## VIII. *On the Calculation of Heights from Observations of the Barometer.*

To the Editor of the Gleanings in Science.

Sir,

The tables for calculating differences of level from barometrical observations, such at least as have fallen in my way, being in general spun out to such a length as to render them nearly as troublesome as the direct calculation from the formula; perhaps you may consider the one I have now the pleasure to send you not altogether unworthy of a place in your Gleanings. In the first volume of the Memoirs of the London Astronomical Society, page 209, Professor Littrow has given as concise tables as I recollect having seen any where: but they are adapted to the French measures, and Reaumer's thermometer, and are, therefore, so far inconvenient. The formula he uses is,

$$N = 9436{,}966.\ (1+{,}00284 \cos 2\phi)\ .\ (1+{,}0025.\ (t+t')$$

$$H = N.\ \log.\ \frac{b'}{[1+{,}00023\ (T'-T)]\ b}$$ in which

$b$, $t$, T { express the height of the Barometer Temperature of the Air, and Temperature of the Mercury at the upper station.

$b'$, $t'$, T'—the same at the lower station.

$\phi$ = Latitude of the place.

H = Difference of level in Toises.

Now, neglecting the factor depending on the latitude of the place, as being too small to be worth attending to, except perhaps in the very nicest experiments, and supposing the barometers at the two stations to be in the first instance reduced to one and the same temperature, 32° for instance*, we shall have for English feet and Fahrenheit's thermometer, this simple formula.

$$N = 56055 + 67{,}05\ (F+F')$$

$$H = N.\ \log.\ \frac{b'}{b}$$ , or in Logarithms

$$\text{Log. } H = \log. N + \log.\ (\log. b' - \log. b)$$

The following is a table of the Logarithms of N for every probable value of (F+F') the sum of the temperatures of the air at the two stations.

| F+F' | Log. N. | Diff. for 1° | F+F' | Log. N. | Diff. for 1°. |
|---|---|---|---|---|---|
| 60° | 4,77871 | | 150° | 4,82028 | |
| 70 | ,78353 | 48,2 | 160 | ,82466 | 43,8 |
| 80 | ,78830 | 47,7 | 170 | ,82900 | 43,4 |
| 90 | ,79302 | 47,2 | 180 | ,83330 | 43,0 |
| 100 | ,79768 | 46,6 | 190 | ,83755 | 42,5 |
| 110 | ,80229 | 46,1 | 200 | ,84176 | 42,1 |
| 120 | ,80686 | 45,7 | 210 | ,84593 | 41,7 |
| 130 | ,81138 | 45,2 | 220 | ,85007 | 41,4 |
| 140 | ,81585 | 44,7 | | | |
| | | 44,3 | | | |

An example can hardly be necessary, except to show that the table gives the same results as other methods. Let us take the one given in No. 3 of your Gleanings, page 87: the two barometers reduced to the same temperature are:

$b' = {,}7344$ log. $= 9{,}86593$

$b = {,}5372$ log. $= 9{,}730115$

log $b'$ = log. $b = {,}13579$

log. $,13479 = 9{,}13287$

for F+F' = 105.°6 the table gives 4,80029

Feet 8573·5 = 3,93316

* A table for this correction, of limited extent, however, will be found in Daniel's Meteorological Essays, 2d ed. p. 372. I have extended it so as to be useful to the residents in mountainous regions, and perhaps you may think it worth printing.

which is precisely the height stated to have been found by geometrical methods.

While on the subject of barometers, I cannot help suggesting to those who keep registers, how much better it would be to reduce their observations to some standard temperature (32° for instance) and so record them: with a copy of the table sent herewith suspended near the barometer. This reduction would cost no trouble, no inconsiderable space would be saved in the register, and the observation, whether at the same time or at different places, might then be compared at once. It would be still better if the correction for capillarity were applied also, and this would be no additional trouble whatever, since each observer might incorporate the correction due to his particular instrument on this account, with that due to difference of temperature; one table giving both corrections: the latter, however, is of less consequence, if I am right in supposing that the tubes sent to this country are generally made of nearly the same interior diameter, about two-tenths of an inch. I am, &c. T.

*Correction to be applied to the Barometer for expansion of Mercury.*

| Temp. of mercury. | In. 14 | In. 15 | In. 16 | In. 17 | In. 18 | In. 19 | In. 20 | In. 21 | In. 22 |
|---|---|---|---|---|---|---|---|---|---|
| 25° | + ,010 | + ,011 | + ,011 | + ,012 | + ,013 | + ,013 | + ,014 | + ,015 | + ,015 |
| 30 | ,003 | ,003 | ,003 | ,003 | ,004 | ,004 | ,004 | ,004 | ,004 |
| 35 | — ,004 | — ,005 | — ,005 | — ,005 | — ,005 | — ,006 | — ,006 | — ,006 | — ,007 |
| 40 | ,011 | ,012 | ,013 | ,014 | ,014 | ,015 | ,016 | ,017 | ,018 |
| 45 | ,019 | ,021 | ,022 | ,023 | ,023 | ,025 | ,026 | ,027 | ,029 |
| 50 | ,025 | ,027 | ,029 | ,031 | ,032 | ,034 | ,036 | ,038 | ,040 |
| 55 | ,032 | ,035 | ,037 | ,039 | ,041 | ,044 | ,046 | ,048 | ,051 |
| 60 | ,039 | ,042 | ,045 | ,048 | ,050 | ,053 | ,056 | ,059 | ,062 |
| 65 | ,046 | ,050 | ,053 | ,056 | ,059 | ,063 | ,066 | ,069 | ,073 |
| 70 | ,053 | ,057 | ,061 | ,065 | ,068 | ,072 | ,076 | ,080 | ,084 |
| 75 | ,060 | ,064 | ,069 | ,073 | ,077 | ,082 | ,086 | ,090 | ,095 |
| 80 | ,067 | ,072 | ,077 | ,082 | ,086 | ,091 | ,096 | ,101 | ,106 |
| 85 | ,074 | ,080 | ,085 | ,090 | ,095 | ,101 | ,106 | ,111 | ,117 |
| 90 | ,081 | ,087 | ,093 | ,099 | ,104 | ,110 | ,116 | ,122 | ,128 |
| 95 | ,088 | ,195 | ,101 | ,107 | ,113 | ,120 | ,126 | ,132 | ,139 |
| 100 | ,095 | ,102 | ,109 | ,116 | ,122 | ,129 | ,136 | ,143 | ,150 |

| Temp. of mercury. | In. 23 | In. 24 | In. 25 | In. 26 | In. 27 | In. 28 | In. 29 | In. 30 | In. 31 |
|---|---|---|---|---|---|---|---|---|---|
| 25° | + ,016 | + ,017 | + ,018 | + ,018 | + ,019 | ,020 | + ,020 | + ,021 | + ,022 |
| 30 | ,005 | ,005 | ,005 | ,005 | ,005 | ,006 | ,006 | ,006 | ,006 |
| 35 | — ,007 | — ,007 | — ,008 | — ,008 | — ,008 | — ,008 | — ,009 | — ,009 | — ,009 |
| 40 | ,018 | ,019 | ,020 | ,021 | ,022 | ,022 | ,023 | ,024 | ,025 |
| 45 | ,030 | ,031 | ,033 | ,034 | ,035 | ,036 | ,038 | ,039 | ,040 |
| 50 | ,041 | ,043 | ,045 | ,047 | ,049 | ,050 | ,052 | ,054 | ,056 |
| 55 | ,053 | ,055 | ,058 | ,060 | ,062 | ,064 | ,067 | ,069 | ,071 |
| 60 | ,064 | ,067 | ,070 | ,073 | ,076 | ,078 | ,081 | ,084 | ,087 |
| 65 | ,076 | ,079 | ,083 | ,086 | ,089 | ,092 | ,096 | ,099 | ,102 |
| 70 | ,087 | ,091 | ,095 | ,099 | ,103 | ,106 | ,110 | ,114 | ,118 |
| 75 | ,099 | ,103 | ,108 | ,112 | ,116 | ,120 | ,125 | ,129 | ,133 |
| 80 | ,110 | ,115 | ,120 | ,125 | ,130 | ,134 | ,139 | ,144 | ,149 |
| 85 | ,122 | ,127 | ,133 | ,138 | ,143 | ,148 | ,154 | ,159 | ,164 |
| 90 | ,133 | ,139 | ,145 | ,151 | ,157 | ,162 | ,168 | ,174 | ,180 |
| 95 | ,145 | ,151 | ,158 | ,164 | ,170 | ,176 | ,183 | ,189 | ,195 |
| 100 | ,156 | ,163 | ,170 | ,177 | ,184 | ,190 | ,197 | ,204 | ,211 |

*Note by the Editor.*

We have substituted a more correct table for that of our correspondent, which being taken from Daniel was affected by the error noticed in our last number, p. 323. The error in the extreme case was ,028 nearly 30 ft. in altitude. The expansion of the mercury had been diminished by the mean value of the dilatation of glass, whereas nothing can be more evident than that the latter should be neglected.

Our readers may see the reason of this in the paper of MM. Dulong and Petit, published in the present number. We have adopted their value of the expansion of mercury as stated p. 365 to be $\frac{1}{5\frac{1}{5}5\overline{5}}$ for the centrigade thermometer which is equal to $\frac{1}{5\frac{1}{5}5\overline{5}}$ for every degree of Fahrenheit, or in decimals ,0001001. There is a correction however (if we do not mistake the matter) which neither Mr. Daniel, nor any of the writers on barometric calculation have introduced into their formulæ. It is the correction which should be made for the varying temperature of the brass scale. Supposing it to have been adjusted at 60° which is I believe the temperature adhered to by English makers;—it is evident that at a temperature of 96° the brass scale has undergone a change of 36°. It may be said that this correction is small,—yet it is twice as great as that of glass, which Mr. Daniel has erroneously introduced, while this one has been altogether neglected. The French standards are graduated at 32°. Here, therefore, the difference would be still greater.

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## IX. *Corrections of, and Additions to, an Article on Ampullaria, in the Second Number of the Gleanings.*

To the Editor of Gleanings in Science.

Sir,

I request that you will have the goodness to give an early insertion to the following correction of an article which appeared in the 2d. Number of the Gleanings of Science, for February, 1829. In that number I stated, that no notice on the subject of the genus *Ampullaria* had, to my knowledge, yet appeared; whereas in the 12th number of the Zoological Journal, for April, 1828, (which, from some mistake, only reached me on the 16th instant,) I find a minute and interesting account of the animal, from the pen of the Rev. Lansdown Guilding, of St. Vincent's; setting my rough account (which was drawn up in December, 1828, from notes made in October 1827) completely in the shade. It is however gratifying to me to find that, as far as my description goes, it is supported in its more obvious points by the more finished account of my fellow-labourer; and that the *Ampullaria* of the East coincides with its brethren of the western hemisphere; the pedunculated eyes, situated at the exterior base of the tentacula, and the subretractile tentaculiform genæ*, being alike in both shells.

In the same paper Mr. Guilding has separated from the genus *Ampullaria* that of *Pachystoma*, under which it appears that our eastern *Ampullaria* should be ranged. Deep, however, as Mr. Guilding's knowledge of the subject is, I should hesitate to adopt the new genus, if on a more minute examination, and a comparison of the animal of our *Pachystomata* with Mr. Guilding's *Ampullariæ*, it appears that there is no essential difference in the characters of the animals. In this case, *Pachystoma* and *Ampullaria*, viewed separately, can hardly be looked upon as divisions of equal value with, or even proximate importance to *Paludina*, which Mr. Guilding places as the first genus of his family of *Ampullariadæ*, and which differs so materially from these two genera united. The mere thickening and partial reflection of the peristome of the shell, and the substitution of shell for horn in the operculum, do not appear to me to afford sufficient generic distinction: the shell *seldom* exhibits the first character until the animal has attained its full growth, and the operculum is often not preserved with the shell; so that it would be difficult to point out the place of a specimen in many cases.

In my notice on *Ampullaria* I mentioned that I had *Paludinæ* with calcareous as well as horny opercula. A curious analogical resemblance is exhibited by the former to *Pachystoma*, the peristome being thickened and subreflected as in that genus. Should the latter genus stand on the difference observable in the shell, a new one will be also required for these *Paludinæ*, the animal of which, I have satisfied myself by comparison with *Paludinæ* with horny opercula, to be essentially the same.

The Rev. Lansdown Guilding combats the opinion, that all the *Trachelipoda* are devoid of eyes, of which some of the land *Pulmonifera* undoubtedly are; and instances

* These are so remarkably like tentacula, that I set them down as such in my Journal on my first examination of the animal at Mirzapore, in October 1826. It was not until I had an opportunity of inspecting them more leisurely, a year afterwards, that I became aware of my mistake.