having a length of nearly eighteen metres. This new technique will have to undergo severe tests in much greater depths than those at present accessible (240 metres) before it can be recommended for deep-sea work. Cores with perfectly undisturbed varves from the estuary of Indalsälven, Gulf of Bothnia, have been obtained by one of the new core-samplers by Kullenberg[8].

Measurements of the radium content of deep-sea deposits and of manganese nodules from the *Challenger*, the Monaco and Agassiz collections have been made by the author[9]. The fall-off in radium content with the depth below the nodule surface indicates a rate of growth of about 1 mm. in a thousand years for manganese nodules from the Pacific Ocean, an increased rate of growth in an upward direction being interpreted as probably due to sedimentation at the rate of 0·5 mm. in a thousand years. The beautifully regular decrease in radium content with depth below the sediment surface, found by Piggot and Urry in long cores from the Atlantic Ocean[10], seems to confirm the suggestion offered by the author in 1937[11], that a precipitation of ionium together with ferric hydroxide occurs in the ocean and gives rise to part of the radium entering into the sediment, at the same time depleting the ocean water by about 90 per cent of the radium, which would correspond to its uranium content, about $1{\cdot}3 \times 10^{-6}$ ‰ according to B. Karlik[12]. From measurements of thorium in the red clay, made here by Dr. F. Koczy, it can be inferred that thorium also has been very thoroughly extracted from the water by the same *Mitreissreaktion*, the thorium content in the water being less than $0{\cdot}5 \times 10^{-8}$ ‰, as compared with an earlier value for the upper limit of $0{\cdot}5 \times 10^{-6}$ ‰ found by E. Föyn and E. Rona[13].

A special study of the manganese and iron present in deep-sea sediments, made by the author[14], provides important evidence against the hypothesis of a biological extraction from the sea water of these elements and their subsequent deposition on the bottom together with the foraminiferic shells, recently revived by W. Correns[15]. On the other hand, an extraction of the manganese present in the water through adsorption on very fine particles of volcanic ash, settling slowly through the water, does not appear improbable. The very pronounced local variations in the iron and, especially, in the manganese content of deep-sea sediments may be due to submarine volcanism, the deep-seated magma ejected over the ocean floor being presumably richer in manganese than continental basalts. The same agency, submarine volcanism, the author also holds to be at least partly responsible for the disappearance of the calcium carbonate from the red clay, due to mineral acids released in the reaction between the hot magma and the bottom water. If cold bottom water were the only lime-dissolving agency there ought to be no red clay below 1 or 2 metres from the sediment surface, owing to the higher temperature during the Tertiary age; a conclusion open to future tests by means of the new core-sampling devices.

[1] *Medd. Oc. Inst.*, No. 1 (1939).
[2] *Sv. H.B.Komm. Skrifter, Hydr.*, **6** (1942).
[3] *Medd. Oc. Inst.*, No. 2 (1939).
[4] *Nature*, **153**, 483 (1944).
[5] *Comm. Statens Met. Hydr. Anst. Sthlm.*, No. 47 (1944).
[6] *Sv. H.B.Komm. Skrifter Hydr.*, **19** (1944).
[7] *Medd. Oc. Inst.*, No. 5 (1941).
[8] *Geol. Fören. Förh. Sthlm.*, **66**, 501 (1944).
[9] *Medd. Oc. Inst.*, No. 8 (1944).
[10] *Amer. J. Sci.*, **38**, 81 (1941).
[11] *Wien. Anz.*, **16**, 1 (1937).
[12] *Medd. Oc. Inst.*, No. 2 (1939).
[13] *Medd. Oc. Inst.*, No. 2 (1939).
[14] *Medd. Oc. Inst.*, No. 9 (1945).
[15] *Göttinger Akad. Nachr.*, **5**, 219 (1941).

CERATIUM AND MARINE HYDROGRAPHY

THE recognized importance of the study of plankton distribution in relation to marine hydrography has called forth a number of intensive investigations in recent years. Three reports* dealing with the distribution of the dinoflagellate genus *Ceratium* are of special interest in this connexion owing to the widespread representation of this genus in all oceans. The important conclusions reached by Graham and Bronikovsky from the examination of the *Ceratium* material gathered during the last cruise of the *Carnegie* in 1928–29 are briefly summarized in the following paragraphs. The survey deals not only with wide areas of the Pacific, but also with the North Atlantic; and, on the basis of the *Ceratium* floras, five regions are distinguished, namely, cold North Atlantic, warm Atlantic, cold North Pacific, warm Pacific and south-east Pacific. These regions are also characterized hydrographically.

Among the factors determining the horizontal distribution of *Ceratium*, temperature plays a foremost part. Apart from a few cosmopolitan (for example, *C. fusus*, *C. horridum*) and subpolar species (for example, *C. arcticum*, *C. lineatum*), the bulk are regarded as tropical. The latter are, however, grouped as species intolerant of colder water and rather closely confined to surface temperatures of 19° C. and above (for example, *C. breve*, *C. lunula*), as slightly tolerant of colder water (for example, *C. contortum*) and as very tolerant tropical species, such as *C. massiliense* and *C. hexacanthum* (*cf.* below). In the opinion of the authors there are no species distinctive of temperate latitudes, such being populated by tolerant tropical and cosmopolitan, with occasional sub-polar, forms.

The influence of the amount of nutritive salts (based on phosphate-determinations) is less easily assessed. Regions of very low phosphate content (for example, the warm Atlantic) are in general characterized by a scanty *Ceratium* flora comprising a large number of species, while those with a high content (for example, the North Atlantic and the North Pacific) tend to be more densely populated by a restricted number of species. There is, however, no exact correlation, and the authors conclude that the phosphate-content has no considerable effect on the horizontal distribution of the species of *Ceratium*, although in a given area relative values may be of some significance. Nielsen's view that the concentration of organic products derived from the plankton is an important factor in determining the distribution of *Ceratium*, a view based principally on the distribution of neritic and oceanic forms, is briefly considered but no data for or against the theory are provided.

The probable value of species of *Ceratium* as current indicators could not be very fully assessed in a gross survey like that undertaken by the *Carnegie*. Currents displace both the flora and its environment, so that species can exist in regions which are unfavourable to them until, by mixing with the adjacent water, that of the current becomes unsuitable and the species disappears. Good examples of displacement

* Peters, N., "Die Bevölkerung des südatlantischen Ozeans mit Ceratien", Wiss. Ergebn. Deutsch. Atlant. Exped. *Meteor*, 1925–7, **12** (1932); Nielsen, E. S., "Untersuchungen über die V breitung, Biologie und Variation der Ceratien im Südlichen Stillen Ozean", *Dana* Report, No. 4 (1934). Graham, H. W., and Bronikovsky, N., "The Genus *Ceratium* in the Pacific and North Atlantic Oceans", Scient. Res. Cruise VII *Carnegie* (1928–9), etc. Carnegie Instit. Washington, Publ. 565 (1944).

by currents are furnished by the tolerant tropical species. Thus, the Gulf Stream carries *C. extensum* to the British Isles (surface temperatures 12·4° C.) and *C. hexacanthum* to Iceland (surface temperatures 8·9° C.), although elsewhere these two species are not found at temperatures below 14·9° and 18·9° C. respectively. It does not appear that the equatorial currents appreciably affect the distribution of species of *Ceratium*.

Comparison of the *Ceratium* floras of the two great oceans shows that only eight of the fifty-eight species recorded are restricted to one ocean only and that is always the Pacific. The species in question (*C. deflexum*, *C. bigelowii*, etc.) are either strictly tropical or only slightly tolerant of colder waters, and the seas around Cape Horn may form an impassable barrier to their extension into the Atlantic. Certain differences in the distribution of species common to the two oceans suggest that there may be greater differences between their *Ceratium* floras than is at present apparent. Thus, although the North Atlantic and the North Pacific resemble one another in the occurrence in both of the subpolar *C. lineatum* and *C. arcticum*, there are striking differences which suggest biological isolation. *C. pentagonum*, a species widespread in the tropical seas of both Oceans, is absent from the North Atlantic while represented in the North Pacific by the very divergent subspecies *pacificum*. Again *C. macroceros*, with the subspecies *gallicum* frequent in all warm-water regions, is represented in the North Atlantic by the sub-species *macroceros*, though lacking in the North Pacific.

Twenty of the recorded species (for example, *C. praelongum*, *C. tenue*) show an increase in frequency from the surface to 100 metres. Such species have thin cells crowded with chromatophores which also extend into the horns when these are present. On the whole there is considerable agreement between the *Carnegie* data and those of Nielsen as regards these 'shade' species. The authors of the *Carnegie* Report, however, suggest that, apart from attunement to shade conditions, such forms may tend to move into layers of the water with a richer supply of nitrates and phosphates than are to be found in the surface layers at times of high plankton production.

F. E. Fritsch.

CARNEGIE TRUST FOR THE UNIVERSITIES OF SCOTLAND

THE forty-third annual report of the Carnegie Trust for the Universities of Scotland covers the academic year 1943–44, and includes a summary of the interim distribution of grants for the period October 1, 1943–September 30, 1944, with details of assistance to students and the abstract of financial accounts for the year ended September 30, 1944. In view of the continuation of war conditions, the Committee deemed it inexpedient to revert to the method of quinquennial distribution, and maintained the interim distribution on the same basis as previously. With regard to research, the situation was very similar to that recorded in 1942–43 and the abstract of accounts shows that a sum amounting to £15,497 has been accumulated, which is being held on behalf of fellows and scholars at present engaged on one or other form of national service, and of recipients of grants who have now been unable to make use of their awards. As it is unlikely that all those who have been awarded fellowships or scholarships since the outbreak of war will elect to begin or resume their researches under the ægis of the Trust, it is possible that a substantial reserve will have been created for the development of the Trust's plans for aiding research.

The decline in the number of beneficiaries was most marked in the Faculty of Arts where there were 164 less than in the previous session. The decline of 55 in science on the figure for the previous session was more than offset by a sharp rise in the number of beneficiaries in the Medical Faculty, the increase in medicine being 80 over the previous year. It is essential that it should be made known as widely as possible that, unless in the future the number of the beneficiaries falls very considerably, the resources at the disposal of the Trust will not permit any additions to the amount at present given by way of assistance in the several faculties.

The report on the work of investigators under the research schemes during the year referred to Miss E. M. Gorgeson's work on the flow of fluids through perforated tubes and through tubes the walls of which offer little resistance to diametrical expansion. Tribute is paid to the achievements of Dr. Hwan-Wu-Peng in a new approach to the quantum theory of fields. Researches in geology, palæontology and geography have been still more restricted, and during the period, scholars in chemistry, with few exceptions, held their scholarships in suspense pending a return to academic studies. Reference, however, is made to Mr. A. M. Mathieson's work on the comparison of the structure of certain sulphur compounds, to Mr. A. C. Docherty's work on thermal diffusion in liquids and related systems and to Mr. W. Graham's discovery of a greatly improved method of obtaining a degradation product of colchicin of primary importance in relation to the structure of this alkaloid, and his synthesis of a new hydrocarbon with five condensed benzene nuclei attained by fusing an additional benzene ring on to the chrysene molecule.

In the Biological and Medical Sections reference is made to Dr. G. Pontecorvo's work on the behaviour of the chromosomes of the germ cells in securing transmission of the normal hereditary constitution, while yet providing for transmission of slight intrinsic variations of the genes, which afford the opportunity for the operation of natural selection and thus for the possible production of mutant forms. Dr. L. Auber continued to investigate the influence of physical and chemical factors upon the meal moth, and Mrs. C. M. Ritchie her investigations on carbohydrate metabolism in collaboration with Dr. H. W. Kosteritz. A list of publications by fellows and scholars and recipients of grants received from September 30, 1943, is appended.

The report of the Laboratory of the Royal College of Physicians, which includes some reference to Dr. Edith K. Dawson's investigations on the sarcoma of the breast and on another rare neoplastic condition. In the field of biochemistry under Dr. W. O. Kermack important progress has been made in the synthesis of various *o*-phenanthroline derivatives substituted in the 2-position by basic side-chains similar to those present in such active compounds as mepacrin or plasmoquin, and effort has now turned to the synthesis of *o*-phenanthrolines substituted in the 9 or 10 position. Mr. Jacomb has concentrated on the preparation of analogous compounds to give *p*-phenanthroline derivatives with a basic side-chain in position 9 or 10 on the benzene ring instead of in the 2-position. 9-Bromo-*p*-phenanthroline has been prepared and