but I submit that the two points stated above afford a solution of these unidentified rings more probable than the ascription of Z-haloes to undiscovered and unlikely radioactive products and, as S. Rosseland (*NATURE*, 109, 711; 1922) suggested, of hibernium to an element of atomic number approximately 40.

If these views are correct, the disintegration series are partly extended to the element mercury; hibernium is identified as thorium- Ω (or one of the two thorium- Ω 's); the half-value period of actinium- Ω calculated from Geiger and Nuttall's relation is of the order of 10^{16} years.

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Christ Church, Oxford,
Sept. 16.

Changes in Herring Shoals.

AFTER the War, extended herring investigations were commenced at Cullercoats, and since 1919 there has been a continued series of observations as to the size, age, sexual development, and growth of the fish from some of the most important shoals in British waters. It is possible to point to three well-defined changes in the shoals; and the evidence from growth data indicates that these have been brought about by migration. There is a possibility that these migrations have been due to hydrographic conditions.

Towards the end of 1920 there was a movement of some of the North Sea herrings to or towards oceanic conditions. This movement was continued in 1921, in which year the whole of the east coast fishery was a failure (*Reports, Dove Marine Laboratory*). The years 1920-21 were marked by an abnormal invasion of Atlantic water into the North Sea. In 1923 the migrants of 1920-21 returned as spring spawners to the grounds off the north of Scotland and about the Shetlands; some few made their way so far south as the Berwickshire coast. Their scales showed a North Sea growth for the first three years and an oceanic growth for 1921-22. In the same year old fish, six winter rings and more, practically disappeared from the shoals of the north of Scotland, Shetlands, East Anglia, and north-west Ireland; the scales of fish from Howth, the Smalls, and St. Ives indicated extended migrations (*ibid.*). The white fishery was poor on practically all our fishing grounds.

Johansen directs attention to an abnormally strong inflow from the Skager Rack to the Kattegat in the spring of 1923 (*Jour. Con. Per. Inter. Explor. de la Mer*, vol. 1, No. 2) and to increased catches of mackerel from Danish waters (*Medd. Komm. Havund.*, Fisk., Bd. 7, No. 8). Watkins, in his report on Cardigan Bay shoals, quotes Lloyd as to the invasion of Cardigan Bay by oceanic forms in the summer of 1923.

In January 1926, extraordinary numbers of young fish (1924 year-class) appeared off north-west Ireland, and trade papers reported the invasion of the lochs of western Scotland by shoals of small size and poor quality. About the north of Scotland, the 1920 year-class and younger fish failed to appear in sufficient numbers to make anything but a poor spring fishery, and the same applies to the Berwickshire coast (*Repts., Dove Mar. Lab.*). In August there was an exceptionally good fishery off the Northumberland coast. Following this we have to note a marked difference between the shoals of north-western Ireland and northern Scotland in the early months of 1927. Previously the relative values of the different year-classes were the same for these grounds, but now the 1923 year-class is predominant about northern Scotland and that of 1924 about north-western Ireland. In Shetland waters the year-

classes which had been good previously are now poor, and the poor year-classes are good. This is illustrated by the age composition of two samples given below.

WINTER RINGS (PERCENTAGES).

Date.	3.	4.	5.	6.	7.	8.	9.	10.	10+	Total.
Feb. 27, 1926 . .	12	2	4	35	7	36	3	—	1	178
Mar. 5, 1927 . .	+	36	7	17	8	21	8	—	1	190

The Northumberland shoals have been marked this year by abnormally high percentages of fish with 2 winter rings. They are a year younger than usual. Reports from friends in the herring trade state that from Wick to below Scarborough the fish have been small. It will be of interest to see if the East Anglian fishery is marked by large numbers of young fish in October and different relative values of the older year groups later in the season.

It is evident that the herrings have been swimming differently and the large catches of salmon off the Tyne 1926-27, and the taking in August off the Tyne of cod more than 40 lb. when gutted, suggest that other fish have been doing the same.

The *Dana* in August 1926 took 297 larval eels from the southern part of the Faroe-Shetland channel, and Schmidt (*Jour. Con. Per. Inter. Explor. de la Mer*, vol. 2, No. 1) gives these an age of $2\frac{1}{4}$ to $2\frac{1}{2}$ years. The International Ice Patrol reported for 1924 an absence of ice and fog, warmer water than usual— 5° to 6° F. above normal in March—over the Grand Bank Region, and for the first time a complete cessation of the flow of Arctic water southward along the east side of the Bank during the ice season. The *Annual Report*, Department of Marine and Fisheries, Newfoundland, 1924, states that Labrador cod were on the grounds before the fishermen were ready, and that whilst the southern Labrador cod fishery was poor, that of northern Labrador was excellent. Huntsman ("The Ocean around Newfoundland") records exceptionally warm water over the Grand Bank early in the season of 1924, cod farther in than usual on the banks off Nova Scotia, large quantities of haddock close inshore off Nova Scotia and New Brunswick, the failure of the cod fishery of the Belle Isle region, and the capelin farther north on the Labrador coast than ever before. Jensen ("On the Fishery of the Greenlanders") records for 1924 the presence of great quantities of large cod in Davis Strait in June, great shoals of small cod off western Greenland at the end of summer, and for the first time in seventeen years the presence of *Gadus virens* in Greenland waters. From the statistics of the cod fishery given by Jensen, it would appear that in 1924 the cod population of western Greenland split, one half going north, the other south.

There is evidence that in 1924 the fish of the north-western Atlantic were swimming differently and that their movements were influenced probably by hydrographic conditions. The connexion between the happenings on the other side of the Atlantic in 1924 and changes in British waters, indicated by the herring shoals as beginning early in 1926, is perhaps worthy of consideration.

At present the chain of events would appear to be as follows: An abnormal activity of oceanic waters in 1920-21 probably due to lunar influence; a cumulative effect or a rebound from the Arctic accounting for the happenings of 1923; the production of a mild Arctic winter, 1923-24; a diminution of cold currents entering the north-west Atlantic in the spring of 1924, followed by changes in the north Atlantic warm currents which influenced British waters and fisheries early in 1926. B. STORROW.

Dove Marine Laboratory,
Cullercoats, Sept. 24.