VIII. *Observations on the heights of places in the Trigonometrical Survey of Great Britain, and upon the Latitude of Arbury Hill. By* B. Bevan, *Esq. Communicated by Sir* H. Davy, *Bart. P. R. S.*

Read May 23, 1822.

THE Trigonometrical Survey of Great Britain having from time to time engaged the attention of the Royal Society, and circumstantial particulars of this great national undertaking having occupied the pages of the Philosophical Transactions, I beg leave to submit a few observations on that subject to the consideration of the Society.

The result of the survey, relative to the different sections of the meridian, in this country, has not altogether proved so satisfactory as might have been expected.

I have lately examined the calculations affected by the observations made at *Arbury Hill* in the county of Northampton, with some hope of discovering the means of reconciling the anomaly in that part of the meridian.

I have been at the expense of having the height of this station determined by accurate levelling to the Grand Junction Canal, from which, and the known difference of level of the various canals connected with this, I have been able to find the *relative* height of this station, with most of the important objects in the counties of Northampton, Buckingham, and Bedford.

From this operation of levelling, I found the country to the north of Arbury station, suddenly to fall about 400 feet, and continue at this depressed state for 9 or 10 miles. Such a defect of matter, to the north of the station, was in itself a

strong ground for supposing a deflection of the plumb-line to the southward. To ascertain if this supposition were supported by the trigonometrical operations, I calculated the latitude of Arbury station, from the latitude of Blenheim, as determined by previous observation, independent of any astronomical observation made at Arbury, and find it *5 seconds* LESS than shown by the zenith sector ; giving countenance to the probability of local attraction by the high land to the *south* of the station, which will appear by the following calculation ; in Trigonometrical Survey, Vol. 2, p. 137, the latitude of Blenheim by observation is stated as 51° 50′ 24″.9 or nearly 51° 50′ 25″.

The measured distance, on the meridian, from Blenheim to Arbury, is 139822, deduced from Vol. 2, part 2, p. 107 ; dividing this distance by 60881.7, according to a table in Vol. 1, part 1, page 168, corresponding to the middle latitude between Blenheim and Arbury, and multiplying the quotient by 10. we obtain the difference of latitude = ° 22′ 58″. this quantity added to   –   –   –   –   51 50 25
gives for the latitude of Arbury   –   –   –   52 13 23
being *5″ less* than by the zenith sector.   It is true that Colonel MUDGE corrected the latitude of Blenheim, from the Trigonometrical Survey, to 51° 50′ 28″, and in this case the computed latitude of Arbury would come out near *3 seconds less* than found by the zenith sector.   In Vol. 2, part 1, page 118, the *latitude of Arbury*, as derived from Dunnose meridian, is given   –   52° 13′ 26″.6
afterwards   52   13 28 .2 from observation*
        1 .6 or 1½ second *south* of the observed

* Vol. 2, part 2, page 109, Dunnose is stated to be . . 50° 37′ 8″,2
        p. 107, from Dunnose to Arbury is .   1   36   19,98
                        52   13   28,18

latitude; all concurring to prove that the observed latitude by zenith sector falls to the north of the calculated, or that the deflection of the plumb-line was to the south: taking, therefore, the table above referred to in Vol. 1, part 1, p. 168, and considering the latitudes of the following stations to be as below:

$$
\begin{array}{llll}
\text{Dunnose} & \text{-----} & 51°\ 37'\ 7'' \\
\text{Greenwich} & \text{----} & 51\ \ 28\ \ 39\frac{1}{2} \\
\text{Blenheim} & \text{----} & 51\ \ 50\ \ 28\frac{1}{2} \\
\text{Arbury} & \text{-----} & 52\ \ 13\ \ 26\frac{1}{2} \\
\text{Clifton} & \text{-----} & 53\ \ 27\ \ 20\frac{3}{4}
\end{array}
$$

and calculating the length of a degree, in their respective middle points, they will be found to correspond with the said table, and maintain a *regular increase to the northward*, agreeing with the assumed general figure of the earth: the above assumption indicates an error of $10\frac{3}{4}''$ at Clifton, and $1\frac{1}{4}$ at Arbury, neither of which is more than might be expected from the visible inequality of the contiguous land.

The result of the operations north of Clifton I have not had an opportunity of ascertaining; but it appears to me that a few more observations by the zenith sector, at other stations, would remove much of the apparent ambiguity at present attached to this interesting question.

Knowing the goodness of the instrument used in the Survey, and the great skill and attention observed by the persons engaged, I have great confidence in the general result of the terrestrial department. I should have been doubly gratified if I could have said as much on the determination of the *heights* of the stations.

Availing myself of the levels through a long district of the

Grand Junction Canal, I have been at the trouble of levelling from the following stations, viz.

<div style="text-align:center">

Wendover Down,

Kensworth,

Bowbrick Hill, and

Arbury Hill,

</div>

to the nearest point of the said Canal, and thus, by means of the known level of the different parts of the Canal, to obtain the *relative heights* of the above mentioned stations.

And as a comparison will be more readily made from a table of heights expressed in positive numbers, I shall assume the highest point of the summit of said Canal to be 402 feet above the level of the sea, at low water spring tides; with this assumption, the heights of the several stations, in feet, above low water mark, will be as follows :

<div style="text-align:center">

Wendover Station - - - - 861

Kensworth ditto - - - - 809½

Bowbrick Hill - - - - - 571½

Arbury Hill - - - - - - 740½

</div>

The heights of these Stations published in the Philosophical Transactions, are as below : in Vol. 3, page 302.

<div style="text-align:center">

Wendover - - - - - - - 905

Kensworth - - - - - - - 904

Bowbrick Hill - - - - 683

Arbury Hill - - - - - - 804

</div>

these will average about 78 feet higher than in the table above.

I have also levelled from the summit of the Regent's Canal, to the mouth of the fixed cannon at King's Arbour, or the upper end of the base on Hounslow Heath, and upon the same data this point will be 90¾ feet above low water mark.

In Vol. 1, p. 173, Colonel Mudge gives $91\frac{1}{4}$ for its height, which differs only by half a foot.

But at page 266 it is stated to be 118 *feet*, being 27 feet above the proper height. Again in Vol. 3, p. 307, it is stated to be 132 *feet*, or $41\frac{1}{4}$ too high.

The grounds of my assumption of 402 feet being the height of the Grand Junction Canal summit, near Tring, are these:

The range of tide, from low water spring tides at sea, to high water near Somerset House, I presume to estimate $19\frac{1}{3}$ feet; from this point to the Regent's Canal summit will be found $83\frac{1}{6}$ feet; from this level I apply the revised section of the Grand Junction Canal $= 299\frac{1}{2}$ to the summit near Tring, making together 402 feet as above.

From these levels it will appear, that Wendover Station above Brickhill is $861 - 571\frac{1}{2} = 289\frac{1}{2}$. Colonel Mudge's numbers give - - $905 - 683 = 222$

$$\overline{\quad 67\frac{1}{2} \text{ error.}}$$

Arbury above Brickhill $740\frac{1}{2} - 571\frac{1}{2} = 69$

Colonel Mudge - - $804 - 683 = 121$

$$\text{Error} \quad \overline{52}$$

Wendover above Arbury $861 - 740\frac{1}{2} = 120\frac{1}{2}$

Colonel Mudge - - $905 - 804 = 101$

$$\text{Error} \quad \overline{19\frac{1}{2}}$$

Some fresh observations with the zenith sector made at Blenheim, and Sutton, would offer a fine check to the latitude of Arbury; and also at Highbeach, and Botley Hill, a check to the latitude of Greenwich would be readily obtained.

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 February, 1822.