§3 Hipparchos at Lindos: a Modest Confirmation

by DR¹

A Hipparchos’ Adopted Latitude

A1 While preparing the preceding article (§2) for publication, I became curious about the modest disagreement regarding Hipparchos’ calculation of the time $M$ which the chosen star (τ Boo) — of declination $\delta = 27^\circ 1/3$ — spends above the true horizon: the $M$ values computed by Neugebauer (224°06′: Neugebauer 1975 p.302) and Wilson (224°07′: §2 §B1) do not agree with that cited by Hipparchos, whose report is more precise than is usual for Hipparchos’ $Comm$ phenomena. Stellar $\delta$ is effectively given to 2° precision,² and $M$ is evidently being expressed to the nearest timemin:³ $M = 15 – 1/20$ hours $= 14^h 57m = 224^h 1/4$ (Hipparchos’ $Comm$ 2.2.26; pp.150-151).⁴

A2 In Rawlins 1994L, we found that Hipparchos’ assumed latitude $\phi = 36^\circ 08'$ (Lindos vicinity) for calculating declinations from zenith distance observations. If we try that value (instead of the generally accepted round figure $\phi = 36^\circ$) in §2 eq. 1, then we find $M = 224^h 21'$ which rounds to $14^h 57m$ or 15 – 1/20 hours, as reported (§A1). By contrast, if we use $\phi = 36^\circ$ in the calculation, the rounded result⁵ is $M = 14^h 56m$ or 15 – 1/15 hours, not Hipparchos’ stated value.

B Excluding 36°N

B1 Next, we instead invert the problem and (via §2 eq. 1) simply seek $\phi$ from the attested Hipparchos values (§A1) for $M$ & $\delta$.

— Note added 2016: —

In 2012, at DIO 20 17 §3, we caught on at last to what had been right in front of us for years: Hipparchos’ eclipse calculations and his climata mutually confirm two historically important discoveries:

[1] Hipparchos’ mechanical calculational ability was unerring, and two of his era’s trig tables were accurate to 1".

These realizations make the foregoing “modest” exploratory paper a good deal less modest. They mathematically confirm our finding by a completely independent induction (Rawlins 1994L or above in fn 8) that in his calculations Hipparchos used $36^\circ 08'$ for the geographical latitude of his observatory, which was near Lindos.

References


O. Neugebauer 1975. History of Ancient Mathematical Astronomy (HAMA), NYC.


D. Rawlins 1994L. DIO 4.1 §3.

¹See K. Pickering at DIO 2.1 §2 §F10.

²The star’s $\delta$ ends in 1°3, which means that pre-rounded $\delta$ was between $27^\circ 17'1/2$ and $27^\circ 22'$. (Hipparchos used degree-thirtys for declinations: Rawlins 1994L §§F2&F4.) However, $\delta$’s precision does not affect the ancient calculation which is the subject of this paper — since it just used $\delta = 27^\circ 1/3$.

³The hour-stars of Hipparchos’ $Comm$ 3.5 are sometimes expressed to 30ths or 20ths of hours — a one-timin discriminating.

⁴Neugebauer 1975 p.302 n.10 correctly reports that Manitius confuses hour-fraction with timemin: Hipparchos’ $Comm$ pp.151 & 298. Neugebauer 1975 p.166 n.3 suggests just the same type of scribal slip by an ancient. Note that precisely this sort of error turned out to be the ancient source of the slight discrepancy (in Almajest 4.11) of Hipparchos’ assumed mean distance (of the Moon) for his eclipse-trio B analysis vs. that assumed for his trio A analysis. (See Rawlins 1991W §G3.)

⁵Exact result: $M = 14^h 56m + 27''$.