change in political outlook and his change of party. Of course, for party purposes, a man must resist the influence of intelligence and stick to his party but it is only from this point of view that change of party is to be deprecated; actually, it is proof of strength and individuality—in no way discreditable.

In a measure, his translation to the Upper House, in 1928, probably in no way satisfied his ambition and was a disappointment, marking as it did the close of his political career. He had aspired to the highest office, beyond doubt, but pronounced idiosyncrasies of manner were against him: he was outwardly 'too foreign' to be acceptable. To satisfy his aspiration, in his later years, he devoted himself to industrial rather than to political statesmanship. The spirit of idealism, which I have spoken of as actuating the father, became greatly operative in the son. He showed himself to be gifted with a co-ordinating mind, whilst his father had been constructive. He entered into a discussion of the problems of labour and in the interests of 'rationalisation'—to use the fashionable word of the day—effected two great industrial combines. Whatever assistance he may have had, there is no doubt that his was the guiding spirit, his the driving force. To come back to chemistry, while the father was a true chemist, a highly original worker, who really made things, the son was like the modern physical chemist, who is more or less a visionary and a speculator in other people's works, not a worker himself. Apparently, the one cannot be the other. Some of us contend that the physical chemist does not know enough chemistry to justify the certainty of his opinions. It is a question whether Alfred Mond knew enough to deal with issues and problems of the complexity and magnitude of those he undertook. Although scientific in his outlook, a systematic user of knowledge, he knew nothing of experimental and physical science and cannot have had any real feeling for the industries with which he was connected.

In effigy to-day he commands an Imperial position in Chemical Industries—his father on his right hand. By a strange turn in the wheel of fortune, he was led to develop, on a colossal scale, the manufacture of ammonia from atmospheric nitrogen by the Haber-Bosch process, so taking a step commercially antagonistic to his father's perhaps most favoured enterprise: ruinous also to the Chile nitrate industry. It may be that one good turn deserves another: industrial progress, so-called, too often seems to involve the supercession of earlier workers. The grave economic, political issue of the present universal industrial rush to our atmosphere, however, has yet to be apparent. To make the inert active is always dangerous, if not an impiety; it may well be a jump from frying-pan into a burning fiery furnace of soil destruction.

Father and son probably could never have exchanged places: they were different natures. Ludwig Mond kept pretty well within the limits of his abilities and sought competent assistance when going outside them: to decide to what extent the son was Napoleonic and overstepped his, will not be easy. One thing is certain, that like his father before him, he gave his full strength to whatever service he undertook. Opinions greatly differ as to the wisdom of his action—as to the competency of a system such as he sought to develop. On account of the growing gravity of the industrial situation, the absolute need of completely scientific management—in other words, of complete understanding—a full inquiry into the problem of control should be undertaken with all possible care and without delay. The matter is already engaging attention abroad and such discussion is therefore of immediate national importance to us. It cannot be undertaken by men of affairs alone—they have not the necessary breadth of knowledge.

Much is said of academic research as the mainstay of industry and industry is being called upon to give support to the work. At the moment, there is great waste of energy and of funds, both national and private, on account of lack of co-ordination and clear-cut views as to the purpose of the work—particularly because of the lack of competent supervision. The great need in industry of full inquiry into the efficiency of the methods followed in its own management and conduct has yet to be recognised: in such direction, industrial research is imperative.

HENRY E. ARMSTRONG.

Southern Whales and Whaling.

THE Discovery Committee appointed in 1923 as a result of the findings of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands is now issuing, under the general heading of "Discovery Reports",* a series of reports by the Committee's scientific staff and others on the investigations being carried out in the southern hemisphere—mainly regarding the scientific aspect of whales and the whaling industry. As in other recent expeditions, the reports are not published in any definite sequence of subject, but as the different stages of the work are completed. The advantages of this procedure are obvious.

The principal industry of the Falkland Islands is whaling, and, since the inception of commercial operations in 1904, there has been a rapid rise in the success of the industry. The history of whaling operations in other parts of the world has acted as a powerful stimulant, both to the administrative controllers of the Dependencies and to scientific experts, to gauge the effects of excessive slaughtering of

* Discovery Reports, Vol. 1. Station List, 1925–27. Pp. 140+plates 1-6. 14*s*. net. Discovery Investigations: Objects, Equipment and Methods. Part 1: The Objects of the Investigations, by Dr. Stanley Kemp; Part 2: The Ships, their Equipment and the Methods used in Research, by Dr. Stanley Kemp and A. C. Hardy; Part 3: The Marine Biological Station, by N. A. Mackintosh. Pp. 141-232+plates 7-18. 9*s*. 6*d*. net. The Natural History of the Elephant Seal: with Notes on other Seals found at South Georgia. By L. Harrison Matthews. Pp. 232-256+plates 19-24. 4*s*. net. Southern Blue and Fin Whales. By N. A. Mackintosh and J. F. G. Wheeler; with two appendices by A. J. Clowes. Pp. 257-540+plates 25-44. 30*s*. net. Parasitic Nematoda and Acanthocephala collected in 1925–27. By Dr. H. A. Baylis. Pp. 541-560. 2*s*. net. The Birds of South Georgia. By L. Harrison Matthews. Pp. 561-592+plates 45-56. 12*s*. net. (Cambridge: At the University Press, 1929.)

whales and, if necessary, to devise a system of regulation to maintain the stock. It is not feared that the whales will be actually exterminated—because the industry must fail long before the whales are reduced to the point of extinction—but that the industry will collapse and the valuable supply of oil will be lost. Any restrictive legislation, whether national or international, must be based on the findings of scientific research. The prevention of waste at shore stations under the jurisdiction of the Government is a matter of routine, but the protection of the stock of whales calls for more knowledge than the scanty data at command can supply. It is, therefore, the object of these investigations to achieve more definite and increased knowledge of whales on which to base methods of conservation, and to Mr. Darnley and Sir Sidney Harmer credit is largely due for laying the foundations of this whaling research.

Vol. 1, which was published during the early part of the past year, contains the results of part of the work undertaken by the staff during the years 1925–1927, and consists of six parts, with a foreword by Mr. E. R. Darnley, chairman of the Committee. The Station List which occupies the first part is more or less stereotyped, but the tabulation, opposite each station, of the hydrological observations, including hydrogen ion concentration, oxygen and phosphate contents of the sea water at different strata, is a distinct advantage.

In the second part, the Director of Research, Dr. Stanley Kemp, gives a brief outline of the aims and objects of the investigations, stating that "the main object of the work is to obtain further information on whales and on the factors which influence them". This entails studies of the whales themselves and of their environment. Work at a shore station was considered essential and a marine laboratory was established at South Georgia, where the whales landed in the course of commercial operations were examined by the resident staff with the view of determining their specific identity and their relationship with similar types captured in other areas. Concurrently with the collection of statistics for racial studies, investigations were undertaken on the anatomy of the whale to elucidate the fundamental points in the life history of the species. As commercial whaling more or less ceases during the antarctic winter, the observations at the laboratory at South Georgia do not cover the full reproductive cycle, so that a transference of the staff during the southern winter was made to South African waters, where similar work was continued on the whales landed at Saldanha Bay. The study of the environment of whales could only be attacked by observations at sea, and it was considered necessary to have two ships to cover the enormous area in which observations would have to be made to cope with profitable lines of research. The *Discovery*, Capt. Scott's famous ship, purchased and specially refitted, was commissioned in October 1925, as the larger ship, for the major part of the oceanographical work; while the smaller *William Scoresby*, built on the lines of a whale-catcher, was designed for the pursuit of whales, with the primary object of shooting numbered discs into them in an attempt to get actual data as to their migrations. The general programme of investigation follows very closely on the lines adopted for the study of commercial food fishes by the International Council for the Exploration of Northern Seas.

In the same report, the equipment of the ships is discussed by Dr. Kemp and Mr. (now Prof.) A. C. Hardy. The structural alterations in the *Discovery* and the fittings for the working of the most modern scientific apparatus are described in detail (see also NATURE, June 20, 1925, p. 950). There are numerous diagrams and photographs illustrating the various points. The *William Scoresby* was built to the specifications of the Committee on the lines of a whale-catcher and was further adapted for commercial trawling. Apparently she has turned out to be very efficient as a sea-going ship and trawler but only moderately successful, so far as the experiments have gone, for shooting numbered discs into live whales—probably because of the ship's larger size, slower handling, and increased noise in comparison with the usual whale-catcher. The type of mark, however, its size, and the method of shooting, from a rifle which is effective only at a very short range, seem to affect the success of the operations. Several methods of marking have been and are being tried, mostly by Norwegians, but there appears to have been a lack of success in all of them. The problem is most difficult and its solution is absolutely essential for the success of the investigations, but no doubt every effort is being made to obtain successful results. In the same report the construction and fittings of the shore laboratory at Grytviken, South Georgia, are described by N. A. Mackintosh, who was in charge of this station. Here the methods employed for counteracting intense cold and high winds form an interesting adjunct.

A further part is devoted to the seals of South Georgia and is by L. H. Matthews. Attention is directed chiefly to a study of the natural history of the elephant seal, which has been the object of pursuit for about two centuries on account of its valuable commercial properties, and has undergone considerable fluctuations in abundance of the stock. The elephant seal is polygamous, as shown conclusively, if such proof were needed, by the photograph of a harem taken purposely during the *Endurance* Expedition in November 1914 and reproduced in this publication. Apart from this factor, which supports scientific selection in slaughtering, the sealing industry has been under efficient Government legislation since 1910, when special sanctuaries were set aside for the preservation of the species. Since the beginning of the century the southern fur seal has been observed on rare occasions in the Dependencies of the Falkland Islands, and the problem of re-establishing the species in these subantarctic islands, with the view of scientific farming on the lines of the successful experiments by the United States Government at the Pribyloi Islands, has been receiving attention.

The section by Messrs. Mackintosh and Wheeler, on southern blue and fin whales, with appendices by Mr. Clowes, is a compendious report which

occupies about half the volume and is the result of the work on the whales landed from 1925 to 1927 at the shore stations—Grytviken, in South Georgia, and Saldanha Bay, South Africa. A considerable part of it is taken up with descriptions of the external characters of these two species and with tables of measurements of body proportions, with the view of establishing the specific characters of southern whales and to define the limits of variation. This is an essential part of the investigations, as information on the specific, sub-specific, or racial relationships with similar whales in other areas is of fundamental and far-reaching importance. From the treatment of their data, the authors are convinced that there are close resemblances between the whales of South Georgia and South Africa, and that there are no definite grounds for sub-specific or racial distinctions. Comparison between the whales of the northern and southern hemispheres has not so far been attempted, at least on a large scale, but the data which are still being collected will, no doubt, be utilised for fuller statistical treatment in the near future.

Examination of the stomach contents formed a routine part of the programme. The results were interesting, in so much as all the whales (excluding the sperm) were found to be feeding on Crustacea—and chiefly, if not exclusively, on Euphausiæ, *E. superba* at South Georgia and *E. recurva* at South Africa. This is an interesting and important point, which no doubt will be supplemented by observations from other southern areas. So far as the fin whale is concerned, this species in the northern hemisphere is known to be a mixed feeder and to subsist largely on fish, but it is considered to be solely a plankton feeder in the south.

Routine measurements of the thickness of blubber were also made with the view of establishing any seasonal increase or decrease and specifying its relation to the food supply. Thickness of blubber has a definite bearing on oil production, but, apart from seasonal variations, information is desired on other points, such as thickness in proportion to length of whale, involving a study of physical maturity, and in females, the conditions during pregnancy and lactation. In pregnant females the blubber is abnormally thick, but in whales generally there is a relative increase in thickness of the blubber with increasing whale length. Whales as a rule were found to be fatter at the end of the South Georgia season, while the thickness decreased in South African waters.

The anatomy and physiology of the reproductive organs have formed an integral part of the researches, and much good fundamental work has been done on the ovaries, mammary glands, and testes. The evidence available from these observations has been used in the interpretation of the breeding habits and growth of whales, but information from other sources, such as the occurrence of fœtuses, the seasonal movements and habits of whales, has been utilised in piecing together the life history and reproductive cycle. The conclusions drawn from the investigations rest ultimately on breeding and feeding migrations, which in the present state of our knowledge are more or less assumed from circumstantial evidence to be north and south; but these deductions would be enormously enhanced in value if supported by direct evidence through the capture of even a few marked whales.

Apart from this apparent weakness, which is largely due to the nature of the work on whales caught commercially, the authors have made good use of the data at their command and have given an acceptable estimate of several fundamental points on which accurate diagnoses are essential. Thus, they have defined the mean length of sexual maturity for—

Blue Whales,	Female,	at 23·7	metres	(77 ft. 9 in.)
,,	,,	Male,	,, 22·6	,,	(74 ,, 2 ,,)
Fin	,,	Female,	,, 20·0	,,	(65 ,, 7 ,,)
,,	,,	Male,	,, 19·5	,,	(63 ,, 8 ,,)

The pairing season takes place principally from May to August, with a maximum in June to July for both these species, but, as stated, the results indicate, at least for the fin whale, a protracted period over seven or eight months. The authors are convinced that whales are polyœstrous, and that if impregnation be missed during any period of ripening of an ovum, there are traces of this occurrence in the ovaries as corpora lutea of 'ovulation'. The frequency of this feature is unknown, but it does not strengthen claims to a breeding concentration and complicates the estimation of age by reading of the number of old ovarian scars. The length of the period of gestation has been estimated at a little more than ten months for blue whales and eleven and a half months for fin whales, with possible variations according to the time of impregnation. This conclusion has been drawn largely from an examination of the fœtuses obtained during the investigations and from the records of the smallest calves, which latter were extremely few. From the same evidence the season of parturition was defined and the period of birth of the calves was stated as mostly April and May for blue whales and June and July for fin whales. The accuracy of the determinations, however, depends largely on the question of the representative nature of the material examined.

The length at birth has also been estimated in a general way and probable estimates have been given as 7·0 metres (23 ft.) for blue whales and 6·5 m. (21 ft. 3 in.) for fin whales. The average length at which weaning takes place has been more difficult to determine, as the data on which the estimate has been made are rather scanty; but the rate of growth of the calf during the nursing period has been approximated with the help of data supplied to the British Museum by the whaling companies at South Georgia and at South Africa. The duration of the nursing period has been put at about seven months for blue whales, and for the fin whales, on slightly less representative material, at six months. During this period the astonishing result has emerged that the blue whale calf more than doubles its length, while the rate of growth of the fin whale calf is also rapid but not quite se considerable. The subsequent growth of the adolescent whale to sexual maturity again rests a good deal on conjecture, but

there seems sufficient justification for the authors' interpretation of the available statistics that sexual maturity is reached at the end of the second year, at lengths already stated for each species. No definite method for determining the age of whales, beyond the early stages, has emerged, though various studies have been made in this direction, but these have not advanced beyond the stage of fixing that the whale is either an old or a young one, for example, by the number of old scars on the skin, the condition of the vertebral epiphyses, and the number of old corpora lutea.

The application of the results obtained to economic conditions is discussed at some length, but as this necessitates a thorough understanding of the whole stock of whales, the question will have to be considered from all points of view. The arguments put forward by the authors refer to the particular areas in which the investigations were made, and rest largely on the assumption that there is little discrimination in the killing of the whales in any particular area, and that the nature and composition of the catches are likely to be fairly representative of the whale population. The problem of fluctuations in the number and condition of whales requires a lengthy series of observations, but several interesting points are touched upon in the present report which, with a fuller knowledge, may prove to be of great importance. Much is made of the concentration of whales in the area of the Falkland Islands, and some of the causes for this concentration are given considerable prominence, but there are a few million square miles of sea round the antarctic barrier still unexplored, and it may well be that other features will emerge which will call for intensive study. In the history of whaling operations in the northern hemisphere, it has been impressed on us that the *locus operandi* has shifted from one locality to another, and that in each case the killing off of the whales almost to extinction in any particular region has not been followed by a return to the region of the same type of whales in numbers sufficient to resuscitate the industry. This is, meantime, an unexplainable point, but one that requires attention.

The fifth part is a purely scientific report by Dr. H. A. Baylis and deals with the first consignment of material belonging to the parasitic Nematoda and Acanthocephala collected from whales, seals, and fishes. Five species of Nematoda and three of Acanthocephala are described as new to science. These are interesting from the point of view of the distribution of their hosts.

Another section by Mr. L. H. Matthews is on the birds of South Georgia. Thirty-one species are listed as having been observed at the island both by himself and by previous observers. The text is in the form of brief notes on the species, except in a few cases, for example, the Albatrosses, where the breeding habits are described from the writer's original observations. In most cases a popular name is given to the species, but one misses familiar terms like Night Hawk for the Cape Hen, Paddy for the Sheathbill, Nellie for the Giant Petrel, and Johnny for the Gentoo Penguin. Nineteen species were observed nesting, while other six are quoted from previous observers as breeding on the island. Fregetta is recorded as being observed only by the Transit of Venus Expedition at Royal Bay, but the scientific members of the *Endurance* Expedition observed a pair of these birds at close range at Larsen Harbour in November 1914. The report opens with a curious mistake as to Shackleton's itinerary on the famous boat journey in April and May 1916 from Elephant Island, South Shetlands, erroneously stated here as South Orkneys, which, by the way, has also been overlooked in the list of corrigenda. There are twelve plates (three in colour) attached to the report, and many of the figures are exceedingly good and most useful.

The New Zealand Earthquake of Feb. 3.

By Dr. C. DAVISON.

OUR knowledge of New Zealand earthquakes extends over little more than a hundred years. Since 1814, when missionaries first landed in the islands, there have been four great earthquakes—in 1826, 1848, 1855, and 1929—but none of these, unless it be the earthquake of 1855, can be compared with the shock that on Feb. 3 brought ruin to Napier and other towns in the North Island. Certainly none has been so destructive of life. On June 17, 1929, 17 persons were killed during the Murchison earthquake; in all previous earthquakes since 1848, not more than seven. During the shock of last week, at least 140 lives were lost, and the number may be increased when the ruins of the larger buildings have been searched.

The earthquake occurred at 10.48 A.M. and lasted for about two minutes. The principal towns damaged are Napier and Hastings. Napier lies on the shore of Hawke Bay, and the houses that suffered most are those in the business quarter, built for the most part on land reclaimed from the sea. Hastings is an inland town about 12 miles south-south-west of Napier. The other places at which buildings are damaged or lives have been lost lie within or near a band about 45 miles long and 12 or 15 miles wide running south-south-west from Napier or parallel to the coast line to Waipukurau. It is in the neighbourhood of Napier, however, that the material damage is greatest. Railway lines there are buckled, roads are fissured, and many landslips have occurred, especially to the north of the town.

The earthquake was recorded at Kew Observatory at 11 h. 6 m. 52 s., P.M. (G.M.T.) on Feb. 2; the amplitudes of the movements were about twice those caused by the earthquake of June 17, 1929, and the total duration of the disturbance was about four hours.

One of the most interesting features of the earthquake is the rise of the land about Napier.