THURSDAY, SEPTEMBER 23, 1880

THE PHOTOPHONE

EARLY in the summer of the current year it was announced in the columns of NATURE that Prof. Graham Bell had made a discovery which, for scientific interest, would rival the telephone and phonograph, and that he had deposited in a sealed packet, in the custody of the Smithsonian Institute, the first results of his new researches; that announcement has now received its due fulfilment in the lecture by Prof. Bell to the American Association for the Advancement of Science, on Selenium and the Photophone, which will be found on another page. In spite of those who ingenuously attempted at the time of our announcement to forestall Prof. Bell and to discredit the idea that he had done anything new, the discovery, which he has now published, is a startling novelty. The problem which he has attacked is that of the transmission of speech, not by wires, electricity, or any mechanical medium, but by the agency of light. The instrument which embodies the solution of this principle he has named the Photophone. It bears the same relation to the telephone as the heliograph bears to the telegraph. You speak to a transmitting instrument, which flashes the vibrations along a beam of light to a distant station, where a receiving instrument reconverts the light into audible speech. As in the case of that exquisite instrument, the telephone, so in the case of the photophone, the means to accomplish this end are of the most ridiculous simplicity. The transmitter consists of a plane silvered mirror of thin glass or mica. Against the back of this flexible mirror the speaker's voice is directed; a powerful beam of light is caught by a lens from the sun and directed upon the mirror, so as to be reflected straight to the distant station. This beam of light is thrown by the speaker's voice into corresponding vibrations. At the distant station the beam is received by another mirror, and concentrated upon a simple disk of hard rubber fixed as a diaphragm across the end of a hearing-tube. The intermittent rays throw the disk into vibration in a way not yet explained, yet with sufficient power to produce an audible result, thus reproducing the very tones of the speaker. Other receivers may be used, in which the variation in electrical resistance of selenium under varying illumination is the essential principle. The experimental details have been worked out by Prof. Bell in conjunction with Mr. Sumner Tainter. They have discovered that other substances beside hard rubber, gold, selenium, silver, iron, paper, and notably antimony, are similarly sensitive to light. This singular production of mechanical vibrations by rays of light is even more mysterious than the production of vibrations in iron and steel by changes of magnetisation. It was indeed this latter fact which led the discoverers to suspect the analogous phenomenon of photophonic sensibility in selenium and in other substances. Hitherto, in consequence of the mere optical difficulties of managing the beam of light, the distance to which sounds have been actually transmitted by the Photophone is less than a quarter of a mile, but there is

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no reason to doubt that the method can be applied to much greater distances, and that sounds can be transmitted from one station to another wherever a beam of light can be flashed; hence we may expect the slow spelling out of words in the flashing signals of the heliograph to be superseded by the more expeditious whispers of the Photophone.

We congratulate Prof. Bell most sincerely on this addition to his well-won laurels, and venture to predict for his photophone a great, if not a widely-extended, future of usefulness.

SILVANUS P. THOMPSON

THE GEOLOGY OF LONDON

Guide to the Geology of London and the Neighbourhood. (An Explanation of the Geological Survey Map of "London and its Environs," and of the Geological Model of London, in the Museum of Practical Geology.) By William Whitaker, B.A., F.G.S. Third Edition. (London: Longmans and Co. and Edward Stanford, 1880.)

SINCE the appearance of the second edition of this most useful little work, some valuable additions have been made to our knowledge of the rocks which underlie the London Basin. The deep borings at Turnford, near Cheshunt, and at Ware, which were executed by the New River Company in 1879, have furnished new data to geologists for determining the position and characters of that great underground ridge of palæozoic rocks, the probable existence of which was so long ago indicated by Mr. Godwin-Austen. This underground ridge of palæozoic rocks has now been reached in no less than six borings, those of Kentish Town, Harwich, Crossness, Meux's Brewery, Turnford, and Ware. In four of these cases the age of the rocks which have been found unconformably underlying the Cretaceous strata is placed beyond question, by the discovery of the well-preserved and characteristic fossils, lists of which have recently been published by Mr. Etheridge. At Harwich the cores of dark-coloured indurated shale yielded *Posidonia*, which proved that the rock belongs to the lowest part of the Carboniferous system; at Meux's Brewery and at Turnford the purple shales yielded the characteristic fossils of the Upper Devonian; while at Ware cores were brought up crowded with the well-known fossils of the Wenlock shale.

But in the case of the Kentish-Town and Crossness borings no fossils have been detected in the cores of rock brought up from the infra-cretaceous rocks, and in these cases geologists have had to fall back upon the far less satisfactory evidence afforded by their mineral characters. Under these circumstances there has arisen considerable diversity of opinion as to the age of red, mottled, and variegated strata which have been reached in these two borings. While Prof. Prestwich is inclined to refer the rocks in both cases to the Old Red Sandstone, the officers of the Geological Survey are in favour of regarding them as belonging to some part of the New Red Sandstone or Poikilitic. Mr. Whitaker has so well stated the objections to the view that the rocks at Kentish Town and Crossness are of Old-Red-Sandstone age, that we cannot do better than quote what he says upon the subject:—

"I may here remark that there is a strong reason

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