The concentration of uranium, thorium and potassium in the outer layers of the Earth must have occurred during its very early history (whether a hot or cold origin is postulated), the thickness of this outer layer being a few hundred km. The mantle under the oceans is thus presumably 'primeval', while that under the continents is 'anomalous'. However, the continents were formed, whether initially or whether, as advocated by Wilson[3], for example, they have grown from nuclei throughout geological time drawing their material from the mantle, the fact remains that the constitution of the upper part of the mantle is at present very different beneath the oceans and beneath the continents. It is this fundamental difference that makes it very difficult to see how continental drift can have occurred —unless the continents drag the upper few hundred km. of the mantle along with them, which seems extremely unlikely.

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Isotopic Distribution in a Greenland Iceberg

The heavy-oxygen content in the ice of the Greenland ice cap is extremely low[1-3]. This is part of a common feature showing decreasing $H_2^{18}O$ content in fresh water when going towards a colder climate[1].

At a given location the seasonal variation in temperature causes a similar variation in the heavy-oxygen content of the precipitation[3,4]. On the Greenland ice cap, where the precipitation accumulates, this latter variation has been refound by investigation of stratigraphical series of snow and ice samples from a borehole 400 m. deep[3]. Parallelism between the deuterium and oxygen-18 content has been shown in snow samples from the Greenland ice cap[5]. The present work shows this parallelism to be conserved in the ice during several hundred years.

The samples investigated were collected during the North American Arctic Institute Greenland Expedition 1958 headed by Dr. P. F. Scholander. The deuterium analyses were made at Centre d'Etudes Nucléaires de Saclay by the technique described in ref. 6, while the oxygen-18 measurements were carried out at the University of Copenhagen by the technique described in ref. 7.

The samples were all taken from one piece of ice emitted from the Ingnerit glacier in West Greenland (70·9° N.). This piece was part of a larger amount of ice the average age of which has been determined by Scholander and co-workers by means of the carbon-14 method using the technique described in erf. 8. The piece of ice in question was white with mostly round bubbles. Three parallel layers of clear ice were situated 33 and 25 cm. from each other. The samples were taken along a line perpendicular to these layers.

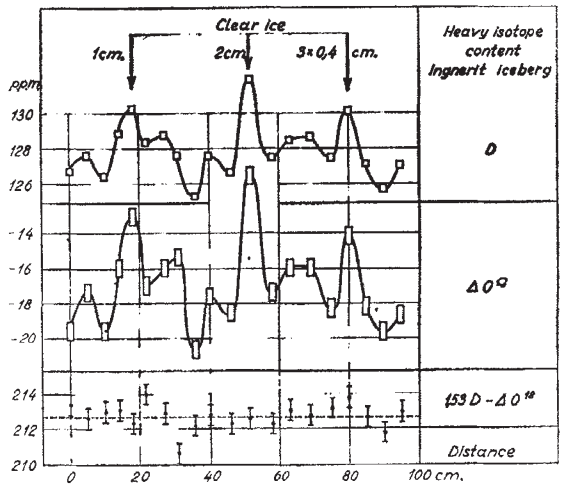

Fig. 1

In Fig. 1 the deuterium content (D) and the deviation of the oxygen-18 content (ΔO^{18}) of the sample from a standard are plotted in units of p.p.m. against the distance of the sample from an arbitrary zero point. In the lower part of Fig. 1 the relation between D and ΔO^{18} is seen to be linear within the measuring accuracy. With the use of our particular standard for oxygen-18 the linear relation is $1{\cdot}53\,D - \Delta O^{18} = 212{\cdot}7$. This shows complete parallelism between the variations in deuterium and oxygen-18, and, furthermore, conservation of isotopic anomalies in the ice during several hundred years.

The highest heavy isotope contents are found in the parallel layers of clear ice probably originating from summer-melting at the time of formation of the ice. This is due to evaporation from the wet snow; the light isotopic component of the water being the most volatile one.

We wish to thank Dr. P. F. Scholander and Dr. J. Koch for their interest in the work. The project was sponsored by the Arctic Institute of North America with principal support from the U.S. Office of Naval Research. Financial support was also granted by Statens almindelige Videnskabsfond, Copenhagen.

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