary, Mr. J. C. Medd, Stratton, Cirencester.

THE *Times* announces the death of Dr. Henry Morton, president of the Stevens Institute of Technology. Dr. Morton was born in New York, December 11, 1836, and graduated from the University of Pennsylvania in 1857. The bent of his studies was then fixed by the fact that he took a post-graduate course in chemistry. He afterwards became secretary of the Franklin Institute of Philadelphia, where he delivered many lectures which attracted much attention. In 1868 he was the chief of an expedition organised to observe and make photographic records of a very notable total eclipse of the sun. In 1870, the Stevens Institute of Technology was organised and its work begun at Hoboken in New Jersey. This was done under the will of Edwin A. Stevens, who had designated Dr. Morton as the president of an institute to be devoted entirely to the higher instruction in technological subjects. Dr. Morton was one of the most proficient of the engineering experts known to America. He lavished his large income upon the institute with great freedom. In 1880 he made his first gift, which took the form of a new workshop fitted up with steam engines and tools. Two years later he gave money for the purchase of electrical apparatus. In 1888 he gave 10,000 dollars for the endowment of a chair of engineering practice, to which, in 1892, he added 20,000 dollars more. For many years he had contributed the whole of his salary as professor of applied electricity to electrical experiments. In all, his gifts to the institute have amounted to about 145,000 dollars. A few years ago he interested Mr. Andrew Carnegie in the work, with the result that Mr. Carnegie contributed a laboratory and endowed it in addition with 100,000 dollars. Dr. Morton was for several years a member of the United States Lighthouse Board and had been a member of the National Academy of Sciences for nearly thirty years.

MR. JOHN BELLOWS, who died on May 5, aged seventy-one, was a well-known member of the Society of Friends, and a printer at Gloucester. He was an active member of the Cotteswold Naturalists' Field Club, and had communicated to its *Proceedings* several papers on local archæology. In one paper he dealt elaborately with the history of the "Speech House" in the Forest of Dean, and endeavoured to show that in the Court still held in that house we have the last vestige of the grand system of the Druids in Britain.

IN connection with the Belgian Royal Academy, a number of prizes are offered for this and next year of which particulars are given in No. 3 of the *Bulletin de la Classe des Sciences*. In mathematical and physical sciences the subjects announced for 1902 relate to critical phenomena, viscosity of liquids, the algebraic and geometric study of n-linear forms where $n > 3$, and the thermal conductivity of liquids and solutions, the prize in each case being 600 francs, also prizes of 800 francs for researches on the action of alcohols on compound ethers and on the unipolar induction of Weber. In natural science, prizes of 600 francs are offered for a study of the beds of Comblain au Pont and their geological position, the modifications produced in minerals by pressure, the development of the Platoda, the effects of osmotic pressure on the phenomena of animal life, and the Devonian flora of Belgium. For researches on the influence of external factors on karyokinesis and vegetable cell division a prize of 800 francs is offered, and for new investigations on the formation of albuminoids in plants a prize of 1000 francs. In every case the essays, written in French or Flemish, must be sent in by August 1. For 1903 the subjects propounded in mathematical and physical sciences are the combinations of the four halogens among themselves, the form of the principal terms introduced by the earth's elasticity into the equations for the nutation in obliquity and longitude, contributions to the study of mixed forms containing any number of series of variables with applications to the geometry of any space, and the determination in altitude and azimuth of the principal terms in the periodic deviations of the vertical on the hypothesis of the non-coincidence of the centres of mass of the earth's crust and its nucleus. In natural science the subjects are the physiological function of

albuminoids in the nutrition of animals or plants, the organisation and development of a Phoronis, and the relations between this genus and Rhabdopleura and Cephalodiscus and the group of Enteropneustes, a description of the elements and their sulphides and binary compounds occurring in Belgian soils, new researches on the different strata included between the "Bruxellian" and "Tongrian" in Brabant, and a determination of the geological age of certain deposits of sand, plastic clay and quartz pebbles in the Oligocene formations the positions of which are indicated by reference to the geological maps. The values of these prizes range from 600 to 1000 francs.

IN addition to the above prizes, a prize of 1400 francs associated with the name of Charles Lemaire is offered for questions relating to public works. A prize, named the Édouard Mailly prize, of 1000 francs is offered to the Belgian or naturalised subject who makes the greatest advance in promoting the study of astronomy in Belgium, a Louis Melsens prize is offered for work on chemistry or applied physics and a Charles Lagrange prize for a mathematical or experimental investigation relating to our *mathematical* knowledge of the earth, the word mathematical in this sense excluding purely statistical measurements unless associated with the investigation of some new law. Finally, a prize founded by Baron Selys Longchamps is offered for the best original work dealing with the whole or part of the Belgian fauna, not necessarily the recent fauna.

HAVING regard to the wide reputation which the Malays have earned for themselves as a maritime people in Eastern seas, it is at first sight not a little remarkable that, so far as the Malay Peninsula is concerned, they have developed no really able type of sea-going boat. Three main factors have been at work influencing the development of boats, and tending to produce the characteristic shallow draft, lack of beam, and a consequent want of stability and weather lines. (1) The rivers are protected by very shallow bars of sand or mud, which make it impossible for a deep-bodied boat to obtain shelter within them. (2) The variable character of the light breezes prevailing in the Straits of Malacca. (3) The great strength of the tides. The lot of the sailing vessel is thus precarious; racing tides and baffling winds and calms make progress very slow. Hence propulsion by oars or paddles was the first necessity of the old-time Malay seaman in the Straits; sails were merely an occasional convenience. The Malay boat, however large and with its quantity of top-hamper, always remains essentially a canoe. Those who are interested in the subject of transport by water will find an important paper on boats and boat-building in the Malay Peninsula, by Mr. H. Warington Smyth, in the *Journal* of the Society of Arts, vol. l. p. 570.

IN *Symons's Meteorological Magazine* for May, attention is drawn to the use of the rainfall tables published each month. The British rainfall organisation established by the late Mr. Symons has been very successful in obtaining the voluntary assistance of some thousands of observers, and it is well known that the results are very carefully collated and published in an annual volume, "British Rainfall." It is, perhaps, not so generally known that in the monthly magazine the rainfall values for some 156 stations are regularly published, so as to give prompt and accurate information as to the state of the British Islands as regards rainfall in the previous month. For forty-five of the stations the departures from the averages for the ten years 1890–99 and also the number of rainy days are shown. In the current issue a table is given showing the aggregate rainfall of the first four months of this year and the averages of the same period, for ten years, at more than fifty stations distributed as uniformly as possible over the country. A glance at this table shows that the south-eastern portion of England has been very dry; within a radius of fifty miles from London the fall has only exceeded two-thirds of the average at London itself. With regard to large districts, the actual state is perhaps more readily seen from the *Weekly Weather Report* of the Meteorological Office, which shows that for the four months in question the rainfall has only exceeded the average in the north of Scotland and the north of Ireland; in the east of Scotland, and the east and south of England, the deficiency exceeded two inches, while in the south-west of England it exceeded three and a half inches.

THE Meteorological Office pilot chart of the North Atlantic and Mediterranean for June shows that down to the middle of May no reports of ice about the Newfoundland banks had been received, a newspaper report of a berg having been seen in a locality much frequented by shipping not being confirmed. Of interest in connection with the exceptionally prolonged spell of cold weather over the British Isles is the statement that during April there was much Polar ice blocking the north and east coasts of Iceland, the region from which the prevailing winds have recently been drawn. In a note on sandstorms it is suggested that the dust which fell in the south-west of England and South Wales late in January last may have come from a sandstorm which had been observed at Ouargla, in the Sahara, on the 16th of the month, falls of sand being reported on succeeding days about the Canaries, Madeira, Portugal, the north-west of France, and finally on our side of the Channel on the 22nd and 23rd. Curiously enough, on the 17th and 18th, when brisk easterly winds were carrying dust from Africa to the Canaries, a westerly wind, strong to a gale, was driving clouds of sand across the Gulf of Suez and the upper part of the Red Sea. From a total of 3200 observations of the temperature of the North Atlantic during the month of March, it is found that, compared with February, the changes were very irregular, the mean values in several localities, chiefly between 30° and 40° N., showing a decline. A strip of very cold water extended southward from the extremity of the Newfoundland bank down to the forty-first parallel, several records being as low as 32° to 35°. To the south-westward of the British Isles the mean values differed but slightly from the average, while the air over the land showed an excess of 2° or 3°.

THE third and last part of the sale catalogue of the library of the late Prof. A. Milne-Edwards, of which a copy has been sent us, contains the works on invertebrates. The total number of lots catalogued in the three parts is 2881.

ACCORDING to its report for the year 1901, the Rugby School Natural History Society is in an unusually flourishing condition. A large collection of invertebrates has been purchased, and the museum has been added to and improved in other ways. A satisfactory feature is the attention devoted to agricultural science, the attendance at the meetings of that section exceeding all the rest in numbers.

IN the course of an article on animal sense perceptions, in which special attention is directed to nauseous or offensive odours as a means of protection, the editor of *The Zoologist*, in the May issue, warns his readers against regarding animal etiology too much from the human standpoint. Because animals cannot speak, we must not assume that they have no modes of communication; it is by no means certain that the ordinary explanation of "warning colours" is the true one, while the evil smell of the durian fruit does not render it distasteful either to the orang or to man himself. To the same journal Mr. G. Renshaw contributes an interesting article on mammals in captivity.

THE auditory organs of the so-called "waltzing mice" of Japan and China form the subject of a paper by Dr. K. Kishi in part iii. of vol. lxxi. of *Zeitschrift für wissenschaftliche Zoologie.*

Although these remarkable mice are commonly called either Japanese or Chinese, it appears that their real home is China, since they are known in Japan as Nanking mice. In Japan, where there were originally a grey and a white breed, these mice are kept in cages on account of their well-known dancing propensities. After an exhaustive examination of their internal auditory organs, the author comes to the conclusion that the dancing of these mice is not due, as commonly supposed, to disease of the labyrinth, but to the effect of confinement for untold centuries in small cages.

THE German scientific periodical *Die Natur* has been discontinued as a separate publication, and is now combined with the *Naturwissenschaftliche Wochenschrift*, edited by Prof. H. Potonié and Dr. F. Koerber and published by Gustav Fischer, Jena.

MR. F. HOWARD COLLINS has compiled from Admiralty sources a collection of tables showing "the magnetic direction and neap and spring rates for every hour of the tidal streams at forty-eight localities alphabetically arranged between the Nore and Scilly Isles." The latitude, longitude and characteristics of each light are stated, and under them are given particulars as to directions and rates of neap and spring tides. The tables are published by Mr. J. D. Potter at two shillings.

THE simple experiments in "Mensuration, Hydrostatics and Heat" given by Mr. G. H. Wyatt in the little book published under that title as one of Messrs. Rivingtons' Handbooks of Practical Science, should be familiar to every schoolboy. The book has now reached a third edition, and contains a course of practical work which can be done with profit by boys in the lower forms of schools. Not only do exercises of this kind develop delicacy of manipulation and minute attention to details in the pupils, but they are also of decided value in connection with other branches of school work.

THE additions to the Zoological Society's Gardens during the past week include a Chimpanzee (*Anthropopithecus troglodytes*) from the Gold Coast, presented by Captain Daniel A. Donovan; an Illiger's Macaw (*Ara maracana*) from Brazil, presented by the Countess of Malmesbury; a Common Kingfisher (*Alcedo ispida*) British, presented by Mr. J. F. Smith; a Hocheur Monkey (*Cercopithecus nictitans*) from West Africa, deposited; three White-throated Capuchins (*Cebus hypoleucus*) from Central America, a Humboldt's Lagothrix (*Lagothrix humboldti*) from the Upper Amazons, purchased; a Burrhel Wild Sheep (*Ovis burrhel*), a Japanese Deer (*Cervus sika*) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JUNE:—

June 2. 15h. 1m. to 15h. 54m. Moon occults 54 Ceti (mag. 5·8).
2. 19h. 0m. Venus in conjunction with moon. Venus 2° 44′ S.
5. 11h. 58m. to 15h. 40m. Transit of Jupiter's Sat. III.
9. Saturn. Outer minor axis of outer ring = 15″·41.
10. 16h. 0m. Uranus in opposition to the sun.
12. 15h. 37m. to 19h. 20m. Transit of Jupiter's Sat. III.
14. 23h. 36m. Moon in conjunction with α Virginis (mag. 1·2).
15. 10h. 15m. to 11h. 31m. Moon occults 86 Virginis (mag. 6·0).
15. Venus. Illuminated portion of disc = 0·711. Mars = 0·989.
18. 9h. 37m. to 10h. 59m. Moon occults ν Scorpii (mag. 4·5).
22. 23h. Saturn in conjunction with moon. Saturn 5° 11′ S.
June 24. Vesta situated 21′ south of Saturn.
24. 17h. Jupiter in conjunction with moon. Jupiter 5° 54′ S.
26. 12h. 25m. Minimum of Algol (β Persei).
29. 9h. 14m. Minimum of Algol (β Persei).

NEW ALGOL VARIABLE.—*Circular* No. 65 from the Harvard College Observatory announces the detection of a new variable on the photographs obtained there. An examination of a plate taken on April 3, 1902, for the possible presence of comet *a* 1902 showed that as compared with a plate of the same region obtained on March 7, 1900, the star + 43°·4101 was abnormally bright. This star is a double, and it is the north preceding component which shows the variability. The position is

R.A. = 21h. 55m.·2
Decl. = + 43° 52′ } (1900).

More detailed examination showed that the star was generally bright and constant in light, so that it must be of the Algol type. It is not very distant from the remarkable variable SS Cygni, which precedes it 16m. and is 44′ south.

The variable is shown at full brightness (about 8·9 magnitude) on 388 plates taken between 1889 and 1902, and on 19 it is shown as fainter than 9·3 mag. The period appears to be about 31·304 days. On plotting the light curve from the data obtained it appears that the star retains its full brightness for 28 days. About one day before the minimum it commences to diminish, attaining the magnitude 11·5 at od. ·43 before minimum. The light then remains constant for more than half a day, with the minimum magnitude 11·6. The time of increase is more uncertain, but apparently is nearly the same as that of decrease. The times of the last minimum, with predicted future ones, are as below:—

		Minima. h.	m.	
1902	April 28	21	33	G.M.T.
	May 30	4	51	
	June 30	12	8	
	July 31	19	26	
	Sept. 1	2	44	
	Oct. 2	10	2	

COAST FOG SIGNALS.

WHEN lighthouse lights and all other seamarks are obscured by fog, sound is the only medium by which warning signals can be conveyed to mariners. It has been thought that it might be possible to transmit such signals by means of etheric vibrations; but assuming such intercommunication were established, it would fail in two most essential requirements for assisting the mariner in foggy weather, as it would not give him any information as to the direction from which the warning message came, nor would it tell him how far distant the signalling station was. Further developments may in the course of time remedy these defects, but from present-day knowledge and experience it cannot be said that etheric vibrations are available for fog-signal purposes at sea. In a paper recently read before the Society of Arts, Mr. E. Price Edwards discusses the present position of this question of sound signals and gives some interesting particulars of the trials carried out at St. Catherine's Point, in the Isle of Wight, last summer. From this it appears that for many years past sound-producing instruments of various kinds have been employed for uttering warning sounds at points of danger on our coasts, and that constant efforts have been made to develop instruments yielding sounds of great loudness and penetrating power, so as to overcome the numerous obstructive influences affecting the propagation of sound through the atmosphere. The instrument which has proved most effectual for this purpose is the siren, sounded by means of air forced through it at a pressure of about 40 lb. on the square inch. It is used in the form of a double cylinder, one cylinder fixed, the other (inside it) rotating, each cylinder having longitudinal slits corresponding in number and area, through which, as often as they coincide, the air passes. In the trials at St. Catherine's, two flat circular discs with radial slits were tried, with very satisfactory results; but this arrangement involves a separate motor to rotate the movable disc, whereas the rotation of the cylinder siren is effected by the air pressure which produces the sound. It is considered that some loss of power and a more or less defective blast result from the

self-driving arrangement, and that the use of a separate motor will remedy these defects. The trials referred to were made with various forms and sizes of siren and several instruments sounded on the reed principle, the result being that the reed instruments proved greatly inferior to the siren instruments in loudness and penetrating power. It is contended by some that the reed principle as applied for the production of loud sounds has never yet been done justice to, and that with proper development a reed instrument could be made to yield sounds as powerful and penetrating as those of the siren; but, as Mr. Price Edwards points out, the reed instruments tried, and which were supposed to be the most effective types of that form of sound producer in existence, were not able to approach the sirens as regards efficiency for coast fog-signal purposes. If a reed instrument could be brought up to an equality with a siren in respect of sound power, it would probably be more economical than a siren in working. The question of trumpets received some special consideration at St. Catherine's, a new form of trumpet designed by Lord Rayleigh having been experimentally tried there. Lord Rayleigh had observed that with the conical trumpets of circular section usually employed there was a liability to some interference of the sound waves issuing from the mouth, caused by the difference in distance of the nearest and furthest parts of the mouth, whereby the waves were likely to get out of step and thus cause interference. He also pointed out that a good deal of sound was sent to the zenith from the mouth of circular section, which sound was certainly wasted. To remedy these defects, Lord Rayleigh's idea is to make the horizontal diameter at the mouth only half the length of the sound wave generated by the sounding instrument, and that the vertical diameter should be elongated to two wave-lengths or more, thus producing a mouth of elliptical section. The tendency for the waves issuing from the mouth to get out of step would thus be reduced to a minimum, and the narrowness of the mouth at top and bottom would offer but little scope for the sound to be projected upward or immediately downward. So far as the trials went, Mr. Price Edwards tells us that the effects produced were most encouraging, and it is now intended to set up this elliptical trumpet for practical trial at a fog-signal station. The mushroom form of trumpet for an all-round signal has been largely used for lightships. Instead of a long horizontal trumpet, or a vertical one with the head bent over (capable of being turned in any direction), the trumpet is fixed vertically with its mouth directed upward. Just above and in the centre of this open mouth is fixed an inverted cone, and the sound issuing from the trumpet strikes the curved sides of the cone and is reflected out with equal force all round the horizon. The trials made with this form of trumpet showed that it was well adapted for the purpose for which it had been designed.

But however powerful and characteristic the sound-producing instruments may be, the conditions of the atmosphere have very much to do with their effectiveness. An opposing wind, as is well known, shortens the range of penetration of the most powerful sound. An instance is given by Mr. Price Edwards when the sound of a siren was on one day heard for a distance of more than twenty miles, while on another day, with a little opposing wind and a noisy sea, the sound of the same instrument was not heard beyond a distance of one mile and a quarter. Fortunately, when sound signals are most needed, viz. in foggy weather, obstructive influences seldom occur; the air is generally still, the sea quiet, and a homogeneous condition as regards temperature and moisture exists, all of which conditions are favourable for the propagation of sound. It does not seem at all probable that the acoustic clouds of Prof. Tyndall are formed when fog prevails; indeed, they appear to want hot sun, causing evaporation from the sea surface, which produces areas of varying temperature and density. Two remarkable phenomena have been experienced in connection with the experiments at St. Catherine's for which no satisfactory explanation is yet forthcoming. In the one case it was found that at times there was a sort of hiatus in the passage of the sounds. Thus the observers on board the Trinity yacht *Irene* would be in full hearing of the sounds at a mile distance from the instruments. On proceeding out, the sounds would very soon fall away in strength until at a distance of between two and three miles they would be very faintly heard or lost altogether. Proceeding further out on the same line of bearing, the sounds would be gradually recovered, until a little beyond three miles they would again come into full hearing and be carried as loud and distinct sounds for a considerable distance. The question is, what becomes of the lost sound, and what is the influence which renders the area in question "a silent area"? The phenomenon apparently does not occur frequently, for very many times the observers went over the same space without experiencing any such hiatus of sound. Mr. Price Edwards suggests that to solve the question prolonged and continuous observation would be necessary in all parts of the sea area over which the sounds are projected—at the sea surface, on the deck of a vessel, and at varying distances upward by means of a captive balloon. It is of importance to determine, if possible, the cause of this intermission of audibility, in order that it may be prevented or guarded against when the sounds are being promulgated as official warnings to mariners.

The other noteworthy phenomenon which occurred at St. Catherine's and on previous occasions when sound signals have been tested by observation at sea were the aërial echoes. With a smooth sea and still atmosphere, the direct sounds from the sirens were immediately reinforced by powerful echoes from the sea. Mr. Price Edwards describes them as starting from a point on the horizon corresponding to the prolongation of the axis of the trumpet from which the sound proceeded, and with great rapidity spreading out over the sea expanse as though a scattered army of trumpeters in quick succession sounded their blasts from all parts of the horizon. Carefully timed, the echoes lasted at times for 30 seconds, or ten times as long as the original blast. Prof. Tyndall suggested that "the duration of the echo is a measure of the atmospheric depth from which it comes." If this be so, the length and strength of the echoes might afford a general indication of the relative penetrating power of the sounds of different instruments. With a disturbed atmosphere and an agitated sea surface, the echoes were very short or not heard at all. It is noteworthy that both the silent area and the aërial echoes occur chiefly in quiet weather, and that disturbance of air or sea appears to be antagonistic to their manifestation.

An important conclusion appears to have been arrived at in regard to the most suitable note pitch for the blasts of sirens or reed horns. In fog—as has been stated—the meteorological conditions are usually equable, and when such is the case a low-pitched note is found to be more effective than a high-pitched one; on the other hand, when air or sea is disturbed, the higher pitched notes seem to be rather less obstructed by the opposing influences, although the advantage is not very great. Having regard to the fact that the sounds are only required for use in foggy weather, a low-pitched note of about 98 vibrations per second (which is that which was heard plainly more than twenty miles away) is perhaps the best for the blasts of a siren fog signal. In this connection it should be mentioned that in order to obtain the best effect from an instrument it is essential that the note given by the sound producer should, if possible, be in unison with the proper note of the associated trumpet, otherwise the issuing sound is apt to be gruff and discordant.

SEA TEMPERATURE AND SHORE CLIMATE.

IN Mr. W. N. Shaw's paper "On the Seasonal Variation of Atmospheric Temperature in the British Isles" (*Proc.* Roy. Soc., vol. lxix., pp. 61–85), it is stated that it seems "probable that the ocean plays a paramount part in the causation of the second-order temperature effect which we experience in these islands. . . . Whether this variation of the temperature of the water which surrounds these islands is the cause of the atmospheric second-order variation, or whether it is only another effect of the same fundamental cause, does not appear, but in view of the fact that the marked second-order effect is not seen at Continental stations, it would seem not unlikely that the ocean temperature is the immediate cause of our second-order periodic temperature variation. . . . All the successive stages of temperature change are delayed by the effect of the sea. . . . The effect of the sea is to delay the seasons." Of course, it is a very old belief that the vicinity of the sea affects the temperature of a climate, moderating the heat of summer and the cold of winter, but the ideas on the subject have been of the usual vague popular character. What is curious is that it has taken so long to initiate some investigation designed to discover what may be the nature of the relationship between the temperature of the sea and that of the air over the adjacent land. Although the North Atlantic is the most frequented of the great oceans,

very little has thus far been accomplished in discussing its variations of temperature month by month throughout the year; indeed, the region between the 50th and 60th parallels, from our islands across to Labrador, has been almost wholly neglected. Some years ago, the Meteorological Office published mean results for four months; the Deutsche Seewarte has made a separate discussion of each of a number of 10°-squares; and the Copenhagen Institute annually supplies information for the far north, mainly on the routes from Denmark to Iceland and Greenland. These are the principal contributions to our knowledge of Atlantic sea temperature.

The Meteorological Council has now made a new departure in this matter. In connection with the publication of the monthly pilot chart of the North Atlantic and Mediterranean, the cooperation of the captains and officers of the Mercantile Marine has been enlisted to promptly supply daily records of sea temperature during their voyages. A gratifying response resulted in the return of more than 2500 ocean temperatures for the month of January last, and 2750 for February. This mass of valuable information has been grouped in spaces of 2° of latitude by 2° of longitude and means obtained. The results between 30° and 60° N. form the new feature of the pilot charts. Those for January appear on the April chart, and those for February on the May chart. In addition to the means, the variations from the averages of a long series of years are also shown, and lines are drawn separating the regions of excess and of defect. Generally speaking, in January the water was a degree or two colder than usual from Ireland down the face of the Bay to Portugal and thence westward across the Atlantic, while further north, from about the 20th meridian westward, the values were nearly all in excess. In February nearly the whole area was colder than during the preceding month, but compared with the February normals the region of excess was much more extensive than in January. The relatively cold water south-westward from the British Isles had, however, expanded westward to about 30° W. Close inshore the fall of temperature was very marked—off Eastbourne, for instance, it was 44° in January, an excess of 3°, while in February it was only 37°, a defect of 3°. Here we have the commencement of an investigation which, if continued, and improved as may be found necessary, should be fruitful of the most useful results. At present, with only the bare ocean results presented to us, it is not easy to explain what effect should be produced ashore. We know that the air temperature over the British Isles during last January was above the average to the extent of about 2°, while February was nearly 4° too cold, the coldest month for seven years. What part did the temperature of the ocean play in influencing the mildness of the one or the coldness of the other month?

With only these first charts before us, it is obviously impossible to form a just conception of the very complicated problem which requires solution. We must wait for a consecutive series of such charts and examine closely the variations disclosed month by month at sea and on land. It may be that the effect produced on our air temperature by the changes in that of the sea to the westward and south-westward is an indirect and not a direct result. The prevalence of winds from particular quarters for any length of time, and the cold or warm ocean surface currents which they set up, the movements of weather systems, &c., must be borne in mind. From the monthly pilot charts it is clear that at times the Gulf Stream fails to reach our shores owing to the existence of a stronger opposing flow. It has been advanced by Dr. Emil Lesshaft, in his paper "Der Einfluss der Wärmeschwankungen des Norwegischen Meeres auf die Luftcirkulation in Europa" (*Meteorologische Zeitschrift*, Band xvi.), that the paths followed by atmospheric disturbances are associated with the temperature of the sea water, and if that should prove to be the case we must consider first of all the temperature of the Atlantic and the march of weather systems, and then the effect the latter produce on our climate. The permanent Atlantic anticyclone maintains its position over a part of the ocean where there is only a slight variation of sea temperature, but its outer limits expand or contract enormously, at times stretching northward as far as Iceland and Greenland, especially in the month of May, when a broad belt of Arctic water flows southward beyond our western coasts. With our present knowledge we can only conjecture as to the causes of these variations, but the information about the sea temperature now becoming available may, perhaps, help us to arrive at a better idea of the forces at work. As the observations become more numerous, would it be possible to issue weekly results of sea temperature?

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ON Thursday next, June 5, the Sir John Cass Technical Institute, Aldgate, will be formally opened by the Right Hon. Lord Avebury, F.R.S.

WITH the object of creating interest in science teaching and nature-study in Southampton and the district, a conference will be held at the Hartley College, on June 14, together with an exhibition of home-made and other simple scientific apparatus. It is felt that much useful work is being done, the character of which is not generally known, and that teachers should be afforded an opportunity of comparing methods and becoming acquainted with that which the experience of others has proved to be of value. A preliminary meeting was held on May 10, when Dr. H. E. Armstrong, F.R.S., gave an address on the chief points to be borne in mind in early lessons in science. As he has often remarked before, science must not be taught so much on account of its matter as for training in scientific methods of work and reasoning. What is desired is that habits which characterise the true worker in science should become general habits, with the object of developing the practice of the best mental faculties.

THERE are many signs that the movement for reform in the teaching of mathematics will have a decided influence upon the scope and character of elementary geometry in schools. Several public examining bodies have lately had the subject under consideration, and changes in the direction of reform are likely to be instituted. The regulations just issued for the Oxford Local Examinations next year contain an announcement referring to the examinations in geometry which will have a very decided effect upon the scope and method of the subject in secondary schools. The notice reads as follows:—"Questions will be set so as to bring out as far as possible a knowledge of the principles of geometry, a smaller proportion than heretofore consisting of propositions as enunciated in Euclid. Any solution which shows an accurate method of geometrical reasoning will be accepted. No question will be set involving necessarily the use of angles greater than two right-angles. Geometrical proofs of the theorems in Book ii. will not be insisted upon." It is evident from this announcement, and the deliberations of other examining bodies and teachers, that Prof. Perry selected the right "psychological moment" for directing attention to the irrational ways of approaching geometry in schools and the need for recognition of work better adapted to modern needs. As both examiners and teachers are in general sympathy with his desire to get rid of artificiality in mathematics, we may expect that the time will come when geometry will not be commenced, as it is in many schools to-day, by learning Euclid's definitions, postulates and axioms and reading propositions, but by the intelligent use of compasses, protractor and scale.

IN introducing the Education Vote in the House of Commons on Monday, Sir John Gorst directed attention to some of the changes and developments which have taken place in the administration of the Board of Education. Schools of science and other secondary day schools inspected by the Board are to have block grants instead of payments by results of examination, the grants being assessed every three years. By this system, it is hoped that all inducement to cram will be removed. Both in the administration of the Parliamentary grant and in the inspection of schools the Board of Education will aim at encouraging originality and variety. The hope was expressed that the time would be far distant when those who had to administer the public funds of this country and to carry out the provisions of the Act with regard to secondary schools forgot the enormous danger of interfering to produce uniformity of system, and that they would give every encouragement to variety and independence. Referring to the Royal College of Science—one of the two Government colleges in London which are entirely under the management of the Board of Education, the other being the Royal College of Art—Sir John Gorst said:—"The vote for this school, which is a very advanced science school, has been increased in the present year by 1000*l.* for the purpose of enabling work to be continued—begun by Sir Norman Lockyer—respecting the relation of certain precedent phenomena in the sun observed through the spectroscope to the subsequent rainfall in India and Australia. No certain law has yet been established, but if the research is successful it will have enormous beneficial economic effects, both for India and Australia."

Other subjects referred to were the educational work of the Victoria and Albert Museum, the new advisory spirit in which the inspection of schools is to be carried on, and the provision by local authorities of a better system of training teachers than at present exists.

Two pamphlets referring to the purpose and programme of the Faculty of Commerce of the University of Birmingham have been received. The Faculty will begin its work in October next and there will be matriculation examinations on June 2 and September 15. In the course of his prospectus, Prof. Ashley remarks that the object of the work to be carried on by this department of the University is the education, not of the rank and file, but of the officers of the industrial and commercial army: of those who, as principals, directors, managers, secretaries, heads of departments, &c., will ultimately guide the business activity of the country. The Faculty represents the first serious attempt to provide training of this kind, though every year shows the need of it. Prof. Ashley points out that the marked acceleration of the speed of industrial and commercial change, the application of science to machinery involving more frequent changes in manufacturing processes, and the extension of means of communication, call more and more for mental flexibility, alertness and adaptability on the part of traders. But such qualities are certainly not likely to be stimulated by early absorption in the subordinate routine of a particular occupation. There is, however, some chance of promoting them by courses of instruction which shall accustom the future trader to survey a wide range of industrial undertakings, to watch the development of the world's great markets, and to estimate the resources and capabilities of other nations. The curriculum which has been drawn up for the three years' course leading to the degree of Bachelor of Commerce in the University of Birmingham comprises studies which fall mostly into four main categories:—(1) languages and history; (2) accounting; (3) applied science and business technique; (4) commerce. The purpose of the scientific subjects included in the course is not to make men scientific experts. Its aim is (*a*) to make their business more interesting to them; (*b*) to enable them to follow the general movement of technological progress, and to realise the directions in which changes of process are probable or possible; (*c*) to show them when they ought to call in an expert, and how much weight they should attach to his opinion.

SCIENTIFIC SERIALS.

Journal of Botany, May.—Mr. Rudolf Beer describes a rare and remarkable conidia-bearing fungus, *Coemansiella Alabastrina*, which has only been recorded twice before. The conidiophore begins like Eruotium, but the sterigmata are few in number and grow out forming a circlet of arms; from each of these a series of conidia is cut off on the upper side. The conidia are fusiform and pointed at both ends. Chlamydospores and other conidial bodies were obtained in the culture, but no traces of perithecia were observed.—Mr. Pugsley has devoted considerable attention to the British "capreolate" Fumitories and submits the following classification:—Subsection 1. *Eucapreolatae*. Bracts as long as pedicel; pedicel recurved; fruit pendulous, narrow at the base. (1) *F. capreolata*; L. (=*F. pallidiflora*, Jord.). (2) *F. purpurea*, Pugsley, which refers to certain English plants named as *F. Boraei*, Jord., but differing from Jordan's original discription. Subsection 2. *Murales*. Bracts shorter; pedicels erect; fruit without a neck. (3) *F. muralis*, Sond. (includes *F. Boraei*, Jord.). (4) *F. confusa*, Jord.—Dr. Rendle describes three new species of Convolvulus from South Africa, a Convolvulus, and two Ipomœas which we regret to find are named after the collectors instead of receiving distinctive names.—Mr. G. C. Druce gives a list of Anglesey and Carnarvonshire plants and Mr. J. Hunter records North Donegal mosses.

Bulletin of the American Mathematical Society, vol. viii. (2) No. 7, April.—S. E. Slocum, on the transformation of a group into its canonical form. A discussion of the Lie group defined by $X_1=\delta/\delta x_2$, $X_2=x_2\delta/\delta x_2+\delta/\delta x_1$.—O. Dunkel, some applications of Green's theorem in one dimension. The theorem thus designated is an integral relation deduced from a linear differential equation and its adjoint. Some applications follow.—V. Snyder, on the forms of quintic scrolls.—E. V. Huntingdon, simplified definition of a group. This interesting paper defines a group as an assemblage of elements satisfying the three postulates: (1) Given any two elements a, b, there is an element x such that $ax=b$; (2) there is an element y such that $ya=b$; (3) if a, b, c, ab, bc, and either $(ab)c$ or $a(bc)$ are elements of the assemblage, then $(ab)c=a(bc)$. A finite group requires the additional postulate that the assemblage shall contain only n elements.—L. P. Eisenhart, on isotropic congruences.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, May 23.—Prof. S. P. Thompson, president, in the chair.—Mr. T. C. Porter showed a lecture experiment on the ebullition of rotating water. If the water in a beaker, having approximately vertical sides, be caused to rotate about an axis concentric with the vertical geometrical axis of the beaker, it is obvious that in any horizontal section of the water the pressure is least in the centre and increases from the centre outwards. If the temperature of the water is just below boiling point and heat is supplied to it whilst it is rotating steam is formed only in the region of least pressure, and a gaseous core is produced. The rotation can be given to the water by stirring it with a glass rod covered with a piece of india-rubber tubing, and maintaining the stirring motion during the act of withdrawal of the rod. Some curious phenomena are shown by the column of steam, if the water is first stirred and then left to come to rest whilst the heating is continued. At first there is a markedly concave surface to the water in the beaker, and the column of steam is practically continuous from base to summit. After this stage pulsations set in. Pulsations can also be produced by stirring cold water in a beaker-shaped jar, having a small hole in its bottom through which a stream of air-bubbles can be blown. The forms of the steam columns in some cases present a likeness to those of solar prominences, and Mr. Porter suggested that the immediate cause of the latter might be the diminution of pressure on the sun's surface at, or near, the centre or centres of depressions caused by violent cyclonic disturbances in the solar atmosphere.—Mr. C. V. Boys exhibited a small heat engine in which rotating water evolved steam without ebullition.—A paper by Mr. J. A. Erskine on the conservation of entropy was read by the secretary. Heat energy may be expressed as the product of two factors—a quantity factor, entropy, and an intensity factor, temperature. The conservation of entropy holds in thermodynamics when dealing with reversible processes, and is analogous to the conservation of other quantity factors such as momentum, moment of momentum, and electric quantity. The author shows the completeness of the analogies by considering Carnot cycles carried out on electrostatic and hydraulic engines. Prof. Wiedeburg has proposed to extend the doctrine of the conservation of entropy to irreversible processes by introducing a new quantity analogous to electric resistance.—A paper by Sig. G. Giorgi on rational units of electromagnetism was read by Mr. Price. Mr. Price prefaced the reading of the paper by saying that both Prof. Fleming and Prof. Fessenden had advocated a partial change of units which would leave the most important ones unchanged, and the method employed by the author was similar to that adopted by Prof. Fessenden. The author starts with a set of three equations, which contain explicitly the four concrete units of E.M.F., M.M.F., electric current and magnetic current, together with that of activity, and considers them as fundamental in electromagnetism. Two fundamental units are required to express these quantities, and their product must reproduce the mechanical unit of activity. If the watt is assumed as unit of activity, there are two units ready made, the volt and the ampere, which satisfy the condition and may be considered fundamental. All concrete units in electricity and magnetism can be expressed in terms of these and the second as unit of time. In order to complete the system, a unit of length is required. The metre and kilogramme are consistent with the watt, and putting them together with the units enumerated in the paper, the author has built up an absolute metre-kilogramme-second system which comprises electric, magnetic and mechanical measures in a consistent frame.

Chemical Society, May 15.—Dr. W. H. Perkin, F.R.S., vice-president, in the chair.—The variation with temperature of the surface-tensions and densities of liquid oxygen, nitrogen, argon and carbon monoxide, by Messrs. E. C. C. Baly and

F. G. Donnan. The measurements were made by a modification of Ramsay and Shield's method between 70° and 90° absolute, and the results were found to be in accordance with the view that these liquids consist of non-associated molecules. The critical temperatures deduced from these observations are in agreement with those directly determined for oxygen and nitrogen, but not with the values assigned to argon and carbon monoxide for this constant.—Comparison of bromonitrocamphane with bromonitrocamphor, by Dr. M. O. Forster. The action of various reagents on bromonitrocamphor has been examined in the hope of isolating derivatives of the latter substance analogous to those obtained from bromonitrocamphane, but in most cases the reactions proceed either further or in a different sense.—αα-Benzoylnitrocamphor and αα-benzoyliodocamphor, by Dr. M. O. Forster and Mr. E. A. Jenkinson. A description of these substances and several of their derivatives is given illustrating the peculiar αα′-isomerism of substituted camphors.—2 : 4-Dibromo-5-nitro- and 2 : 4-dibromo-3 : 5-dinitrotoluenes and their behaviour on reduction, by Mr. W. A. Davis. These substances are produced by the direct nitration of 2 : 4-dibromotoluene, and on reduction furnish respectively 4 : 6-dibromo*meta*-toluidine and *sym.*tolylene diamine.—The purification of hydrochloric acid from arsenic, by Dr. Thorne and Mr. E. H. Jeffers. The purification of hydrochloric acid to be used in testing for arsenic may be accomplished by digesting in it pieces of bright copper gauze, so long as these become stained by the deposition of arsenic on their surface.—The radioactivity of thorium compounds, and the cause and nature of radioactivity, by Prof. Rutherford and Mr. Soddy. Thorium, from which the radioactive substance Th.X has been separated, regains its activity after a time, while that of Th.X. slowly disappears. This production and disappearance of activity is not affected by any known agents, and proceeds independently of the physical and chemical conditions of the molecule; the authors believe that the source of this energy is to be found in a chemical change producing new types of matter.—The radioactivity of uranium, by Mr. F. Soddy. Prof. Rutherford has already shown that uranium exhibits a dual radiation, one, α, having little action on a photographic plate and a second, β, almost inactive to the electrometer under ordinary conditions. The author now finds that the substance Ur.X isolated from uranium possesses only the β-radiation, the α-effect being retained by the parent substance.

Royal Meteorological Society, May 21.—Mr. W. H. Dines, president, in the chair.—Captain D. Wilson-Barker read a report prepared by Mr. Dines and himself on the wind force experiments which had been made on H.M.S. *Worcester* off Greenhithe and at Stoneness Lighthouse, 817 yards from the ship on the north bank of the river. These experiments were in continuation of those on the exposure of anemometers at different elevations which were carried out on the *Worcester* a few years ago. All the observations were made with the pressure-tube anemometer. The broad general result is that the lighthouse experiences steadier and stronger winds than the *Worcester*, the velocity being about 6 per cent. greater, notwithstanding the fact that the elevation is less than half, but that in both positions the extreme velocities reached in the gusts are about equal.—Dr. H. R. Mill read a paper on the Cornish dust fall of January, 1902. When the west of England newspapers of January 24 announced falls of "pink snow" and "muddy rain" in several parts of Cornwall and South Wales, it seemed to the author possible that fresh light might be thrown on what is at present the chief object of progressive meteorology, viz. the movements of the upper air. He therefore took steps to collect as much information as possible from the whole of the district, and found that the phenomenon was reported from seventy-five different places in the south-west of England and Wales. These were all south of a line joining Milford Haven and Chepstow, and west of the meridian of Bath. By means of a map, Dr. Mill showed that four separate areas were visited by the dust between January 21 and 23, viz. (1) Cornwall, 1400 square miles; (2) North Devon, 150 square miles; (3) Milford Haven, 50 square miles; and (4) Bristol Channel, 600 square miles. The dust appears to have been confined mostly to low rather than high ground, for none was reported to have fallen on the Mendip Hills, Dartmoor, Exmoor and the Welsh mountains. The observations show that January 22 was undoubtedly the day when most falls occurred and that the colour of the dust was yellowish or brownish. From a consideration of the meteorological conditions at the time and for several days before, the author is inclined to believe that the evidence points to the dust having been transported in the upper air from the African deserts.

EDINBURGH.

Royal Society, May 5.—Prof. Geikie in the chair.—A paper was communicated by Prof. Beattie on the leakage of electricity from charged bodies at moderate temperatures (part iii.). The paper described a great variety of experiments in which such substances as common salt, lithium chloride and potassium bichromate, when laid on zinc and sprinkled with iodine or bromine, and then raised to a temperature between 300° and 350° C., caused electrification of the surrounding atmosphere of air, coal gas, oxygen or carbonic acid gas. Hydrogen was not electrified under similar conditions. The effects differed from those produced in other ways. Thus, in addition to the well-known electrifying properties of flames and their fumes, there seem to be three distinct methods of obtaining an electrified gas by heating: (1) by oxidation or deoxidation as in the atmosphere drawn from the neighbourhood of oxidising or deoxidising metals (Schuster), (2) by driving off a gas which carries a charge with it as in the case of the gas obtained by heating potassium permanganate (Townsend), (3) by the methods described in the present paper.—Prof. MacGregor communicated a paper by the late Prof. C. Piazzi Smyth, Does the spectrum place of the sodium lines vary in different azimuths? The paper bore the date May 25, 1882, and the investigation had been suggested by Prof. Tait, among whose papers the manuscript had been found. The apparatus used consisted of a Rutherford grating with 17,296 lines to the inch, the necessary collimator and telescope, and an end-on vacuum tube containing sodium vapour. The whole was set up on a rotating table, and measurements of the positions of the D lines were made in various azimuths. The results were negative. An idea of the sensitiveness attained may be gained from the statements that the two principal D lines were separated by 266 micrometer divisions, and that the probable error of observation was two of these divisions.

PARIS.

Academy of Sciences, May 20.—M. Bouquet de la Grye in the chair.—On the optical arrangements necessary for remedying the visual troubles in cases of keratoconia, by M. J. Janssen. A description of a lens system by means of which the effect of this disease can be almost entirely compensated.—On the composition of the ashes projected from Mont Pelée on May 3, 1902, by M. Michel Levy. Andesine and hypersthene were recognised as the chief constituents of the volcanic ash.—On the spermatogenesis of the diptera of the genus Sciara, by M. Alfred Giard. The emission of the spermatic elements in Sciara is accompanied by phenomena nearly as complicated as in the Cephalopods. There is no production of a capsule forming a true spermatophore.—The addition of hydrogen to ethylenic hydrocarbons by the method of contact, by MM. Paul Sabatier and J. B. Senderens. The catalytic action of reduced nickel and copper in causing the addition of hydrogen to unsaturated hydrocarbons has been extended to propylene, trimethylethylene, hexene and octene. Propylene mixed with hydrogen in excess is readily transformed by reduced nickel at 160° C. into propane; copper behaves similarly, but the reaction is slower. Trimethylethylene is similarly converted into pure methylbutane in the presence of nickel, but copper is without action in this case. It has been found that copper and nickel are equally capable of effecting the addition of hydrogen in the case of ethylene derivatives containing the grouping $=CH_2$, but that compounds of the type $R.C=CR'$ do not add on hydrogen under the action of copper. Application is made of this to the case of limonene, with the result that the formula ordinarily attributed to it, representing it as containing a $=CH_2$ group, is confirmed.—On the arithmetical properties of entire and quasi-entire functions, by M. Edmond Maillet.—On the repulsive force and electrical actions emanating from the sun, by M. H. Deslandres. A criticism of the views of S. Arrhenius, with some remarks on the nature of nebulæ.—On the constitution of matter and spectroscopy, by M. B. Eginitis. The author regards the elimination of air lines in Schuster and Hemsalech's work on spark spectra as being chiefly due to the metallic vapours produced.—The action of light on precious stones, by M. Chaumet. A connection is shown to exist between the

fluorescence of a diamond under violet light and its lustre under ordinary artificial light. In the case of a yellow diamond, after a short exposure to violet light, the colour changed from yellow to a dark brown; after twenty-four hours, however, the diamond recovered its original colour and lustre.—The volumetric estimation of iodides in the presence of chlorides and bromides, by M. V. Thomas. In dilute solution, in the presence of an excess of a thallic salt such as the chloride, the whole of the iodine in the iodide is set free. Test analyses are given showing the accuracy and range of the method.—On the action of sulphites on the nitroprussiates, by M. Juan Fages.—On a method of gradual synthesis of aldehydes, by MM. L. Bouveault and A. Wahl. Nitroisobutylene, reduced by aluminium amalgam or by zinc dust and acetic acid, is converted into isobutyric aldoxim. Nitrostyrolene, $C_6H_5—CH=CH—NO_2$, was found to undergo a similar change on reduction by either of the above-mentioned reagents, giving phenylacetaldoxime.—The sexual elements and fertilisation in Pterocephalus, by MM. Louis Léger and Octave Duboscq.—On the destruction of certain noxious insects in agriculture and especially the wire worm in the plum-tree, by M. J. Laborde. The composition and mode of application of an insecticide is given which has been proved by experiment to be efficacious in combating the parasite.—*Sarcocystis tenella*, a parasite of man, by M. Paul Vuillemin.—On *Kinkeliba* and its botanical origin, by MM. E. Perrot and G. Lefèvre. Kinkeliba is an arborescent plant the leaves of which are employed by the natives all over western Africa as a medicine, and which merits a complete therapeutical study. It is identified as *C. micranthum*.—On the tectonic relations between Greece and western Crete, by M. L. Cayeux.—A point of the geology of the neighbourhood of Bayonne, by M. R. Chudeau.—On a principle of rational classification of gorges cut by water courses, by M. Jean Brunhes.—The microbiological study of the steeping of flax, by M. L. Hauman. The aërobic rotting of flax has been accomplished with pure cultures of various organisms, including *Penicillium glaucum*, *Aspergillus niger*, *Botrytis cinerea*, *Bacillus coli communis* and others. The process appears to consist essentially in the fermentation of pectic bodies, considerable quantities of which are present in the original flax, but of which traces only can be found after fermentation. The rotting of flax is thus a purely biological process which is accomplished by means of the bacteria and moulds of the soil. The disintegration is due to the disappearance of the tubes of the young tissues filled with pectic substances which separate the fibro-vascular bundles.—The influence of lecithin on the development of the skeleton and of nervous tissue, by MM. A. Desgrez and Aly Zaky. It is shown that the increase in weight of animals receiving lecithin is not due to an abatement of nutrition, but is due to the phosphoric acid retained by the organism, under the influence of the lecithin, being normally utilised for the development of the osseous and nerve-cells.—The vaccination against pasteurelloses, by MM. Joseph and Marcel Lignières. The name pasteurelloses is applied to a group of diseases of the same type, including typhoid fever and pneumonia of the horse, chicken cholera and hæmorrhagic septicæmia of the sheep, ox and pig. It has been proved by experiment that it is possible to prevent these diseases by a process of vaccination.—The etiology of the canker and gum in fruit trees, by M. F. P. Brzezinski.

DIARY OF SOCIETIES.

THURSDAY, MAY 29.

ROYAL SOCIETY, at 4.30.—The Minute Structure of Metals and other Plastic Solids: G. Beilby.—The Influence of Varying Amounts of Carbon Dioxide in the Air on the Photosynthetic Process of Leaves and on the Mode of Growth of Plants: H. T. Brown, F.R.S., and F. Escombe.—On the Influence of an Excess of Carbon Dioxide in the Air on the Form and Internal Structure of Plants: Prof. J. B. Farmer, F.R.S., and S. E. Chandler.—On the Structure of the Gills of the Lamellibranchia: Dr. W. G. Ridewood.

SOCIETY OF ARTS, at 4.30.—Western Australia: its Progress and Resources: Hon. J. W. Venn.

INSTITUTION OF MINING ENGINEERS (Geological Society), at 11.—Working Coal under the River Hunter, the Pacific Ocean and its Tidal Waters, near Newcastle, New South Wales: A. A. Atkinson.—Lead and Zinc Deposits of the Mississippi Valley, U.S.A.: Prof. C. R. Van Hise and H. Foster Bain.—The Campbell Coal-washing Table: Clarence R. Claghorn.—The Mining, Concentration and Analysis of Corundum in Ontario: Dr. W. L. Goodwin.—Re-opening of Hartley Colliery: R. E. Ornsby.—Deposits of Hydroborate of Lime: its Exploration and Refination: Carlos A. Lynes Hoskold.—Remarks on Mr. M. Walton Brown's "Report on Mechanical Ventilators": Prof. A. Rateau.

FRIDAY, MAY 30.

ROYAL INSTITUTION, at 9.—The Electronic Theory of Electricity: Prof. J. A. Fleming, F.R.S.

INSTITUTION OF MINING ENGINEERS (Geological Society), at 10.30.—The Training of Industrial Leaders: Prof. J. Wertheimer.—Smelting in British Columbia: W. Denham Verschoyle.—Treatment of Low-grade Copper-ores in Australia: J. J. Muir.—The Tarkwa Gold-field, West Africa: A. R. Sawyer.—Gold-dredging: T. Ross Burt.—Gold-dredging in Otago, New Zealand: F. W. Payne.—Electric Traction on Roads and Mineral Railways: W. R. Cooper.—The Analytical Valuation of Gas-coals: G. P. Lishman.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—A Doubtful Case of Hæmorrhagic Smallpox: S. Murphy and Dr. Klein, F.R.S.—An Outbreak of Syphilis in an Indigenous Tribe in India: Dr. L. Rogers.

MONDAY, JUNE 2.

INSTITUTE OF ACTUARIES, at 5.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—A Contribution to the Chemistry of Whiskey, I.: Dr. P. Schidrowitz.—The Estimation of Perchlorate in Saltpetre, &c.: Dr. A. Dupré, F.R.S.—On the Will Test for Nitrocellulose: Dr. R. Robertson.—On the Effect of the Alcohol Duty on Chemical Industries: Dr. O. Silberrad.

TUESDAY, JUNE 3.

ZOOLOGICAL SOCIETY, at 8.30.—The Wild Sheep of the Upper Ili and Lower Lena Valleys: R. Lydekker, F.R.S.—On Differences in Dicynodont Skulls, apparently due to Sex: Dr. R. Broom.—On the Gonad Ducts and Nephridia of Eudrilus: F. E. Beddard, F.R.S.

ROYAL INSTITUTION, at 3.—The Laws of Heredity, with special Reference to Man: Prof. Karl Pearson, F.R.S.

WEDNESDAY, JUNE 4.

ENTOMOLOGICAL SOCIETY, at 8.—The Butterflies of Chile, with an Exhibition of Specimens: Henry J. Elwes, F.R.S.—The Protective Resemblance to Flowers borne by an African Homopterous Insect: S. L. Hinde.

THURSDAY, JUNE 5.

ROYAL SOCIETY, at 4.30.

CHEMICAL SOCIETY, at 8.—The Action of Ungerminated Barley Diastase on Starch. Part I.: J. L. Baker.—The Decomposition of Chlorates. Part V. Potassium Chlorate in presence of Oxides of Manganese: W. H. Sodeau.

RÖNTGEN SOCIETY, at 8.30.—The Sources of Phosphorescence: Herbert Jackson.

LINNEAN SOCIETY, at 8.—On certain Species of Dischidia and their Double Pitchers: H. H. W. Pearson.—(1) On "Silver-leaf" Disease of Plums; (2) Observation on the Occurrence of Crystals of Calcium Oxalate in Seedlings of Alsike (*Trifolium hybridum*, Linn.): Prof. J. Percival.—On the Morphology of the Cerebral Commissures in the Vertebrata: Dr. Elliot Smith.

FRIDAY, JUNE 6.

ROYAL INSTITUTION, at 9.—The Nile Reservoir and Dams: Sir Benjamin Baker, K.C.M.G., F.R.S.

GEOLOGISTS' ASSOCIATION, at 8.—On a Peculiarity in the Course of Certain Streams in the London and Hampshire Basins: H. J. Osborne White.—Note on the Occurrence of *Microtus intermedius* in the Pleistocene Deposits of the Thames Valley: M. A. C. Hinton and G. White.

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