Sir John Murray & Johan Hjort, The Depths of the Ocean: Scientific Researches of the Norwegian Steamer Michael Sars (1912)

increases, and by this process some heat is taken up which is drawn from the liquid, lowering its temperature. When, therefore, a water-sample is drawn up in an insulating water-bottle from a depth of 1000 metres, the temperature of the water-sample sinks a little. Nansen first called attention to this fact, and has drawn up tables for the corrections according to Lord Kelvin's formula. The corrections prove to be quite considerable. When employing an insulating water-bottle, account must be taken, not only of the alteration of volume in the water-sample, but also of that taking place in the solid parts of the water-bottle. A water-sample, for instance, brought up in an ordinary-sized Pettersson-Nansen water-bottle from a depth of 1000 metres in the Norwegian Sea, is cooled 0.06° C. while being hauled up; a sample from the same depth in the Mediterranean is cooled 0.17° C. This difference is due to the fact that the amount of cooling depends on the temperature of the water, which at 1000 metres in the Norwegian Sea is about −1° C. and in the Mediterranean +13° C.

We are here confronted with a problem of considerable interest. When a body of water sinks from the surface down to great depths, its temperature rises a little because of the compression. The "bottom-water" of the Atlantic Ocean averages nearly $2\frac{1}{2}$° C.; supposing that it has sunk from the surface to a depth of 3000 metres, it has been heated about 0.27° C. in the course of its descent, by reason of the increasing pressure. If it should appear at the surface again, the reduction of pressure will have lowered the temperature by the same amount,—0.27° C. There are various other conditions which produce changes in the temperature, as, for instance, mixing with other bodies of water, in the upper layers absorption of solar heat, near the bottom possibly a very slight influence from the internal heat of the earth. It is, of course, difficult in such a combination of factors to single out the effects of one of them individually.

During the "Michael Sars" Expedition in the North Atlantic we made a certain number of observations in the deeper layers with a Richter reversing thermometer, which seemed to prove in several cases that the temperature increased slightly towards the bottom. The following extract from the "Michael Sars" tables shows the number of the station, the depth, the temperature (measured *in situ*), and the temperature that the water would acquire—on account of the reduction of pressure—if it were raised to the surface. The latter

http://19thcenturyscience.org/HMSC/HMSC-Reports/1912-Murray/README.htm