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CH. SORET. - On the equilibrium state of the concentration field obtained by an initially homogeneous saline solution held at different temperatures at either end; *Archives de Genève*, 3^o période, t. II, p. 48; 1879.

Mr. Soret has proposed to resolve experimentally the following question: "Given an originally homogeneous solution, contained in a vertical cylindrical tube, the upper part of which is maintained at a high temperature and the lower part at a lower one, will the concentration remain uniform?" To this end, he has employed tubes the slim upper parts of which were heated inside a thin hollow copper sleeve placed in a boiler, while the lower parts, thin and bent, were submerged in cold water. These tubes were filled in the fashion of thermometers, in such a manner as not to contain any air bubbles and, when the experiment was terminated, were emptied by breaking the lower end, then the upper end, and recovering in three flasks the lower, middle, and upper portions of the liquid. It was consistently found that the cold part was the most concentrated, and more so as the initial concentration was increased.

To interpret this result, Mr. Soret supposes that the amount of salt traversing in a time dt a unit horizontal surface depends only on the state of the solution on either side of this plane. That is, designating by x the distance to a horizontal plane taken as the origin, by τ the temperature, and by q the concentration, this quantity is a function solely of q , τ , dq/dx , and $d\tau/dx$. As elsewhere, it is assumed that the flux vanishes for $dq/dx = 0$ and $d\tau/dx = 0$, and changes sign with these quantities, so that this flux may contain only odd powers of these derivatives and must reduce, at least to a first approximation, to $\alpha dq/dx + \beta d\tau/dx$, α and β being functions of q and τ . The equation governing the diffusion is then easily obtained¹:

$$\frac{dq}{dt} = -\frac{d}{dx} \left(\alpha \frac{dq}{dt} + \beta \frac{d\tau}{dx} \right). \quad (1)$$

Until now, only the case where the temperature is constant in the entire mass of liquid has been studied. In that case, the evolution equation becomes

$$\frac{dq}{dt} = -\alpha \frac{d^2q}{dx^2} - \frac{d\alpha}{dq} \left(\frac{dq}{dx} \right)^2. \quad (2)$$

Experience establishes, as is known², that the second term of this expression is approximately negligible.

In the case explored by Mr. Soret, the final equilibrium is defined by the equation

$$\alpha \frac{dq}{dx} + \beta \frac{d\tau}{dx} = 0; \quad (3)$$

β is a second diffusion coefficient that plays with respect to the temperature the same role that the ordinary diffusion coefficient α plays with respect to the concentration. Denoting by ρ the density of the liquid, the quantity β/ρ^2 is shown by Mr. Soret's experiments to grow rapidly with concentration, but is still very weak by comparison with α .

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¹This is obtained, analogously to the ordinary diffusion equation $\frac{dq}{dt} = -\alpha \frac{d^2q}{dx^2}$, by writing the quantity accumulated in a slice of thickness dx during a time dt as the difference between the quantities of salt traversing the two bounding planes.

²See for example the experiments carried out by Weber (*Journal de Physique*, t. IX, p. 338:1880).