been largely limited to a description of the background and planning of the investigation. The results so far available are preliminary ones, but those which are of general interest will be published from time to time.

It is impossible to acknowledge in detail the help and encouragement which are forthcoming from so many people. Without this co-operation, however, it would obviously be impossible to conduct the investigation, which can safely be said to represent a good example of a large-scale, co-operative experiment in the field of occupational hygiene.

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NUCLEAR RADIATION MEASUREMENTS DURING THE INTERNATIONAL GEOPHYSICAL YEAR

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THE development in the field of nuclear physics in recent years has indeed been remarkable. Not only has our understanding of the principles of nuclear reactions been vastly increased, but refined techniques for identifying and measuring radioactive isotopes in exceedingly small amounts have also been developed. These latter methods have been of great use in biological and medical studies; of late they have been applied to geochemistry, and are now finding their way into geophysics. A new and powerful tool for studies of our environment has thus been placed at the disposal of the Earth scientists, the ultimate possibilities of which we cannot judge to-day. It is highly desirable that the great promise of this field be realized and a global observational programme formulated, particularly in view of the intimate world-wide co-operation in all fields of geophysics during the International Geophysical Year 1957–58.

A number of natural radioactive elements are found in Nature, the existence of which has told us interesting facts about, for example, the history of the Earth, the exchange processes in the atmosphere and the sea as well as through the interfaces between these media. Thus determinations of beryllium-10 in deep-sea sediments may be of importance for studying the chronology of the bottom floor; the distribution of the much more rapidly decaying isotope beryllium-7 might yield interesting information about the horizontal large-scale mixing in the atmosphere. Determinations of carbon-14 in the sea and atmosphere have given much more precise knowledge about the exchange of carbon dioxide between the atmosphere and the ocean, and may very likely tell us something about the speed of circulation of the deep ocean. Similarly, studies of the radium and ionium content of the deep sea throw some light on the water motions in the bottom strata of the deep sea. A number of investigations of radium and thorium and their daughter products have given us better knowledge of exchange processes in the surface layers of the atmosphere.

In the past twelve years an increasing number of radioactive elements have been introduced into the atmosphere through nuclear weapon tests. In a thermo-nuclear explosion more than one hundred different radioactive isotopes are formed directly or indirectly. Most of these isotopes were previously not present in measurable amounts in Nature, while in other cases this new source means a contamination of the natural reservoirs of radioactive elements. Thus the amount of tritium in the atmosphere, sea and lake waters has significantly changed due to these experiments. It may, therefore, now be difficult to determine precisely the amount of tritium on the Earth that is of natural origin. On the other hand, the variable input of tritium by man into the atmosphere, and its propagation in the water-cycle, will probably yield interesting information about this cycle itself, that might have been difficult to find using only the naturally formed tritium. Other radioactive isotopes produced by nuclear weapon tests are strontium-90 and cæsium-137, the distribution of which has already revised our ideas about the vertical exchange in the stratosphere, and most likely will be of great importance for the study of the general circulation of the atmosphere.

Already measurements of the total amounts of man-made radioactivity deposited on the ground have shown remarkable variations. Meteorologists might earlier have thought of the motion of the atmosphere as a large-scale turbulent process, but observations of the radioactivity of the air reveal details that would have been very difficult to obtain by any other method.

In view of the large observational programme in all fields of geophysics during the International Geophysical Year 1957–58 it seems highly desirable also to organize a programme for observations of radioactive elements in Nature. Quite a large observational network for measuring the radioactivity of the air and the deposited radioactivity has been reported to the United Nations, but the question of health hazard has been the main objective in the organization of these observations. It seems that the purely geophysical and geochemical aspects of the problem deserve a much more detailed examination. Recognizing this the Special Committee for the International Geophysical Year (CSAGI) in September 1956 endorsed a recommendation that a programme be formulated for measuring, on a world-wide basis, the nuclear radiation of air and precipitation and of solid particles deposited on the ground. Based on this recommendation a Working Group on Nuclear Radiation met at Utrecht during January 22–26.

The programme adopted by the Special Committee for the International Geophysical Year should be looked upon as a minimum programme. In view of

the short time available for preparations before the beginning of the International Geophysical Year it was felt most important to start a basic programme which might then gradually be expanded. It is quite clear that most of the observations suggested should continue after the end of the International Geophysical Year, and therefore observations starting during the Geophysical Year would be of great value to future work in this field. Furthermore an Advisory Committee on Nuclear Radiation has been appointed to co-ordinate these efforts. This may be even more necessary here than in other disciplines, partly because of the short time still available for preparations, and partly because the programme covers a number of different fields in geophysics, such as cosmic radiation, meteorology, oceanography and glaciology. The chairman of the Advisory Committee is Dr. W. Bleeker, of the Royal Netherlands Meteorological Institute, de Bilt. It was also considered important to keep in close contact with the United Nations Special Committee and the World Meteorological Organization on this subject.

Essentially four observational programmes were outlined in the recommendations from Utrecht.

Measurements at ground-level of: (*a*) particulate airborne fission products; (*b*) the deposition of fission products in precipitation and as dry deposits; (*c*) the natural radioactivity of the air.

In the first place the programme aims at measurements of the total activity of air and precipitation, which would be of considerable interest, for example, as identifiers of air-masses. Where technical facilities exist for more detailed analyses of the samples the following isotopes were considered as of particular interest to the geophysicist, namely, strontium-89 and 90, cæsium-137, bismuth-210 and polonium-210.

Observations of radioactivity of the air in the free atmosphere. It is clearly realized that one can scarcely expect a fully world-wide network to be established for the International Geophysical Year. A knowledge of the distribution of the radioactivity in the free atmosphere is, however, of fundamental importance for a correct interpretation of the fall-out pattern at ground-level. Even a small number of additional measurements would be of great value in this respect, and would thus supplement the programme of measurements at ground-level. Furthermore one may hope to achieve a more complete network at an earlier date by extending international collaboration at the present stage.

Measurements of the tritium content of water before nuclear weapon detonations, for determination of the natural distribution of tritium. The water cycle in Nature is of great interest from many points of view. Tritium offers an excellent possibility for studying this cycle in more detail. In particular the speed of circulation within and between the different reservoirs may be determined. The natural distribution of tritium is poorly known, since nuclear weapon tests have thrown considerable amounts of tritium into the atmosphere. It should be possible, however, to establish the 'pre-atomic' tritium distribution by analysing glacier ice which has not been contaminated by melting. In middle latitudes wine bottled before 1945 should yield representative figures.

Determination of carbon-14 and tritium in the oceans at the surface and if possible at greater depths. Interesting results have recently been obtained about the circulation of the ocean and the exchange between the ocean and the atmosphere of carbon dioxide and water. These results are based upon very few measurements, and it is doubtful if these are truly representative. A world-wide programme for such measurements would be of very great interest both to oceanographers and meteorologists.

Some of the scientists actively engaged in applying these new techniques to geophysical problems may regard the programme outlined above as too limited. It may, nevertheless, be difficult to achieve even this modest goal during the International Geophysical Year. It is therefore necessary to look upon this programme as a first attempt to arrive at international co-operation among geophysicists in the field of nuclear radiation. Geophysicists would profit greatly from such a development. Equally important, however, is the recognition of the fact that geophysicists are needed for the best utilization and interpretation of the nuclear radiation data that until now have been collected essentially by physicists. We should be looking forward not only to international co-operation but also to interscientific co-operation.

OBITUARY

Lord Clinton, P.C., G.C.V.O.

The age of the great landlords of Britain is passing. Heavy taxation limits their activities during life, and death duties break up their estates after they die. But the countryside, agriculture and forestry owe much to these men for their devotion to their estates and their work to improve methods of farming and management of woods.

Lord Clinton, who died recently in his ninety-fifth year, was one who contributed much. It is true that he does not leave behind him a name such as "Turnip" Townshend or Coke of Norfolk, or possibly even that of his friend and colleague Sir John Stirling Maxwell, who introduced modern methods of tree planting. But he was a great landowner owning very large properties in Devon and with estates in Scotland. He devoted his life to the management of those estates, and, except for an interlude when he served with the Devon Yeomanry during the First World War, all his activities were concerned with the land he loved and understood so well.

His personal interest in his estates was such that in effect he managed them himself, extensive though they were. But forestry was probably his greatest interest in land use, and at a time when there was no great encouragement to private forestry he managed his extensive woodlands in the light of the most modern knowledge at the time. His personal interest may perhaps best be shown by the fact that whenever possible he made a practice of marking his own thinnings.

For a short while after the First World War he was Parliamentary Secretary to the Ministry of Agriculture. But with the passing of the Forestry