

*	$\alpha$	$\delta$	Authority.
<i>c</i>	0 <sup>h</sup> 32 <sup>m</sup> 40 <sup>s</sup> 59	+10° 18' 47'' 8	Argelander.
<i>d</i>	0 32 50,96	+10 48 44,7	Bessel.
<i>z</i>	51,12	48 45,1	Schjellerup.
Adopted	0 <sup>h</sup> 32 <sup>m</sup> 51 <sup>s</sup> 04	+10° 48' 44'' 9	
<i>e</i>	0 34 19,48	+11 14 7,8	Bessel.
<i>z</i>	19,27	14 6,3	Schjellerup.
<i>z</i>	19,45	14 6,9	Argelander.
Adopted	0 <sup>h</sup> 34 <sup>m</sup> 19 <sup>s</sup> 38	+11° 14' 6'' 9	
<i>f</i>	0 33 6,16	+11 23 59,3	Argelander.
<i>g</i>	0 34 3,44	+11 33 2,7	Bessel.
<i>h</i>	0 57 12,03	+14 31 23,9	Bessel.
<i>i</i>	0 59 1,15	+14 40 58,7	Bessel.
<i>k</i>	1 7 13,91	+15 26 41,9	Eq. comp. with Weisse 81, 105.
<i>l</i>	1 34 29,57	+17 59 37,4	Bessel.
<i>m</i>	1 42 59,07	+18 42 12,3	Eq. Comp. with $\gamma$ Arietis.
<i>n</i>	1 53 57,45	+19 53 14,8	Bessel.
<i>o</i>	2 32 14,42	+22 35 47,2	Argelander.

### Supplementary Notes on the Observations for magnetism and position, made in the U. S. Naval Observatory Expedition to Siberia to observe the solar Eclipse of Aug. 7<sup>th</sup> 1869.

Communicated by Commodore *B. F. Sands*, U. S. N., Superintendent U. S. Naval Observatory.

The tardy arrival of the instruments from San Francisco preventing a complete reduction of all our observations in time for the publication of the U. S. Naval Observatory reports, I wish to give here some additional notes on the observations for magnetism and position.

As our determinations of latitude depend on the *Pistor & Martins* Patent Sextant *N* 107, I have made a series of measurements of the distances between known stars in order to test the work of this sextant.

The following table gives the results of these measurements:

Objects.	Distance.	Errors.	<i>N</i> of measures.
$\alpha$ Arietis to $\beta$ Arietis	30,9	+9'' 1 $\pm$ 3'' 6	20
$\alpha$ Tauri = $\beta$ Tauri	16,8	+2,4 $\pm$ 3,1	14
$\alpha$ Lyrae = $\alpha$ Aquilae	34,2	-7,3 $\pm$ 4,3	20
$\alpha$ Tauri = $\beta$ Ceti	66,8	-7,2 $\pm$ 3,7	19
$\alpha$ Tauri = $\alpha$ Urs. min.	72,8	+1,0 $\pm$ 2,7	12
$\alpha$ Lyrae = $\alpha$ Aurigae	93,3	-10,0 $\pm$ 3,0	15
$\alpha$ Aquilae = $\alpha$ Aurigae	115,2	-1,1 $\pm$ 5,7	15

The resulting errors are so small and of such a character that I shall not make any correction of the sextant observations. From the 115 measurements, the average probable error of a single measured distance is 15'' 1.

The following observations of latitude were made July 24 at Illioulouk on the island Unalaska. The observing station is at the sun dial erected by the Russian Fur Company, and is about 80 yards very nearly north of the west end of the Greek church. The longitude has been assumed to be 5<sup>h</sup> 57<sup>m</sup> 47<sup>s</sup> 4 west of Washington.

On account of cloudy weather, no observations could be made for time, and those for latitude were made through light clouds. Each value of the latitude has been computed from the mean of five observed contacts.

	Illioulouk.
1869 July 24. $\phi =$	+53° 52' 60''
	52 58
	52 50
	52 39
	52 36
	52 27
	52 37
	52 39
	52 31
	52 26
	52 19
	$\phi = +53^{\circ} 52' 38'' \pm 2'' 7$

At Esquimalt, Vancouver Island, sextant observations were made for time and latitude, and through the kind permission of Captain *Edge*, R. N., our observing station was on Duntze Head, the point to which the longitudes are referred in the elaborate survey, by the officers of the English Navy, of the waters around Vancouver Island. The following are the results obtained for latitude, each value depending on a single altitude.

	Duntze Head.
1869 Sept. 4 <sup>th</sup> .	$\phi = +48^{\circ} 25' 47''$
	+48 25 37
	+48 25 40
	+48 25 39
	+48 25 33
	+48 25 58
	+48 25 31
	+48 25 52
	+48 25 37
	+48 25 58
	+48 25 65
	+48 25 63
	+48 25 35
	+48 25 9
	+48 25 62
	+48 25 49
	$\phi = +48^{\circ} 25' 45'' \pm 2''5$

1869 Sept. 4, 3417  $-8^h 11^m 39^s$   $\pm 0^s 28$  by 16 altitudes of the sun.

" " "  $-8 11 39.2$   $\pm 0,38$  " 12 " "  $\alpha$  Bootis.

Adopted  $-8^h 11^m 39^s 4$   $\pm 0^s 24$

A set of twelve altitudes of the sun observed with a Dollond sextant, owned by Mr. *Very*, the navigator of the U. S. S. *Mohican*, give for this correction  $-8^h 11^m 40^s 6 \pm 0^s 35$ .

The comparisons and rates of the chronometers give the following values of the longitude of Duntze Head from Mare Island Navy Yard.

Chronometer.	Mare Island Sept. 4, 3417.	Duntze Head Sept. 4, 3417.	Longitude.
Negus 1316	$-8^h 7^m 2^s 4$	$-8^h 11^m 39^s 4$	$+4^m 37^s 0 \pm 0^s 8$
Negus 1276	$-3 6 39,5$	$-3 11 17,5$	$+4 38,0 \pm 0,7$
Negus 1097	$-8 8 12,1$	$-8 12 50,5$	$+4 38,4 \pm 1,2$
Dent 2118	$-10 50 34,8$	$-10 55 9,7$	$+4 34,9 \pm 1,0$
Negus 599	$-8 50 57,8$	$-8 55 35,4$	$+4 37,6 \pm 1,8$
Negus 772	$-7 45 21,2$	$-7 50 3,4$	$+4 42,2 \pm 1,7$
Negus 1287	$-9 32 32,8$	$-9 37 9,4$	$+4 36,6 \pm 0,6$
Desilva 694	$-8 55 6,3$	$-8 59 44,7$	$+4 38,4 \pm 2,1$
Negus 1317	$-10 44 4,8$	$-10 48 45,2$	$+4 40,0 \pm 3,0$
Negus 1298	$-8 13 32,8$	$-8 18 9,2$	$+4 36,4 \pm 0,7$

#### Duntze Head.

1869 Sept. 8<sup>th</sup>.  $\phi = +48^{\circ} 25' 25''$

+48 25 34  
+48 25 39  
+48 25 45  
+48 25 46  
+48 25 56  
+48 25 48  
+48 25 50  
+48 25 48  
+48 25 50  
+48 25 54  
+48 25 43  
+48 25 52  
+48 25 49  
+48 25 59  
+48 25 58  
+48 25 67  
+48 25 56  
+48 25 48  
+48 25 55

$\phi = +48^{\circ} 25' 49'' \pm 1''3$

Our observations for time give the following corrections of the standard chronometer, Negus 1316, on local mean time; the date of the observations being expressed in the time of this Chronometer.

Combining the several results according to their weights, the longitude of Duntze Head from Mare Island is

$+4^m 37^s 1 \pm 0^s 40$ .

The probable errors of the longitudes given by the single chronometers have been deduced by comparing the rates of the chronometers among themselves, and serve only for a combination of the various results. The real probable error of the final result is no doubt greater than that given above; but to determine it would require an investigation of the temperature coefficients, and the stationary and traveling rates of each chronometer. Assuming the longitude of our observing station on Mare Island to be  $8^h 9^m 4^s 0$  west of Greenwich, the longitude of Duntze Head is by our observations:

$8^h 13^m 38^s 1$ .

The position of Duntze Head given in the English Survey is:

Latitude  $= +48^{\circ} 25' 49''$

Longitude  $= + 8^h 13^m 47^s 1$ .

An increase of the longitude of Mare Island will probably result from the telegraphic determination of the longitude of San Francisco by the U. S. Coast Survey; and this will bring the preceding results for longitude into better agreement.

The sextant observations were made by Mr. *Joseph A. Rogers* and myself, both of us generally taking part in the observation, one using the sextant, and the other observing the time.

The observations for magnetic force were made with *Lloyd* needles, after the method proposed by Dr. *Humphrey Lloyd*, and described by him in the Report of the British Association for the Advancement of Science 1835.

For the value of the magnetic dip, to be used in computing the relative values of the magnetic force, I have taken for each station the means of the values observed with the common needles. The values of the dip given by these needles are as follows:

Washington.....	71° 19' 2 (May)
Washington.....	71 24,7 (December)
Plover Bay, Siberia....	74 38,8
Esquimalt, V. J. ....	71 7,7
Yerba Buena .....	62 29,9

By comparing the above values of the dip with the values given by the *Lloyd* needles, the corrections for these needles are:

Needle 1  $E = -65'6$ ; Needle 2  $E = -4'5$ .

The observations at Washington give the only means of estimating the effect of a change of temperature on the values of the dip given by the *Lloyd* needles. Hence we have

Needle 1  $\Delta\delta = -1'81\Delta t$ ; Needle 2  $\Delta\delta = -1'09\Delta t$ .

The values of the coefficients have been found from a change of temperature of 25°; but an examination of the observations will show that disturbance from other sources, probably a slight rusting of the needles, is so great that it is not worthwhile to apply any correction for temperature.

If  $\Phi$  be the total magnetic force at a station,  $\delta$  the corrected dip of the *Lloyd* needle, and  $\theta$  the dip of the needle when loaded with a weight; and  $\Phi, \delta, \theta$ , denoting

similar quantities at another station, we shall have by Dr. *Lloyd's* method, —

$$\frac{\Phi}{\Phi_1} = \frac{\cos \theta \cdot \sin(\delta_1 - \theta_1)}{\cos \theta_1 \cdot \sin(\delta - \theta)}$$

Our observations give the following values of  $\delta$  and  $\theta$ ; two values of  $\theta$  being observed with each needle as the weight was inserted in the hole nearest and farthest from the axis, —

Station.	Needle.	$\delta$	$\theta$	$\theta_1$
Washington	1	71° 2' 6	—20° 27' 3	—36° 21' 6
"	2	71 6,0	—45 45,0	—55 43,4
Yerba Buena	1	62 9,3	—36 13,6	—45 28,3
"	2	62 12,9	—50 51,7	—57 17,4
Plover Bay	1	74 29,7	—34 53,4	—51 47,8
"	2	74 46,5	—59 29,4	—65 53,2
Esquimalt	1	71 44,5	—29 21,0	—41 47,1
"	2	71 27,6	—47 30,0	—57 36,4

Assuming that the force at Washington is expressed by the number 13,35 (in English units), the forces at the stations are found to be as follows: —

Yerba Buena	force = 11.68
"	= 11.64
"	= 11.71
"	= 11.78
Mean	= 11.68

Plover Bay	force = 12.38
"	= 11.90
"	= 11.96
"	= 12.23
Mean	= 12.12

Esquimalt	force = 12.65
"	= 12.83
"	= 13.22
"	= 13.09
Mean	= 12.95

U. S. Naval Observatory, Washington, 1870 January 17.

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