THE RISE OF TEMPERATURE ASSOCIATED WITH THE MELTING OF ICEBERGS.

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In a letter to Nature, published in the issue of December 1, 1910, I showed by means of microthermograms taken on a trip to Hudson's Straits that an iceberg melting in salt water produces a rise of temperature. The experiments were performed on the Canadian Government steamship "Stanley," and indicated that when approaching ice a rise of temperature occurred followed by a rapid fall of temperature a quarter of a mile abeam of the 'berg.

During the past summer I had an opportunity of examining in detail the temperature effects of icebergs. The Canadian Government placed its steamship "Montcalm" at my disposal for the tests, and three weeks were spent through the Straits of Belle Isle. Careful records were made of the temperature effects of icebergs and land. These tests have shown conclusively that it is the rise of temperature which is the direct action of the melting iceberg, and that when a fall of temperature is observed near ice it is due to the action of a colder current in which the iceberg is floating, and is not due to the cooling influence of the ice. Cooler currents may exist throughout the Arctic Current, whether accompanied by ice or not, but the presence of the ice causes a zone of warmer water to accumulate for a considerable distance about it.

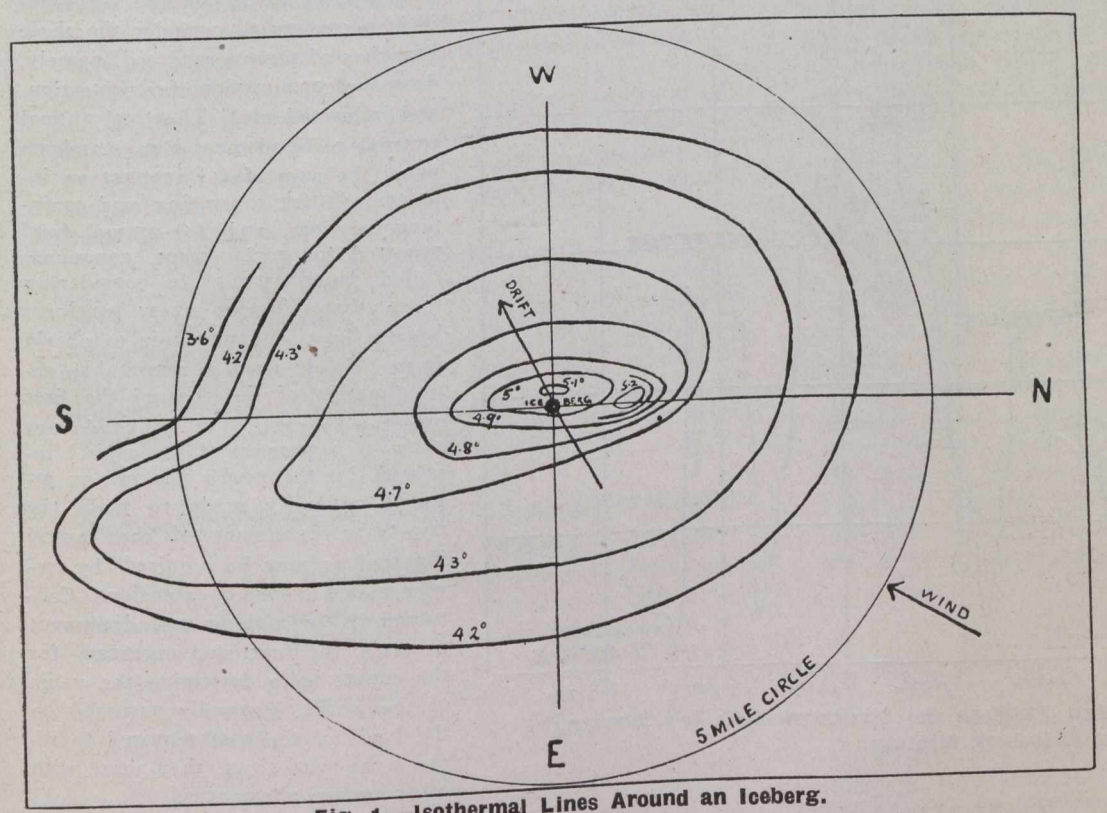

Fig. 1.—Isothermal Lines Around an Iceberg.

The icebergs I studied in the Straits of Belle Isle and off the eastern end of the Straits in the Labrador Current showed no appreciable cooling, even within a few yards of them. The rise of temperature approaching an isolated 'berg was somewhat over two degrees Centigrade. In Fig. 1 I show the isothermal lines about a typical 'berg off the eastern end of the Straits of Belle Isle. This diagram was obtained by arranging a number of courses for the ship from all sides up to a radius of six miles.

As a good illustration of how icebergs and groups of icebergs affect the water temperature I show a micro-thermogram in Fig. 2, taken from the records made passing westward through the Straits of Belle Isle. In every case the approach to ice caused a rise of temperature.

The explanation of this effect which I gave at my Friday evening discourse at the Royal Institution last May was founded on Pettersson's theory of ice melting in salt water. By this theory, which can easily be verified by a simple experiment, ice melting in salt water produces three currents: (1) A current of salt water cooled by the ice which sinks downward by gravity; (2) A current of warm salt water flowing towards the ice; and (3) A current of light fresh water from the ice rising and spreading out over the surface of the salt water.

I at first thought that it was this surface current of fresh water that influenced the microthermometer. The fringe of this lighter water would be warmer than the sea water on account of the action of the sun and scattered radiation, which is very strong at sea. The lighter water would retain the heat because it could not mix readily with the sea water. Near the iceberg I considered that a fall of temperature would result from the cooling influence of the surface current of fresher water.

My recent tests have shown, however, that an iceberg melts so slowly that no effect of the dilution can be detected, even right beside the berg. I took a number of samples of sea water at different distances from icebergs as well as samples taken far from ice. These samples I carefully bottled and brought home to the laboratory, where they were most accurately tested by the electric conductivity method in the Physico-Chemical Department by Dr. McIntosh and Mr. Otto Maass. No possible error could result in this way, and the tests, being carried out at a constant temperature under the most favorable circumstances, there is no reason to doubt their correctness. The comparison shows no dilution due to the icebergs, which goes to show how quickly the melted water from the 'berg is mixed with the sea water. Larger variations were found at different parts of the sea than were obtained in the proximity of ice.

It is evident that an iceberg in melting causes only two of the Pettersson currents, i.e., a cold current which sinks downward carrying with it all the melted ice water, and a horizontal surface current of sea water flowing in towards the ice to cause its melting. By this means we should expect the sea in the immediate proximity of icebergs to be warmer than further away, because the sea surface current is moving in towards the 'berg and does not share in the normal vertical circulation which tends to keep the sea surface temperature cooler.

The iceberg, in causing its own current of warmer water, provides for its own disintegration. Abundant evidence is at hand to show the melting process going on under the water line.