III. *Note on the Tides.* *By* J. W. Lubbock, *Esq., V. P. and Treas. R.S.*

Read March 7, 1833.

By the permission of Mr. Dessiou, I am enabled to communicate to the Society some results which he has obtained, from observations made at Plymouth, Portsmouth and Sheerness, under the superintendance of the masters attendant at those dock-yards. The *establishments* of these ports (that is, the time of high water when the moon passes the meridian at 12 o'clock,) may now be considered as accurately determined. The retard $(\lambda - \lambda_{,})$ at Portsmouth appears to be intermediate between that at Brest and at London, being about $1^h\ 30^m$; that at Plymouth appears to be greater, and not less than that which obtains at London, for which circumstance it is difficult to account. The retard at Sheerness agrees with that observed at the London Docks. The constant which involves the mass of the moon does not differ much, as inferred from these observations at various places; it is however impossible to obtain more than a rough approximation, by these means, to that important element in astronomy, the mass of the Moon. Even a minute (of time) in the difference of the interval between the moon's transit and the corresponding time of high water, materially affects the value of the moon's mass; and insurmountable difficulties appear to be in the way of any nice determination of that quantity by these means, even if there were none of an analytical character. It would be well, by a discussion of the inevitable errors of the various data employed, to ascertain the limits of the errors which may be incurred in determining the mass of the moon by various methods, particularly through the constant of the moon's parallax.

Mr. Dessiou, with undaunted perseverance, has just completed the discussion of about 6000 more observations of the tides at the London Docks, with a view to rest upon a sure basis the corrections for the moon's parallax and declination; but these cannot be published unless he is fortunate in meeting with more encouragement than he has hitherto experienced. These results do

not differ materially from those already published in the Phil. Trans. 1831, Part II. p. 413, the accuracy of which therefore they serve to confirm.

The results which Mr. DESSIOU has obtained are not reconcileable with the theory of BERNOULLI; therefore the Tables founded on this theory which profess to give the corrections for the moon's parallax and declination, and which are to be found in various works on navigation, but had never previously been compared with observation, must be rejected as inaccurate and utterly inapplicable.

The following Table has been formed by taking the mean of all the times of the moon's transit occurring within a given half hour, and the mean of all the corresponding times of high water according to the method explained, Phil. Trans. 1831, Part II. p. 384; the difference is of course the interval between the time of the moon's transit and the corresponding high water, which interval is given in the Table.

Plymouth.			Portsmouth.			Sheerness.		
Moon's Transit.	Corresponding Interval.	Number of Obs.	Moon's Transit.	Corresponding Interval.	Number of Obs.	Moon's Transit.	Corresponding Interval.	Number of Obs.
h m	h m		h m	h m		h m	h m	
0 14·6	5 30·9	26	0 14·6	11 35·4	29	0 14·3	+0 35·7	28
0 44	5 25·4	23	0 45·7	11 31	28	0 45	+ 32·4	31
1 10·5	5 19·5	21	1 15·6	11 24·4	28	1 15	+ 19	28
1 44·8	5 7·3	23	1 44·8	11 17·6	31	1 45·2	+ 15·1	31
2 15	5 1	22	2 15·5	11 10·2	29	2 15·5	+ 4	27
2 45·8	4 48·7	25	2 45·6	11 0·8	30	2 45	− 5	31
3 17·6	4 41·2	21	3 16·6	10 54·2	27	3 16·7	− 12·7	28
3 45·2	4 32	22	3 45·5	10 49·3	30	3 44	− 15	30
4 15·7	4 23·1	23	4 12·7	10 46·3	27	4 14·5	− 25·5	28
4 44·8	4 22·5	22	4 44·2	10 41·3	30	4 44	− 28	30
5 15·8	4 14·5	25	5 15·4	10 41·4	32	5 15·6	− 33·6	31
5 46·1	4 14·7	23	5 46·5	10 43·7	29	5 46·2	− 32·2	27
6 16·5	4 11·9	22	6 15·5	10 47·6	29	6 15·6	− 37·6	30
6 44	4 23·3	20	6 45	11 1·2	29	6 44·6	− 26·2	28
7 15	4 40·7	24	7 15·2	11 18·5	29	7 14·6	− 13·6	31
7 47·6	5 3·7	23	7 47·1	11 34·1	29	7 46·6	+ 3·4	30
8 18·6	5 22·4	21	8 18	11 44·8	29	8 17·4	+ 19·2	27
8 46·7	5 28·8	20	8 46·9	11 57·9	26	8 46·3	+ 42	27
9 16·3	5 42·7	20	9 15·2	12 1·9	28	9 15·5	+ 47	29
9 45·6	5 48·6	24	9 46·2	12 0·6	30	9 46·4	+ 53·2	29
10 16·6	5 47·5	21	10 16·7	12 1·8	28	10 16·6	+ 53·7	27
10 45·6	5 43·1	23	10 46	11 54·4	27	10 45	+ 49·8	28
11 15·2	5 41·4	20	11 15	11 49·1	26	11 15	+ 43	31
11 42·2	5 35·6	21	11 44	11 45	27	11 44	+ 42·6	27

The following Table has been obtained by laying down the observed *points*, and drawing a curve amongst them by the hand, from which curve the inter-

polated *points* are obtained. The dotted line (see Plate I.) passes through the points observed, the continuous line, in the case of the London Docks, shows the curve which results from the theory of BERNOULLI, (see Phil. Trans. 1831, Part II. p. 388.) The agreement between theory and observation so far amounts to identity, and is very remarkable.

The following Table shows the interval between the moon's transit and the corresponding high water at Brest, Plymouth, Portsmouth, Sheerness, and the London Docks.

Moon's Transit.	Brest.	Plymouth.	Portsmouth.	Sheerness.	London Docks.	Moon's Transit.
h m	h m	h m	h m	h m	h m	h m
0 0	3 48	5 33	11 40	+0 39	1 57	0 0
0 30	3 41	5 28	11 34	+0 34	1 50	0 30
1 0	3 33	5 22	11 28	+0 26	1 42	1 0
1 30	3 26	5 13	11 21	+0 17	1 35	1 30
2 0	3 18	5 4	11 14	+0 9	1 26	2 0
2 30	3 11	4 55	11 6	0 0	1 18	2 30
3 0	3 4	4 45	10 58	−0 9	1 11	3 0
3 30	2 58	4 37	10 52	−0 15	1 3	3 30
4 0	2 53	4 28	10 47	−0 20	0 56	4 0
4 30	2 50	4 21	10 44	−0 26	0 51	4 30
5 0	2 49	4 16	10 41	−0 31	0 45	5 0
5 30	2 50	4 13	10 42	−0 34	0 43	5 30
6 0	2 55	4 12	10 45	−0 35	0 42	6 0
6 30	3 5	4 18	10 54	−0 32	0 44	6 30
7 0	3 18	4 30	11 10	−0 22	0 52	7 0
7 30	3 33	4 51	11 26	−0 8	1 5	7 30
8 0	3 47	5 11	11 39	+0 9	1 22	8 0
8 30	3 58	5 26	11 51	+0 30	1 39	8 30
9 0	4 5	5 37	11 59	+0 44	1 56	9 0
9 30	4 8	5 45	12 2	+0 52	2 5	9 30
10 0	4 7	5 48	12 1	+0 54	2 10	10 0
10 30	4 5	5 47	11 58	+0 52	2 10	10 30
11 0	4 0	5 44	11 53	+0 48	2 8	11 0
11 30	3 54	5 38	11 47	+0 44	2 3	11 30

The preceding Table gives the principal or semi-menstrual inequality; the form of the curve is better seen by reference to the annexed plate, (see Plate I.) It appears that the *establishments* of Brest, Plymouth, Portsmouth, Sheerness and the London Docks are as follows:

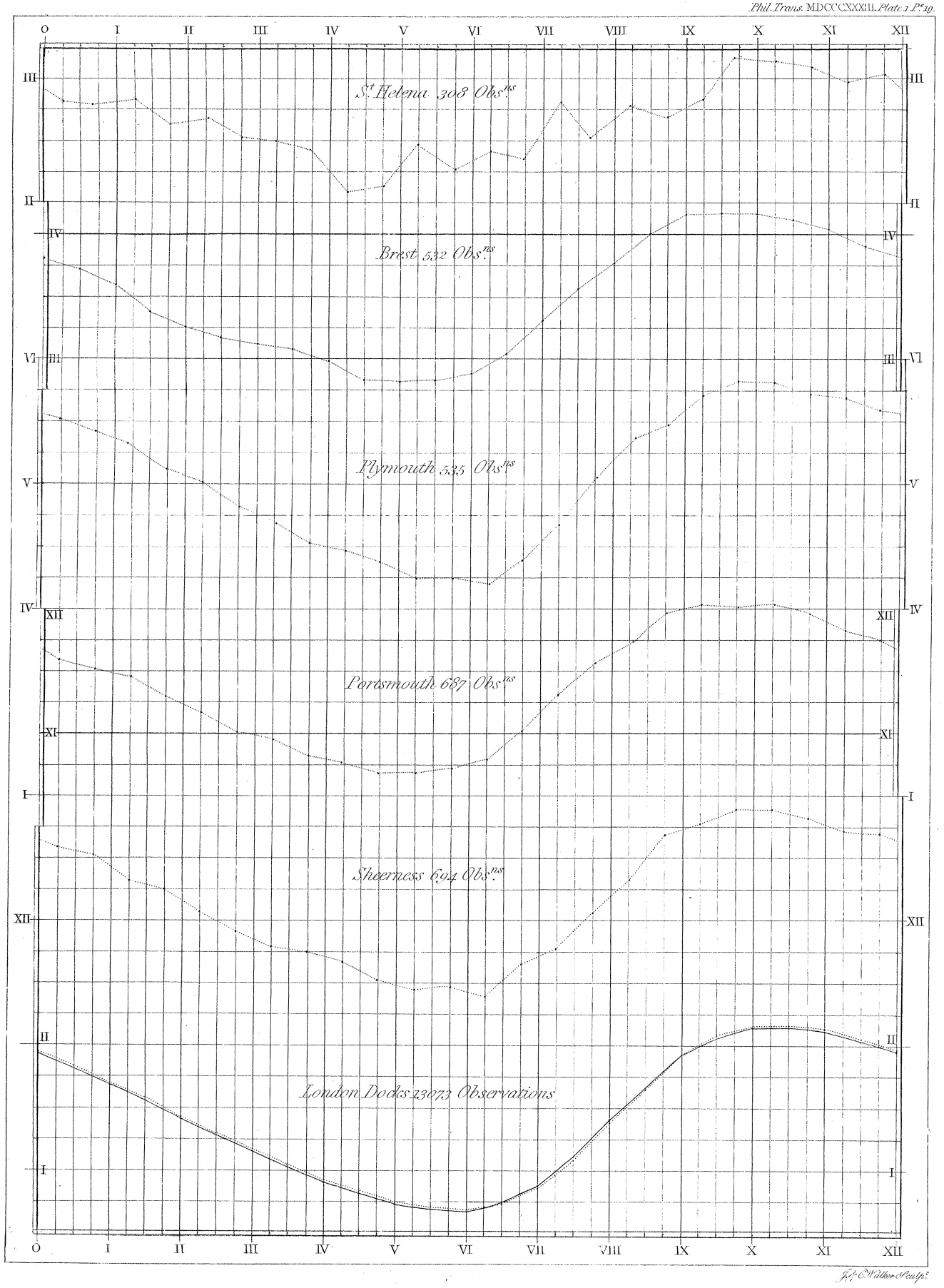
Brest	$3^h\ 48^m$
Plymouth	5 33
Portsmouth	11 40
Sheerness	0 39
London Docks	1 57

Since this paper was presented to the Society, Mr. Dessiou has furnished me with the following results obtained by him from some observations communicated to the Society some time since by the late Mr. Fallows. The numbers are very irregular, owing to the paucity of observations and the difficulty of fixing the time of high water with precision, the *rise* being only about three feet. It appears that the *establishment* is about $2^h\ 56^m$.

St. Helena.			St. Helena.		
Moon's Transit.	Corresponding Interval.	Number of Obs.	Moon's Transit.	Corresponding Interval.	Number of Obs.
h m	h m		h m	h m	
0 16	2 48	15	6 16	2 25	13
0 40	2 47	11	6 43	2 22	12
1 16	2 50	12	7 15	2 48	15
1 45	2 38	12	7 39	2 32	14
2 17	2 41	14	8 13	2 47	13
2 46	2 32	14	8 45	2 42	12
3 14	2 30	13	9 14	2 50	12
3 43	2 26	13	9 42	3 10	14
4 16	2 5	15	10 17	3 8	14
4 47	2 8	10	10 46	3 5	10
5 15	2 28	14	11 16	2 58	12
5 46	2 16	12	11 46	3 2	12

Semi-menstrual inequality of the Time of High Water

Phil. Trans. MDCCCXXXIII. Plate 3 Pt. 2 p.



J.& C. Walker Sculp.t

In these curves the abscissa represents the time of the Moon's transit, and the ordinate the corresponding interval between the transit & the time of High Water ..... Observation ——— Theory