REPORT ON ARCTIC MAGNETIC OBSERVATIONS.[1]

THIS report, which was printed under the auspices of the Videnskabs-Selskabet of Christiania, at the expense of the Nansen Fund for the Advancement of Science, deals with magnetic observations made in the Polar expedition of 1898–1902 under the command of Captain Otto Sverdrup. The observations were taken by Messrs. V. Baumann and G. Isachsen, and reduced by Mr. Steen. A large part of the report is occupied by the reduction of the observations, which were not in reality very extensive. The following abstract of the mean results at the four stations where observations were made comprises the principal facts summarised on p. 81:—

Station	Rice Strait	Havne Fjord	Gaase Fjord	Gaas Fjord
Latitude N.	78° 46′	76° 29′	76° 49′	76° 40′
Longitude W.	74 57	84 4	88 40	88 38
Epoch	1899·2	1900·5	1901·6	1902·5
Declination W.	103° 4′	116° 47′	129° 33′	128° 51′
Inclination N.	86 0	87 1	87 41	87 53
Horizontal Force	0·04031	0·03315	0·02518	0·02353

The observations, as is evidenced by the smallness of the horizontal force, were taken at no very great distance from the magnetic pole, and the instruments, as Mr. Steen explains with regret, were not well adapted for use under such conditions. Captain Sverdrup's original programme, which had to be largely modified, would have taken him further from the magnetic pole, but, even if circumstances had been propitious, a modification in the outfit would seem to have been desirable. However zealous the observers, as Mr. Steen justly remarks, they can hardly be expected to retain their full interest in the work unless the behaviour of the instruments gives them confidence that the results being accumulated are trustworthy; and, it may be added, however competent those reducing the observations, the outcome of their efforts must be accepted with some reserve unless reliance can be placed both in the instruments and the observers. In the present case, economic grounds seem to have been largely accountable for the instrumental deficiencies. After the experience gained during the last few years, those responsible for expeditions to the neighbourhood of the magnetic poles will have small grounds for excuse if they fail to exercise due foresight in the choice of magnetic instruments and the training of magnetic observers in their use.

C. CHREE.

DEVELOPMENT OF LEMUROIDS.

THE development of the tarsier (*Tarsius spectrum*) and the slow loris (*Nycticebus tardigradus*) forms the subject of the seventh fasciculus of Prof. F. Keibel's "Normentafeln zur Entwicklungsgeschichte der Wirbelthiere," now in course of issue by G. Fischer, of Jena. The part before us is the joint work of Prof. A. A. W. Hubrecht and the editor. Although the text is necessarily of an extremely technical nature, the beautiful illustrations of embryos permit the student to see for himself how essentially different are the early phases in the development of these two strange Malay animals, which are included by most zoologists in the order Primates.

Prof. Hubrecht has for several years past devoted special attention to the developmental history of the tarsier, on which he has published papers from 1895 onwards. He has regarded the genus as the most primitive phase of the Primate type, sundered very widely indeed from all other lemuroids, with which it was formerly so closely associated. His unique material has been generously placed at the disposal of his coadjutor for the purpose of illustrating this fasciculus of the "Normal Plates," in connection with such material for the developmental history of the slow-loris as could be obtained—material, unfortunately, much less rich than that available in the case of the tarsier.

While Prof. Keibel, as already indicated, worked out the history of the tarsier, Prof. Hubrecht undertook that of the loris, and has likewise written the general account and the comparison of the two forms.

In the concluding section support is given to Prof. Hubrecht's original suggestion that, in view of the marked and radical divergence of their development, it is illogical to include the loris and the tarsier in the same mammalian order. Before their relative positions can be definitely determined and a thoroughly satisfactory classification of mammals in general formulated, it is necessary that the series of these normal plates of development should be very greatly extended, and our knowledge of the ontogeny of such forms as Manis, Galeopithecus, Hapale, and Chrysochloris and other insectivores very largely augmented. As an instalment to this most desirable end, the fasciculus before us is all that could be desired.

R. L.

MARINE BIOLOGY ON THE WEST COAST.[1]

YEAR by year the report on the Lancashire Sea Fisheries Laboratory increases in bulk, and the fifteenth of the series is again rather thicker than its predecessor. It contains fourteen scientific papers, as against eleven in the previous volume, and in the present case two or three gentlemen other than members of the staff have contributed.

As usual, the volume opens with a general report and review by Prof. Herdman, the honorary director of the scientific work. This is followed by twenty pages by the same author upon sea-fishery research, in which he reviews the present situation and the nature of the work done in the international investigations of the North Sea, and criticises the value of that work from the point of view of the fisheries. Without either agreeing with or dissenting from Prof. Herdman's views, we can say that he has set forth a very clear statement of his case.

Mr. Andrew Scott's report on the sea-fish hatching at Piel again records the liberation of several millions of fry, and again lacks any word as to the results of thus increasing the fish population of the area. In another paper on sea-fish hatching in Norway, however, Captain Dannevig discusses what appear to him to be the results of liberating artificially hatched cod larvæ, but his conclusions are traversed by Mr. K. Dahl, whose paper on the same subject suggests that the increase of cod in the district shows no relation to the liberation of the fry, but is dependent upon variations in the currents of water which are responsible for the distribution of the eggs. Thus the value of "interfering" with the natural reproduction of the food-fishes still remains to be proved.

Mr. Scott also reports, as usual, upon the tow-nettings for the year, and we cannot but admire the amount of trouble taken; at the same time, we are inclined to be sceptical as to whether the value of such work is equal to the labour expended upon it.

The same author contributes a short paper upon the food of young fishes. In this paper also, Mr. Scott illustrates his capacity for taking pains, and there is no doubt that such work will prove valuable, especially when taken in conjunction with work upon the food of mature fishes, such as Mr. R. A. Todd has contributed to the North Sea investigations.

Mr. James Johnstone's paper upon this subject deals only with the plaice and dab, and is upon the same lines as the one he contributed last year upon the same subject. He has now, however, gone more carefully into detail, and shows that, although the dab is less particular than the plaice in its choice of food, both the species depend mainly upon lamellibranch molluscs, especially Solen, and his observations on this point agree well with those of Mr. R. A. Todd on the same species in the North Sea.

The fish-marking experiments were continued during

[1] Report of the Second Norwegian Arctic Expedition in the *Fram*, 1898–1902, No. 6. "Terrestrial Magnetism." By Aksel S. Steen. Pp. 82. (Christiania, 1907.)

[1] No. xv., Report for 1906 on the Lancashire Sea-fisheries Laboratory at the University of Liverpool and the Sea-fish Hatchery at Piel. Pp. 269; illustrated. (Liverpool, 1907.)

1906, and Mr. Johnstone's results agree with his previous ones in so far as they show an off-shore migration in the summer and an along-shore movement in the winter. A number of other movements were observed, just as in the North Sea, where individual fish moved long distances, *e.g.* to the east and south coasts of Ireland, but such movements appear to be irregular according to present knowledge.

The same author also gives a valuable contribution on sewage pollution of shell-fish, and in this connection we regret that Prof. Herdman has not been able to give us a report upon the action of copper in connection with the purification of infected shell-fish, of which a preliminary statement appeared last year.

As usual, there is no lack of charts, tables, and illustrations, and the volume certainly shows very well Prof. Herdman's idea as to the association of scientific research and fishery problems.

FRANK BALFOUR BROWNE.

INCANDESCENT ILLUMINANTS.[1]

A LITTLE more than twenty years ago Auer von Welsbach, who was engaged on researches on the rare earths, invented the modern incandescent mantle. His first mantles were made of zirconia and yttrite earth in the proportion to make a normal zirconate. Shortly afterwards he found that the best material has a basis of thoria. Pure thoria, which requires care in its preparation, gives very little light, but if a small percentage of a coloured and permanent oxide, such as ceria, is added, it gives good illumination.

There has been much discussion about the theory of the incandescent mantle. It has been generally assumed that the temperature of a Bunsen burner is too low for a mantle to give the light it does by simple radiation unless it is much hotter than the flame. Unfortunately, the temperature of the flame is generally taken with a thermocouple, and this gives far too low a reading, as the thermocouple never reaches the real temperature of the flame; but, admitting that the temperature of the flame is high, it is still urged that the light given by the thoria with a small percentage of ceria is so great that there is something more than mere thermal radiation. It is said that the ceria acts as a catalytic agent, and that it oscillates between two states of oxidation. Ceria does act somewhat in the same way as platinum; for instance, if a ceria mantle is put on a lighted burner, the burner turned out, and the gas turned on again, the ceria mantle will glow and finally light the gas. It is odd that this is not brought forward by the advocates of the catalysis theory; but the opponents might urge that zirconia will do the same thing, and the zirconia mantle gives very little light. This does not prove that ceria does not increase the rate of combustion, however.

According to the simple radiation theory, the light depends only on the emissivity, or blackness of the mantle, and its temperature. Its temperature must be lower than that of the flame, as it must be robbing the flame of the heat it radiates. In order to give the flame every chance of supplying the heat, the threads of the mantle have to be made very fine, so that the flame can rush through the meshes, and the hot gas should be in brisk movement through the interstices of the mantle. By using a special draught arrangement, known as the intensive system, about twice the light per cubic foot of gas can be obtained. In order to get the highest temperature the emissivity should be low, that is to say, the mantle should be very white; but then, though it would get to a high temperature, it would give very little light. On increasing the emissivity the light will first increase, but this means a lower temperature, so that as the emissivity is increased from white to black the total radiation increases, but as that means a greater abstraction of heat from the flame, the mantle is cooler, and therefore radiates a larger proportion of the energy as heat and a smaller proportion as light, so the mantle gets redder and gives less light. This is just what happens in practice, whether ceria or any other coloured oxide is used.

It has been urged that, as pure ceria is white, adding it cannot make the mantle blacker; but ceria is white only when cold. A mantle may look quite white cold, and be darker in colour when hot. Rubens has devised an experiment to show this. The mantle is strongly illuminated by an arc and condenser, and its image is thrown on the screen. It looks quite white, of course. On lighting the gas, the mantle, instead of becoming still brighter, at once becomes dull. Again, alumina, which is white, gives little light. Chromium oxide is so dark that it gives only a dull red glow. But on adding a little chromium oxide to the alumina, a dark red light is first given, because the chromium oxide is too dark, but as soon as it combines with the alumina to make a light pink mantle a good light is obtained.

The incandescent mantle is now applied, not only to the ordinary Bunsen burner, but to an inverted form, which lends itself to decoration, and to the petroleum lamp. It is now also applied to air carrying a little hydrocarbon gas, and this application is said to provide an extraordinarily cheap light, which is especially useful for country houses.

One of the drawbacks to gas, compared with electric lighting, is that merely turning on does not light gas. This difficulty has been largely overcome by the use of the bye-pass, but further advances have been made. Welsbach has discovered that an alloy of cerium and iron gives off sparks on being scraped or filed, and a burner has been designed in which the act of turning on the gas scrapes a little wheel of this alloy, causing a spark which lights the gas. This overcomes the drawback of having a little jet always burning. Another invention allows the gas to be lighted from a main tap. Each burner has an attachment which lets the gas straight through to the burner when the pressure is on, but on turning the main supply off, and allowing a little gas to pass at the controlling tap, the attachment to each burner turns off the burner and lights a little pilot jet, which keeps alight until light is wanted again. On turning on the main tap the pilot jets light the various burners and go out themselves. By this means burners can be fully lighted up by turning one tap at the door of the room.

The electric incandescent light is undergoing a great change. Carbon is being replaced by metal wires. It has been found possible to make wires of high enough resistance of tungsten, osmium, tantalum, and a few other metals and compounds. The osmium lamp was the first of these, but there was difficulty in making it of high enough resistance. The tantalum lamp is now in great demand. It is made for 100 volts to 130 volts, and is much more efficient than the carbon lamp. It will not last long on alternating currents, however. The wires of a lamp that have been run for some time on a direct current show a curious notched or crinkled appearance under the microscope; but a wire that has been run on an alternating circuit looks as if the metal had been melted into short cylinders with round ends, and these cylinders had stuck together end to end without their centres being in a line. Sometimes the little cylinders are nearly separated, merely touching at a corner. This action is very extraordinary, and has never been explained. In addition to this, when a lamp breaks down on an alternating circuit, the wire sometimes goes at one point and sometimes it breaks in several places, and tangles itself up in an extraordinary way; at other times it breaks up into numerous little pieces, which will be found lying on the inside of the globe. Some of the other lamps show a change under the action of the current, but it is not so marked as in the case of tantalum.

One of the most interesting of the new lamps is the zircon. It is said to be made of zirconium and tungsten, and lamps of this material have been made for 200 volts, a matter of the greatest importance from a distribution point of view. It is possible that the conductor is really a zirconide of tungsten, and this opens up a new series of compounds. A zircon lamp for 100 volts has really six separate loops of wire mounted in series inside a bulb. A recent improvement is to provide an extremely

[1] Abstract of a Discourse delivered at the Royal Institution on Friday, April 26, by Mr. J. Swinburne, F.R.S.