

Citation:

A. Pannekoek, Determinations of latitude and azimuth, made in 1896-99, in:
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causes taken into account) as the only certain *physical* criterium of purity.

As long as it has not been proved that existing impurities *cannot* account for the phenomena *quantitatively*, I see no reason to abandon the thesis that each substance shows a critical point at which the two coexisting phases become identical, so that one single critical density belongs to the critical temperature and the critical pressure.

Geodesy. — “*Determinations of latitude and azimuth, made in 1896—99 by Dr. A. PANNEKOEK and Mr R. POSTHUMUS MEYJES at Oirschot, Utrecht, Sambeek, Wolberg, Harikerberg, Sleen, Schoorl, Zierikzee, Terschelling (the lighthouse Brandaris), Ameland, Leeuwarden, Urk and Groningen.*” Short account of the report published under this title by Prof. J. A. C. OUDEMANS.

Besides the stations mentioned in the title, the programme, as drawn by the Dutch Geodetic Committee, contained also the stations Leyden and Ubagsberg, where the observations were made under superintendence of Prof. H. G. VAN DE SANDE BAKHUYZEN, who himself will publish them.

The observations of Messrs. PANNEKOEK and POSTHUMUS MEYJES at the above named thirteen stations, have been made under my superintendence, and in an introduction I have given an account and a criticism of them. Here the following details may suffice:

The mean latitude of the four northernmost stations, Terschelling, Ameland, Leeuwarden and Groningen is $53^{\circ}18'39''$, that of Schoorl, Urk and Sleen $52^{\circ}42'45''$, that of Leyden, Utrecht, Wolberg and Harikerberg $52^{\circ}10'40''$, that of Zierikzee, Oirschot and Sambeek $51^{\circ}35'51''$, while the latitude of the southernmost station Ubagsberg is $50^{\circ}50'53''$.

The entire arc of meridian, of which the length will be computed as soon as the results of the entire triangulation will be known, amounts therefore to $2^{\circ}27'46''$ and may be considered to consist of four parts of $35'54''$, $32'5''$, $34'49''$ and $44'58''$ respectively. Thus it will appear afterwards whether the curvature of the meridian, as found here, agrees with the form adopted.

The Universal instruments used for the observations were of REPSOLD; they were provided with a horizontal circle of 315 mms., and a vertical circle of 245 mms. in diameter, and belonged to the observatories of Leyden and Utrecht respectively. The circles were graduated to $4'$, whereas the microscopes of the Utrecht instrument are read directly to $2''$, those of the Leyden instrument to single seconds.

Dr. J. E. VERSCHAFFELT. "The influence of admixtures on the critical phenomena of simple substances and the explanation of Teichner's experiments."

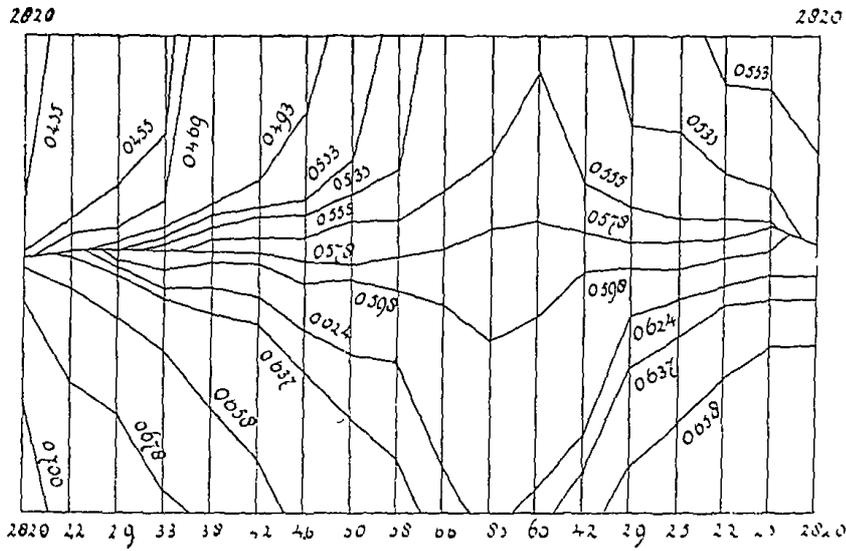


Fig. 1.

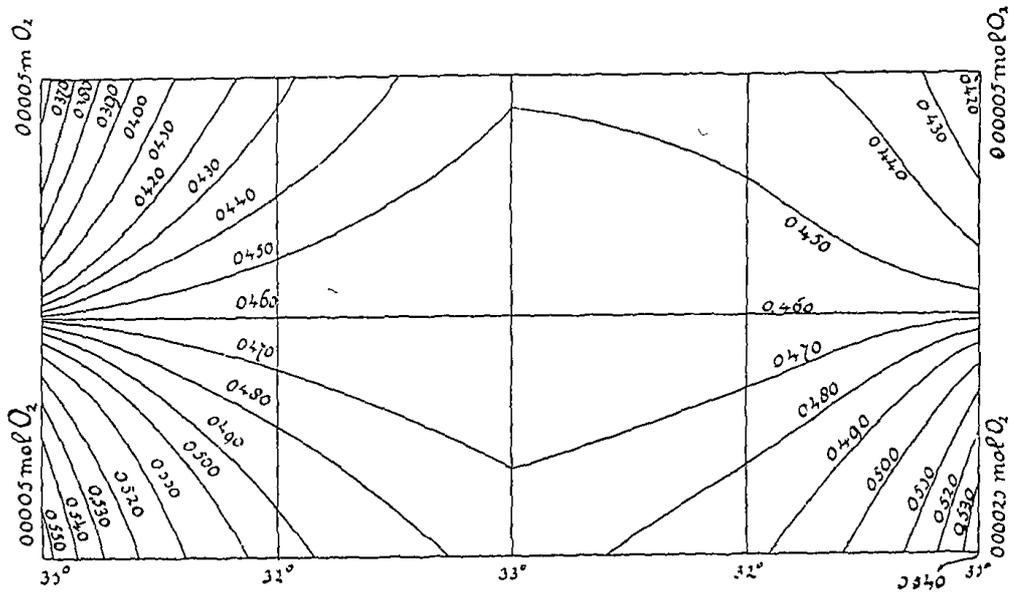


Fig. 2.

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The micrometer screws, the levels and the differences in diameter of the pivots were accurately investigated and all irregularities were accounted for. For the illumination, electric lamps were always used, for which the current was supplied by accumulators.

The latitudes were determined by zenith distances of northern and of southern stars. For the northern stars only the two pole stars, α and δ Ursae Minoris were used; the southern stars were chosen so that they had a northern declination from 6 to 14° , and consequently culminated at zenith distances almost equal to that of the pole, i. e. equal to the co-latitude.

As a rule, for each determination 16 zenith distances of the pole stars were observed, without regard to the point on the parallel they occupied; of the southern stars, four in number, 8 zenith distances were observed, four before and four after culmination; so that each complete determination of latitude rests on 32 zenith distances north and 32 south of the zenith.

At each station four such determinations were made in four positions of the circle which differed by 45 degrees. If we bear in mind that the reading was always made by two opposite microscopes, the zenith distance of each star may be said to be determined by eight different arcs of the circle, hence the periodic error of the graduation may be considered as almost entirely eliminated.

The declinations of the stars used were taken from the *Berliner Jahrbuch*, while due account was taken of the latest corrections, published by AUWERS in nos. 3927 -29 of the *Astronomische Nachrichten*. Finally the latitudes found were corrected for the polar motion, according to the latest data furnished by ALBRECHT.

For the azimuth determinations only the Polar star was used at different points of its parallel. The horizontal distance between the Polar star and the object was measured four times in 12 positions of the circle, differing 15 degrees; this was done according to the following scheme:

Object, Polar star, Polar star, Object, reverse the instrument 180° ; Object, Polar star, Polar star, Object, while for each pointing at the Polar star the level was read in two positions. Accordingly each determination of azimuth consisted generally of 12 series of 8 observations i. e. 2 complete determinations each; hence of 24 complete determinations.

As object was used either a lamp, or a heliotrope, in most cases a heliotrope. Its position with relation to the adopted centrum of the station was determined by the Triangulation Service.

The following may be remarked about the accuracy attained :

For the mean error of one result from two zenith distances $\pm 0''455^1$) was found as mean value ; the mean error of each final result, derived from say 128 double observations, was then calculated in different manners to be $\pm 0''065$.

For the determinations of azimuth the mean error

of a single determination was found to be $\pm 1''22$,

hence that of the mean of 12 determinations $\pm 0,355$.

The amount of all these mean errors can very well stand a comparison with the determinations of other observers.

To this criticism of the determinations executed for geodetic purposes two appendices are added, namely :

I. "A comparison between the latitude, determined at the station Utrecht, Cathedral tower (Domtoren), by Mr. POSTHUMUS MEYJES, and the determinations made at the Observatory."

The final result of this investigation was the following : Latitude of the Universal instrument at the Observatory :

| | |
|---|--------------|
| derived from observations of circummeridian | |
| zenith distances | 52° 5' 9''48 |
| derived from the observations in the prime vertical | 52 5 10,29, |
| „ „ „ result of Mr. POSTHUMUS MEYJES, reduced | |
| from the "Domtoren" to the Observatory . . . | 52 5 9,84. |

This agreement is quite satisfactory, especially if we consider that the observations of the circummeridian zenith distances at the Observatory, which had been made for exercise, were executed in only one position of the vertical circle, which was also a motive for neglecting the polar motion.

II. "A comparison between the azimuth of Amersfoort, determined by the author in 1879 and '80, and the same azimuth determined by Mr. POSTHUMUS MEYJES in 1896."

The final result of this comparison, after due regard was paid to all reductions, was : Azimuth Utrecht (Centre) — Amersfoort (Centre) :

Determination of 1879,80. $68^{\circ} 22' 44''71 \pm 0''31$,

„ „ 1896 : $45,59 \pm 0,29$.

Between these two determinations there is a difference of $0''88 \pm 0''42$ (mean error), which partly may be explained by the accidental errors of the observation and the graduation, and partly by the uncertainty in the different reductions which occur in this comparison. We should also bear in mind that in the results of Mr. POSTHUMUS

¹⁾ For Mr. PANNEKOEK $\pm 0''49$, for Mr. P. MEYJES $\pm 0''42$, two numbers that are nearly reciprocal to the magnifying powers of the telescopes of the two instruments (60 and 68 times).

MEXES three out of twelve differences from the arithmetic mean exceed the negative quantity $-0''88$, whereas in the author's results five out of nineteen differences exceed the positive quantity $+0''88$. Accordingly the difference between the two results may be considered as purely accidental.

(The last sentence does not occur in the original. It should be remarked that in the publication of 1880, the last difference from the arithmetic mean for 1879, must be $+0''74$ instead of $+1''74$).

ERRATA.

Page 238, line 5 from bottom, for "increases" read "decreases."

„ 240 „ 12 „ „ „ T' read T''' .

„ „ „ 10 „ „ „ T' read T''' (twice).

„ 241, in the formula for X_{lpT} , X_1 , X_{rpT} read x_{lpT} , x_1 , x_{rpT} .

(January 25, 1905).