The Snellius Expedition.

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IN view of the lack of knowledge concerning the inland seas between Asia and Australia, the Society for Scientific Researches in the Dutch Colonies and the Royal Dutch Geographical Society at Amsterdam planned an oceanographical, geological, and biological expedition to those parts for the years 1929-30. The field of research, shown on the accompanying chart (Fig. 1), embraces the deep basins in the eastern part of the Dutch colonies with the adjacent regions of the Pacific and the Indian Ocean, which they connect. The area is nearly as large as that of the Mediterranean and the Black Seas combined. The conditions are very different from those in the open ocean and render this part of the Archipelago a region of great interest for oceanographical, geological, and biological work.

In view of these joint interests the scientific staff is composed as follows: an oceanographer-leader, with two oceanographers (one chemical, one physical), a chemist, a geologist, and a biologist. The scientific equipment of the research vessel (H.M.S. *Willebrord Snellius*, a surveying ship of 1200 tons) was transported while she was being built in Holland. By the co-operation of the East Indian Government and the Navy Department at Batavia, this ship is being withheld from her ordinary surveying work and put at the disposal of the expedition for fifteen months. The naval staff is composed of a commander, four naval officers, a naval engineer, a doctor, and a paymaster.

The main purpose of the expedition is to acquire more data concerning the physical and chemical properties of the sea water, the horizontal and vertical circulation in the various layers, the configuration of the bottom and its deposits, and the distribution of the plankton. Moreover, biological and geological investigations ashore and on coral reefs form part of the programme.

The investigations of ocean temperatures, the salinity and the amount of oxygen of the water, the determination of currents by calculation and direct measurements, and the meteorological observations directly connected with oceanography, are in charge of the leader of the expedition, assisted by Dr. H. J. Hardon and Mr. H. C. Hamaker. Commander F. Pinke and his officers and men are responsible for a considerable amount of work, of which echo soundings, the determination of the position of the ship, and laboratory work form the principal part.

The chemical investigations are in charge of Dr. A. B. Boelman. The determinations are to be such as will help and complete the oceanographical, geo-

logical, and biological work, not such as would be of purely chemical interest; hence determinations of salinity, oxygen content, alkalinity, and pH were chosen. The first is only of oceanographical, the second of both biological and geological interest. As already mentioned, these two are under the direct supervision of Dr. Hardon. Alkalinity measurements belong to the geological side, those of the pH to all three together. Up to the time of writing no opportunity had occurred for determinations of the phosphate content. It is hoped that it will be possible to

FIG. 1.

make some phosphate determinations in the future, for these, together with quantitative plankton fishing, afford valuable information on the biology of the seas.

Data of importance for geology are obtained by the echo soundings that are made at frequent intervals during the sailing, and by wire soundings with a bottom sampler at each station. Dr. Ph. H. Kuenen, the geologist, is responsible for the latter.

The task of the biologist, Dr. H. Boschma, is confined to investigations which may help to give a better understanding of geological phenomena. At sea the biological work consists of the collection of plankton—surface catches at nearly every station, and, occasionally, catches with closing nets or large tow-nets for macroplankton. Every now and then (twice or thrice a month) a couple of days are spent ashore together with Dr. Kuenen; then collections are made of the animals inhabiting the reefs and the shore. The results of the investigations ashore are mostly of local interest, but these observations

on reefs and reef islands will no doubt prove to be of more general importance when viewed as a whole.

To the small number of existing wire soundings off the shelves many thousands of echo soundings are being added. These will enable us to make corrections on the present depth chart.

The track of the ship during the first five months is plotted on the chart (Fig. 1), the dots representing the position of the stations. In most cases observations have been made along cross-sections of the troughs between the isobaths of 200 m., so as to allow

calculation of currents in various layers by the methods of dynamical oceanography.

Interesting results have already been obtained concerning the physical and chemical properties of the sea water in the deep basins which are separated by rather shallow sills. Direct current measurements have been made at two anchor stations (39° and 135° , depth 2300 m. and 1200 m. respectively), where the influence of the tide near the bottom was observed (135°). Moreover, investigations have been carried out at these stations concerning the variations in the properties of the sea water, probably due to internal waves.

Optical Rotatory Power.

THE Faraday Society's second General Discussion on "Optical Rotatory Power" was held in the rooms of the Chemical Society, Burlington House, London, on Friday and Saturday, April 25 and 26. In addition to English workers in this field of research, the Society had the pleasure of welcoming a large delegation of their foreign colleagues, from France, Germany, Italy, Belgium, and Switzerland. The foreign guests included Prof. R. Betti (Bologna), Dr. Bretscher (Zurich), Prof. E. Darmon (Paris), Dr. R. Descamps (Brussels), Dr. Drucker (Leipzig), Prof. P. P. Ewald (Stuttgart), Dr. Werner Kuhn (Heidelberg), Mme. Liquier-Milward (a pupil of Prof. Cotton, now resident in England), Dr. R. Lucas (Paris), and Dr. K. Wolf (Karlsruhe). Papers were also received from Prof. G. Bruhat and Prof. A. Cotton (Paris), and Prof. R. de Malleman (Nancy), who were unable to attend the meetings.

An introductory address by Prof. Ewald on the physical aspects of optical rotatory power was listened to with interest, and will be read with still greater interest when it appears in print. This was followed by a paper on "The Wave-Mechanics of Optical Rotation and of Optically-active Molecules" by Mr. G. Temple, of Trinity College, Cambridge. Up to the present, wave-mechanics has contributed but little to the theory of optical rotatory power, but it appears likely that the challenge provided by this discussion may result at no distant date in the development of a satisfactory method of formulating the older experimental results in terms of the newer theory. At present, some confusion has arisen from attempts to identify the symmetrical and anti-symmetrical forms of the molecule, as they exist in hydrogen and in ammonia, with the dextrorotatory and levorotatory forms of an optically active compound. Since these forms differ in energy content, they must therefore differ (at least slightly) in rotatory power. This conclusion is, however, directly contrary to the well established postulates of Pasteur, and to the doctrine, held universally by all workers during the past hundred years, that enantiomorphism implies an absolute identity of properties, except when these are reversed in sign, but not in magnitude, by reflection in a mirror. This anomaly is one that must be removed as soon as possible, if the newer theories are to prove their equality to or superiority over the old, and Dr. Kuhn (whose simple model of an asymmetric molecule seems likely to provide a bridge between theory and experiment) has already suggested that, instead of being identified with the symmetrical and antisymmetrical solutions of the wave-equations, the dextro and levo forms should each be represented by a combination of these two solutions, with an appropriate difference of phase, so that the precise equality of the mirror image is restored.

The theory of wave-mechanics also postulates that all optical activity is unstable and only of transient duration, but without specifying whether the half-life period is to be reckoned in millions of years or in

millionths of a second. Under these conditions, it is impossible to check the theory against experiments, which have established the apparent permanence of optical activity; but, since racemisation (or the related phenomenon of inversion of one of a series of asymmetric carbon atoms, as in the mutarotation of the sugars) is so often found to depend on a catalyst, many physical chemists would envisage the process as one that occurs normally only in complex molecular systems, although the inversion of pinene vapour has been claimed as an example of an uncatalysed reaction. The racemisation postulated by the theory of wave-mechanics is therefore apparently a phenomenon of a different order from those which have been studied by chemists.

Dr. Werner Kuhn, who contributed a paper on "The Physical Basis of Optical Rotatory Power", has achieved unique success in deriving from theoretical physics results which are sufficiently simple to be of immediate practical value. In particular, whilst Drude's simplified equation for rotatory dispersion is valid only in a region of complete transparency (his complete equation has not yet been tested against experiment), Kuhn's equation is valid right through the region covered by an absorption band. Drude's equation has the merit of having made it possible for the first time to resolve the rotatory power of unsaturated compounds into partial rotations of high and low frequency, which are often of opposite sign; but this analysis is obviously less exact than that of Kuhn, and it is of interest to know that the discrepancy which the writer has observed repeatedly between the characteristic frequencies deduced from direct measurements of absorption and (with the help of Drude's equation) from measurements of rotatory dispersion, can be predicted from Kuhn's equation, in which this discrepancy does not occur.

The three following papers, by Dr. K. Wolf, Dr. H. G. Rule, and Prof. R. Betti, were all concerned with the influence of polarity on rotatory power, a subject on which Dr. Rule has published a long series of papers in recent years. Dr. Wolf in a paper on "The Principle of Free Rotation in Optically Active Molecules" described the measurements which he has made of dipole moments, for example, of the active and meso forms of tartaric acid and its esters, in order to find out whether 'free rotation' occurs about the central bond. He concludes that it does not; but this result can be attributed in some cases to the chemical effect of subsidiary valencies, and further experiments are contemplated on compounds in which this factor is unlikely to be operative. Prof. Betti, who contributed a paper on "Optical Rotatory Power and Chemical Constitution", has prepared a series of derivatives of the base, $\text{HO} \cdot \text{C}_{10}\text{H}_6 \cdot \text{CH}(\text{C}_6\text{H}_5) \cdot \text{NH}_2$, and in order to eliminate the effects of rotatory dispersion, has calculated the 'absolute' molecular rotations of his compounds. He has thus been able to establish a graphical relation,