

miles distant. Mr Hampden, with a telescope, placed himself in the water as a bather, with his eye not exceeding eight inches above the surface. The flag and the boat down to the water's edge were clearly visible throughout the whole distance, so that he concluded if the surface of the water had risen as above mentioned, he could not have seen the boat at all. We have neither the space nor the inclination to follow Mr Hampden in the far-fetched theories contained in his volume. Suffice it to say that this gentleman offered to stake five hundred pounds on his theory; and Mr A. R. Wallace accepted the challenge, offering, in like manner, to stake five hundred pounds upon the issue, and agreeing to 'prove the convexity or curvature of the surface of a canal, river, or lake.' The spot chosen was that portion of the Old Bedford Canal between Old Bedford Bridge and Welney Bridge, a distance of six miles in a straight line.

The experiment came off March 5, 1870; and an oblong signal, six feet by three, was placed on Old Bedford Bridge, its centre being thirteen feet four inches above the water. At three miles' distance along the canal (we quote from the report of Mr Carpenter, Mr Hampden's referee), a staff was erected, having a red disc of wood one foot in diameter affixed to it, the centre of which was also thirteen feet four inches above the water; and on Welney Bridge, three miles farther, a third signal was placed, reaching the top of the bridge, thirteen feet four inches likewise above the water. The observations were made by means of a large telescope (four-inch object-glass), and also by means of a sixteen-inch Troughton level, placed in the same position and height above the water as the large achromatic. On the central signal-staff there was a red disc, which was allowed to remain nine feet four inches above the water, or four feet lower than the other.

Now the result was, that in each of these observations, one taken from Welney Bridge, and the other from Old Bedford Bridge, with the large achromatic telescope, the two discs of the central staff appeared in each case above the other bridge, shewing that the signal-staff in the centre was higher, and thus proving the convexity of the water. Similar results appeared with the telescope of a sixteen-inch Troughton level, placed in the same position. The umpires, of course, could not agree, and the editor of the *Field* was called in as referee. He decided that Mr Wallace, by means of the experiment agreed on, has proved to his satisfaction the 'curvature to and fro' of the Bedford Canal to the extent of five feet more or less. He therefore paid Mr Wallace the one thousand pounds that had been lodged at Coutts's Bank.

Mr Wallace, in a letter to the *Field* (April 2, 1870), commenting on Mr Carpenter's remarks in his Report, says that that gentleman objects to the value of the view in the large telescope 'because it shewed but two points, when a comparison had to be instituted between three;' but he omits to state that the telescope itself was placed accurately at the third point, just as was the spirit-level telescope—to the view shewn by which he makes no objection. The views from both extremities of the six miles agreeing so closely, both prove the very great accuracy of the level used, and that it may be depended upon to shew that the surface of water does really sink below the true level line in

IS THE WORLD ROUND?

WE hope our readers will not think us demented for asking the above question; but Mr John Hampden (or 'Parallax') has recently backed his opinion to the contrary by a sum of five hundred pounds; and an interesting experiment has taken place. This gentleman, in 1865, published a book to prove that the earth is a *plane*, without motion, and unaccompanied by anything in the firmament analogous to itself. The whole question turns on the convexity of water, for if the earth is a globe, and twenty-five thousand miles in circumference, the surface of all standing water must have a certain degree of convexity; every part must be an arc of a circle, rising at the rate of about eight inches per mile; and in every succeeding mile, eight inches multiplied by the square of the distance. Mr Hampden says he tried the following experiment. In the Old Bedford Canal, Cambridgeshire, a boat and flag was directed to sail from Welney Bridge, and remain at Welche's Dam, six

a continually increasing degree as the distance is greater; but the proof of convexity in no way depends on this accuracy, as it was shewn still better by the large telescope without a spirit-level. The curvature shewn by the large telescope is about five and a half feet at the middle signal, three miles distant; equal to eleven feet, if measured at the farther signal; and the depression below the cross hair or true level line being, according to Mr Carpenter, an equal amount, makes twenty-two feet in all, leaving less than two feet for refraction to bring it to the full theoretical amount, which is something less than twenty-four feet. The three points deviated in a vertical direction very nearly as much as is required by the assumed dimensions of the earth, so that we may conclude that the level telescope line is a tangent to a circle, approximately the circle of the earth. Mr Vernon says, if the telescope in this experiment had been laid exactly at right angles to a plumb-line dropped from its centre, it would have been found that the surface of the water three miles off was six feet, and at six miles, twenty-four feet, lower than the water at the spot where the observation was made.

Of course Mr Hampden was not satisfied with the result, and still asserts that the surface of water is as flat as any billiard-table in the metropolis; and in an angry letter to the *Field*, he tells the editor that if he touches the money to hand it to Mr Wallace, he will serve them both with a writ for conspiring to obtain money on false pretences.

Mr J. N. Hearder of Plymouth tells us that 'Parallax' some years ago visited Plymouth, and in one of his lectures asserted that the rock upon which the Eddystone Lighthouse is built, and which is about sixteen miles from the shore, could be seen as distinctly from the beach under the Hoe as it could from the top of the Hoe itself, an elevation of about eighty feet. Several gentlemen agreed to meet on the Hoe to test the experiment. The Eddystone Lighthouse is about eighty feet high, and is built on a rock which is nearly covered at high-water. The building is surmounted by a lantern, which occupies some ten or twelve feet of its upper portion, and the remainder of the structure is painted in different coloured bands; so that, as Mr Hearder remarks, it formed an admirable object for the purpose of this experiment. A telescope was fixed on the top of the Hoe at the height of about eighty-four feet from the level of the sea below, to correspond with the height of the Eddystone, sixteen miles off. From this, the whole of the Eddystone and its rock were distinctly visible. But when the telescope was removed ten or twelve feet lower, the rocks were invisible; and in proportion as the telescope was removed lower and lower, band after band of the body of the building sank below the horizon, till at last, ten feet above the water's edge, nothing could be seen but the lantern. Five feet lower, the lantern itself disappeared. 'Parallax' being asked to account for this, said it was due to the undulations of the waves; but the day was so fine, that small vessels could be seen on the horizon with the naked eye, and the breeze was very slight, and did not produce waves sufficient to prevent the observers from standing within an average distance of three feet from the edge of the water on the beach. On the same occasion, several vessels were watched, some of which, leaving the shore, could be seen gradually to descend below the horizon, until the hull, and

even half the rigging, were out of sight to all the observers but 'Parallax,' who always protested he could see the hull as plainly as before.

Homer considered the world as flat. Mr Gladstone, in his *Studies of Homer and the Homeric Age*, states that in Homer's estimation the form of the world was not circular, but oval, having a shorter diameter from east to west than from north to south. In the map he gives, it is in the form of a parallelogram with rounded edges, like the oblong shield then in use. The merit of the discovery of the *spherical* form of the earth is due to the Pythagoreans, who came to the conclusion from astronomical observations; but it is uncertain whether Pythagoras was himself aware of this truth. It was not received generally in Greece until the age of Plato. The Arabs speculated on the spherical form of the globe, and the calif Almanoun, in 814 A.D., ordered the measurement of a degree in the plains of Mesopotamia, which, at a much later period, was imitated by Snellius in Holland, and Norwood in England. The length of degrees of the meridian in different latitudes gives the form and size of the earth. Eleven arcs have been measured in Europe, one in the Andes, two in the East Indies. No two of these yielded the same result, shewing the slightly irregular form of the earth. Mrs Somerville, in her *Physical Geography*, points out that the dip or depression of the horizon is, in round numbers, a fathom for every three miles of distance; that is to say, an object a fathom or six feet high would be hid by the curvature of the earth at the distance of three miles. Since the dip increases as the square, a hill one hundred fathoms high would be hid at the distance of ten miles. Another mode of determining the form of the earth is by the oscillations of the pendulum. Its descent, and consequently its oscillations, are accelerated in proportion to the force of gravitation, which increases from the equator to the poles. Experiments have been made at various places, but no two sets give exactly the same results. The method employed for measuring arcs of the meridian, and that of deducing the form of the earth from the oscillations of the pendulum, are given in the sixth section of Mrs Somerville's *Connection of the Physical Sciences*, eighth edition. Of course, all this will be nonsense to 'Parallax;' but we may be well content to leave the matter in the hands of all thinking men.