

FISHERY INVESTIGATIONS IN THE
NORWEGIAN FJORDS.¹

DR. NORDGAARD has collected the results of investigations made in some of the fjords of northern Norway in the winters of 1899 and 1900, during the course of researches in the fishing waters of Lofoten, carried out at the expense of the Bergen Museum and the Norwegian Government. Two "expeditions" were made. The first, January to May, 1899, included the Vest Fjord and the sea beyond Lofoten, Vesterdaalen, Sengen, and Finnmarken, besides a large number of fjords, as the Kirk, the Øgs, the Kanstad, the Sag, and many others. The second, in the winter of 1900, was made so as to obtain material from the fishing banks which would compare with that of the previous year, and it included visits to the Morsdal, Salten, Skjerstad, and Folden fjords.

The hydrographical observations, which are numerous, have been made according to recognised standard methods, and are therefore comparable with observations made further out at sea, in the regions in which the full explanation of many of the facts brought to light here is doubtless to be found. The chief hydrographical result arrived at by Dr. Nordgaard is that the northern fjords can be divided into two groups, those in which the bottom temperature is 6° C. to 7° C., and salinity about 35 *pro mille*, and those in which the bottom temperature is below 6° C., and salinity less than 35 *pro mille*. As examples of the former, the Salten, Folden, Tys, Ofot, and Vest fjords are given, and as examples of the latter the Malang, Lyngen, Kvaenang, Porsanger, Tana, Varaanger, Skjerstad, Skjomen, Kanstad, Øgs, and Kirk fjords. It is suggested that while in some cases, as the Skjerstad fjord, the inflow of ocean water is cut off by a submarine ridge, the occurrence of the two typical groups may be accounted for by the distribution of rainfall. The heavy winter rainfall in western Norway affords a large supply of fresh water to the surface layers of the fjords, which accordingly remain specifically light, notwithstanding the fall of temperature. In northern Norway the rainfall is much less, hence the surface waters retain a high salinity, and as their temperature falls they sink to considerable depths.

Dr. Nordgaard also discusses at some length the varying influence of different amounts of rainfall on the currents within the fjords. Heavy rainfalls, which raise the surface level of the water, are for the most part the result of winds from the ocean, which produce a similar effect; it is difficult to separate the effects of the two causes, but a rainfall above the average is taken as a fairly certain index of abnormal strength in the oceanic streams.

In the "biological notes" which accompany the tables a number of points are brought out showing and defining the connection between fauna and hydrography. It is shown that whereas in the first or warm-water group of fjords the deep-water fauna is chiefly boreal, in the second group, where cold water of lower salinity makes its way downwards, the predominant forms are Arctic. The effect of the increased precision of modern methods of investigation in greatly reducing the number of so-called cosmopolitan species is also emphasised.

The section of this memoir which deals with fisheries is specially important and suggestive. In discussing the Lofoten fisheries, Dr. Nordgaard adopts the view that the currents in the Norwegian Sea are controlled by the winds, and that, as already explained, abnormal movements of the currents off-shore or on-shore can be associated with rainfall above or below the average. Again, he says, "It is clear that during the movements to or from the coast of the surface water, a compensating current must be set in motion in the deep water; it has long been a recognised phenomenon in the fjords, that the surface and under currents go in contrary directions." From an examination of the observations, Dr. Nordgaard concludes that herrings move coastwards specially in the surface layers, while the cod travels along in the deeper layers.

¹ Bergen Museum. "Hydrographical and Biological Investigations in Norwegian Fjords." By O. Nordgaard. "The Protist Plankton and the Diatoms in Bottom Samples." By E. Jørgensen. Pp 254; with 21 plates and 10 figures in the text. (Bergen: John Grieg, 1905.)

It must therefore, he continues, "be supposed that as cod and herrings, to a certain extent, depend upon contrary current phases, a particularly good spring herring fishery would prevent a correspondingly good cod fishery in the same district; for a strong tendency of the upper layers towards the coast certainly takes herrings along in the current, but this at the same time causes a compensation current in the deep water, and this current hinders the cod in its passage to the spawning places."

The statistics of the yield of the cod and herring fisheries for some years are discussed and compared with corresponding values of rainfall, with results which appear to support the hypothesis brought forward. It would of course be easy to suggest difficulties, such as the extension of the current *régime* observed in fjords to areas which can hardly be regarded as such, and may therefore have a different system of movements. But as the whole question is at present under investigation on the large scale by the International Council, we content ourselves with an attempt to summarise Dr. Nordgaard's results, deferring fuller discussion of them until the more abundant data are available.

A NEW SLIDE RULE.

MESSRS. JOHN DAVIS AND SON, of Derby, the well known instrument makers, are bringing out a variation of the slide rule which is likely to increase its value for certain classes of calculation without interfering with the simplicity and convenience of the form with which we are all familiar. The lower groove on the outside of the rule, which ordinarily is only wide enough to hold the inturned edge of the cursor, is made wider, so as to take one of the tongues of a spare slide, and this slide is held in place when required by two light aluminium clips which grasp the ends of the rule and of the spare slide while leaving the usual slide free to move. An extra cursor is also provided which is long enough to grasp both the rule and the extra slide. By this means any rare or special scales upon the extra slide are for the time being equivalent to scales upon the rule, and these may be read against scales upon the other slide by means of the long cursor. If desired, the extra slide can take the place of the ordinary slide, or may be removed altogether when the rule, if provided with an ordinary cursor adapted to the altered lower groove, becomes an ordinary slide rule. In the example submitted, the extra slide carries what are called E and -E scales. The E scale is a log log scale, and is always being re-invented; it was called a P line or power line by Lieut. Thomson, who showed it at the Inventions Exhibition, and it was long before invented by Dr. Roget. This P or E line is very handy, for it at once enables the logarithm of any number on any scale, *i.e.* to any base, to be read according to its position against an ordinary A line, while fractional or high powers of numbers are read with equal facility. Compound interest, pressures and volumes of gases under isothermal or adiabatic conditions are readily evaluated with the aid of the E line read against an A line. If, however, a pair of E slides are used, one in the usual position and one attached below the rule by means of the clips, then against any value, say of v , on one, the cursor will show the value of v^{γ} on the other, γ having any desired value according to the relative position of the two slides.

The slide rules made by Messrs. Davis and Son are too well known for their accuracy and finish for it to be necessary to refer more to such points, but by some curious perversity or accident there is one little fault in the rule sent for examination which only needs to be pointed out to be put right. On the feather edge a scale of inches in 16ths is provided; on the lower face outside the rule there is no scale at all, while inside, to be used like a hat measure, there is a scale of millimetres beginning at 550. If, therefore, the rule is required for the prosaic but very useful purpose of measuring a length, this can only be measured in inches if it is 20 inches or less, or in millimetres if it lies between 550 and 1040 millimetres. If,

therefore, the bald outside edge were divided in millimetres, the whole range would be available for metric measurement, and if the lower half of the space at the back of the slide now empty were divided in inches, hat measurements from 20 to 41 inches would complete the range for the English scale.

C. V. B.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. Frederick Wilkin, of Lower Consley Wood, Wadhurst, Sussex, proposes to found a studentship in memory of his son, Mr. Anthony Wilkin, late of King's College, and for this purpose he proposes to make over to the university the tithe rent charge on Wadhurst Parish. This benefaction is for the furtherance of ethnological and archæological research, and the holder is to be termed "The Anthony Wilkin Student." It is proposed that the student shall be selected by the board of anthropological studies; the income is estimated at about 40*l.* a year, and the board suggests that this should be accumulated for periods of five years in order that a substantial sum of about 200*l.* may be available for the selected candidate. The first studentship will be offered in 1910.

Mr. W. W. Watts, of Sidney Sussex College, Mr. H. Y. Oldham, of King's College, Mr. A. R. Hinks, of Trinity College, and Mr. G. G. Chisholm have been appointed examiners for part ii. of the examination for the diploma in geography.

A combined examination of non-resident candidates for open scholarships, exhibitions, &c., will be held at Trinity College, Clare College, Trinity Hall, Peterhouse, and Sidney Sussex College, Cambridge, beginning on Tuesday, December 5. Forms of application for admission to the examination may be obtained from any of the tutors of Trinity College, the senior tutor of Clare College, the tutor of Trinity Hall, the senior tutor of Peterhouse, or the master of Sidney Sussex College, to one of whom the form of application (when filled up), together with certificates of birth and of moral character, should be sent. Entries should be made not later than November 23.

A TEACHING observatory will, it is reported by *Science*, be established by the Ontario Government at the University of Toronto. Dr. C. A. Chant expects to visit the observatories of the United States to study their plans and methods.

A CONFERENCE of scientific students was held at Colorado College, Colorado Springs, on April 28 and 29, and representatives of leading universities and colleges were present. A number of papers upon subjects relating to the scientific problems of the Rocky Mountain country were read. A similar conference, held a year ago at the same institution, was of such importance that it led to this second series of meetings.

WITH the view of making the municipal museum a centre of education in the broad principles of natural science, the Hull authorities have arranged with the curator, Mr. T. Sheppard, for the delivery by him of simple lectures to school children on geology, zoology, and anthropology. The lectures are given in the mornings by arrangement. Permission for pupils to visit the museum must be obtained from the clerk of the education committee. Each lecture lasts about half an hour, and is illustrated by objects from the cases. The remainder of the morning is occupied in examining the specimens, taking notes, and making sketches.

MR. A. C. BENSON contributes to the *National Review* an important article on an Eton education. Mr. Benson, though a classicist, is by no means satisfied with the existing state of educational matters at Eton. Describing the average boy who leaves Eton, Mr. Benson says:—"The basis of his education has been, as a rule, the classical basis; that is to say, the greater part of his working hours have been devoted to Latin and Greek. A small percentage of fair classical scholars and a still smaller sprinkling of distinguished classicists is the result. But the average boy leaves Eton with no mastery of either of these languages.

He cannot, as a rule, construe at sight an easy passage in either, or turn a piece of English into either language without a large crop of mistakes." In another place Mr. Benson states that the boy "never reaches the stage at which classics become literature." He urges that for the large class of boys who are not intended for the university, the strictly classical programme might be with advantage modified. Mr. Benson believes that a boy who left school with a thorough knowledge of French, "who knew the elements of science, so as to be able to understand something of what was going on in the world around him, in heaven and earth and sea, in field and wood," who knew arithmetic and had a reasonable knowledge of geography and history, would leave school a fairly educated man. Mr. Benson would have a very simple core of education on the lines just indicated, and then any evidence of special capacity, linguistic, mathematical, scientific, or historical, should be carefully observed, and at a certain age a boy's studies should converge more closely upon a special subject, care being taken at the same time that the general education should not be neglected.

A VALUABLE address was delivered by Prof. A. Pedler, F.R.S., Vice-chancellor of the University of Calcutta, and Director of Public Instruction with the Government of Bengal, at the recent convocation of the Senate of the university for conferring degrees. During the course of his remarks, Prof. Pedler said that fifty years ago university education in Bengal had no existence, the doors of western learning had not been opened, and the knowledge of western science was absolutely beyond the reach of anyone in the country. During the last half-century the possibilities of obtaining western knowledge and western culture, and the facilities for higher education, have been rapidly developed, until a whole network of educational institutions has been spread over Bengal. Inquiring as to whether the form of education being given to the people is affecting them in the most satisfactory way, Prof. Pedler came to the conclusion that it is not. The arrangements he said, are wanting in concentration of effort, in thoroughness of method, and in the intelligent appreciation of means to ends. After instituting a comparison between what has been accomplished in Japan and in Bengal, he came to the conclusion that the secret of the brilliant success of university education in Japan is to be found in the observance of certain cardinal principles, viz. patience in obtaining results; thoroughness in work; concentration of university work in a few really well equipped and strongly staffed colleges, each institution being devoted to one special section of learning, which is taught thoroughly; adaptation of the courses to the practical wants of life and of modern civilisation, as exemplified by the large proportion of graduates who elect the practical rather than literary courses of study; originality as shown by the large number of young men who undertake research work, and also shown by the large number of original contributions in science. In the future, Prof. Pedler remarked, it will be necessary in Bengal to adopt all these principles and to adhere to them with uncompromising tenacity, if university work is to be placed on a really satisfactory footing. The principles could also be applied with profit to a large part of the work of our own educational institutions.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, April 19.—Mr. H. B. Woodward, F.R.S., vice-president, in the chair.—The Blea Wyke beds and the Dogger in north-east Yorkshire: R. H. **Rastall**. The author describes the type-section at Blea Wyke in detail, dividing the rocks into the following divisions, enumerated in descending order:—(5) Dogger; (4) yellow beds; (3) Serpula beds; (2) Lingula beds; (1) *Striatulus* shales. Descriptions and fossil lists from these divisions are given, and the succession is compared with others.—Notes on the geological aspect of some of the north-eastern territories of the Congo Free State: G. F. J. **Preumont**, with petrological notes by J. A. **Howe**. This paper is a brief sketch of the geological structure of the northern part of the Congo State, from Buta on the River Rubi and Bima