

as signifying a stream. Leland the Chronicler wrote that "there runneth a praty lake out of Sudeley Parke down by the Castle and runneth into Essebourne Brook at the south syde of Winchcombe." And again: "I passed over 2. or 3. small lakes betwixt Chiltinham and Gloucester and they resort to Severne." The word is still used in some places as meaning a stream; children on the Severn banks still sing of the moon as claiming to guide the ship "up the lake."

The first Lord Avebury, in writing of meanders ("Scenery of England"), mentions, as one of the results, "that the loop often remains as a dead river-channel or mortlake." Such loop-lakes are known in America as "oxbows." There is, however, a great difference. In the case of an "oxbow" the loop, formed by a lateral deviation of the river, has been entirely cut off from the main stream. A mortlake may be defined as the line of a closed part of one of the two sections of a river (previously divided so as to surround an island in the stream), the other channel remaining open and serving as a single channel for the river.

Of the two sections of a river enclosing an island, one of them at least must have a curved line. Two straight lines cannot enclose a space. If, then, the whole or a part of the stream in one of the sections be effaced, the remaining section, now forming the whole of the river, must have a more or less curved line. It must be a river-winding. The form and the length of it will, of course, depend on the shape and on the size of the former island. Thus a result of the formation of a mortlake may be one of those meanders or river-windings which are a familiar and picturesque feature in the landscape. The explanation of them has been a puzzle from classic times until the present. The subject was discussed at length by six contributors to NATURE in November and December, 1907.

I have come to the conclusion that the conversion of river-islands into areas bounded by single streams, more or less curved, is part of the ordinary course of river development. This, in my view, may be briefly stated thus: A newly exposed part of the earth's surface receives the rainfall on every square inch of it, but the water will not flow away in the form of a sheet; minute runnels form, and these will not be in straight lines parallel to each other. I cannot imagine straight "primary consequent streams" as they are sometimes depicted. Even slight obstructions would turn them aside so that they would meet and coalesce, thus forming a miniature network of streams, each of the meshes enclosing an islet. Then the water on the up-stream side of every islet will have alternative routes before it. These routes may, for a time, be equally easy, but they will not continue to be so; one of them will be preferred, and this may not be the most direct. The stream which continues may be the one which meets with the least obstruction, or it may be the one most necessary for continuance as having to receive longer or more numerous tributaries. A channel no longer needed will cease to be used; it will silt up. Then the islet will become continuous with an adjoining islet. This process being many times repeated, islands of increasing size—which may be large and, possibly, of very great extent—will result. Ultimately, they will all cease to be islands, in the absence of need for two channels. The development, in my view, is not from "primary streams" into a "complicated network" of channels, but from the complexity of a network of channels towards the simplicity of one principal stream with tributaries converging towards it. Certain it is that in a river system as we see it there is no network.

I do not wish to suggest that the formation of mortlakes is the only cause of river windings. Thirty-

seven years ago I pointed out (in a paper read before a local society, and printed at the time) the influence of tributaries as one cause; and I recognise others. But the same laws govern the development of all rivers. Although Herodotus found the rivers of Egypt to be different from other rivers, I, in imagination, see the life-history of the Nile as very strikingly depicted in its present course. I have elsewhere shown ("The Lower Severn," Proceedings of the Cotteswold Naturalists' Field Club, xvi., 1909) an outline picture of a thousand miles of the Nile below Khartum compared with one of ten miles of the Severn below Gloucester. The resemblance is so close as to lead to the remark that it almost seemed as if the one figure had been drawn in ink on the second page of a sheet of paper and the other by pressing the ink before it was dry against the opposite page. The size of the two rivers and the character of the rock formations being so very different, it is at least remarkable that the course of the two should be so very much alike. In the *Times* of a recent date (March 15) is a report from Dr. Chalmers Mitchell of his view from an aeroplane in passing above the railway between Wady Halfa and Abu Hamed. He saw "huge cliff-lines submerged at intervals by desert," which suggested the "proper bed" of the Nile. It is really a relic of the time when the area, now partly enclosed by the great sickle-shaped curve of the Nile, was a huge river-island two hundred miles wide and five hundred miles long. That which Dr. Chalmers Mitchell saw was the line of the eastern arm of the Nile; it is now the line of a long mortlake.

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Eiffel Tower Wireless Time-Signals.

It may interest a number of readers of NATURE to know that the Eiffel Tower is at present sending out two additional sets of "scientific" time-signals. The scientific signals are arranged as a time-vernier, gaining about one beat in fifty. They have hitherto been sent at 11.30 p.m. G.M.T., followed at 11.45, after the ordinary time-signal is concluded, by numbers which give the moment of the first and the last signal of the set, according to the standard clock of the Observatory of Paris. A comparison can thus be made with the introduction of a very small error, often not exceeding one-fiftieth of a second. These valuable signals have suffered from two awkward features: In summer time they are inconveniently late, and the purring or snoring note (*ronflée*) on which they are sent is much obscured by atmospheric conditions when the latter are bad, so that sometimes one failed to pick up the identification breaks which occur at the end of every sixty beats.

In addition to the old series, which remain unchanged, two new series are now being sent; these are on wave-length 2600 metres and a high musical note that cannot be confused with atmospheric conditions. Otherwise they are the same as the original—300 dots, the 60th, 120th, 180th, and 240th being suppressed. They are sent: (1) at 10.30 a.m. G.M.T., the comparison numbers giving Paris time following after completion of the 10.45 ordinary signal; and (2) at 11 p.m. G.M.T., the comparison numbers being sent after the 11.45 ordinary signal, along with those which refer to the old 11.30 signal, the two references being distinguished by the letters ML (*musicale*) and RF (*ronflée*) respectively. The new series are beautifully clear, and ought to be of great service to those who require accurate time.

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Royal Observatory, Edinburgh, April 17.