"The Origin and Growth of Ripple-Mark." By Mrs. Hertha Ayrton. Communicated by Professor W. E. Ayrton, F.R.S. Received April 21; received in revised form May 26,—Read June 16, 1904.

(Abstract.)

The object of the investigation was to determine how ripple-mark started in perfectly smooth sand, apart from accidental variations of surface friction; how the ripples grew; how the amplitude and depth of the water affected them; and whether there was any connection between ripple-mark and kindred phenomena, such as the dust figures in a Kundt's tube.

In the course of the investigation the causes, form, and mode of action of "ripple vortices" in the water were determined, and the fact that no vortices of this kind can form in a current flowing steadily in one direction *over* an obstacle was demonstrated, both theoretically and practically. Also many minor details came to light, such as the fact that each ripple is continually travelling, as a whole, and why it does so.

As regards the starting of ripple-mark, it was found that a single ridge forms, on perfectly smooth sand, wherever the water happens to have the same place of maximum longitudinal velocity during several oscillations. That as soon as this ridge is high enough (less than a millimetre is sufficient), the water, in flowing over it, forms a spiral vortex with horizontal axis, which starts a new furrow and ridge in the lee of the first—on one side during one swing and on the other side during the next. That the vortex that forms in the lee of each of these two ripples in turn originates a new ripple there, and that in this way, fresh ripples are begun with each succeeding swing of the water till the whole sand is ripple-marked.

It was shown that the "ripple vortices" only came into existence during the time when the water was rising above the mean level, and the causes and manner of formation of the vortices were given.

It was found that when the place of maximum horizontal velocity was constant, not merely for several oscillations, but for a considerable time, as at the loop, for horizontal motion, of a stationary wave, the ridge mentioned above grew into a ripple-marked heap which was highest at the loop and lowest at the nodes. By oscillating water in the simplest possible way, *i.e.*, so that it alternately rose and fell at one end of the trough while it alternately fell and rose at the other, a stationary wave having its length twice the length of the trough was obtained, and in this case a ripple-marked mound arose of which the apex was at the middle of the trough—one loop of the wave—and

the lowest parts were near the ends—the two nodes. When the stationary wave was of the same length as the trough two mounds arose, one near each end, and so on.

It is suggested that the tidal ridges in estuaries and the chains of sand banks under the sea are formed in this way, by stationary or nearly stationary water waves, and that the sand dunes of the sea-shore and of the desert, and the clouds in a "mackerel sky" may be similarly the products of stationary air waves.

"The *Rôle* of Diffusion in the Catalysis of Hydrogen Peroxide by Colloidal Platinum."

By GEORGE SENTER, Ph.D., B.Sc. (Lond.). Lecturer on Chemistry at St. Mary's Hospital Medical School. Communicated by Sir WILLIAM RAMSAY, K.C.B., F.R.S. Received March 7,—Read March 30, 1905.

According to a theory of reaction-velocities in heterogeneous systems recently put forward by Nernst,* the observed velocities are those with which diffusion and convection renew the reacting material at the boundary of the two phases, the actual chemical change at the boundary being very rapid in comparison. Nernst is of opinion that the same considerations apply to the catalytic decomposition of hydrogen peroxide by colloidal platinum and similar substances, but has not gone fully into the discussion of this particular class of heterogeneous reactions.

In a recent paper on the effect of poisons on the catalysis of hydrogen peroxide by hæmase,† I have discussed the probable mechanism of catalysis by colloidal particles, and have arrived at the conclusion that the experimental results obtained by Bredig and his pupils and by myself are best accounted for on Nernst's hypothesis.

In an important paper on this subject, Sand,‡ starting from certain assumptions regarding the size and nature of the particles in a colloidal platinum solution, has calculated the minimum value of the velocity-constant (which we may call K_D) to be expected on Nernst's hypothesis, and finds that it is at least 16 times as great as the velocity-constant obtained experimentally by Bredig.§ Hence, he concludes that Nernst's hypothesis does not apply to this particular reaction; the observed velocity is really that of a chemical action.

* 'Zeitschrift für physikal. Chemie,' vol. 47, p. 52, 1904.

† 'Roy. Soc. Proc.,' vol. 74, p. 201, 1904.

‡ 'Roy. Soc. Proc.,' vol. 74, p. 356 (1905).

§ Bredig and Müller von Berneck, 'Zeit. für physikal. Chemie,' vol. 31, p. 258, 1899; Bredig and K. Ikeda, 'Zeit. für physikal. Chemie,' vol. 37, p. 1, 1901.