A SELEUCID TABLE OF DAILY SOLAR(?) POSITIONS[1]

Asger Aaboe

EXCERPT: (Photograph, description and fragmentary table omitted. The text continues below to the end.)

"...What we have is clearly a list of longitudes without dates, and the nature of the differences suggests strongly that they are solar positions on successive days. In ACT[2] we have already evidence for table of daily solar positions; in Nos. 185, 186 and possibly 187, we find lists of consecutive dates and corresponding solar longitudes computed under the simple assumption that the sun's daily progress is 0;59,9°.

From No. 200, sect. 8, Neugebauer restores a scheme (see Table 3) which assigns to each zodiacal sign a constant daily solar progress. The mean is here the better value of 0;59;8°, and the other values are derived by makingthe difference 0;1,12° from sign to sign.

Further, in his commentary to No. 200d, sect 1. Neugebauer interprets the text's 1,1,45 as the maximal solar progress in degrees per tithi (1 tithi = 1/30 mean synodic month), for 1;1,45 degrees per tithi is very nearly 1;2,44 degrees per day which is the value from No. 200, sect. 8.

If our text is indeed a list of solar longitudes on successive days, it seems reasonable to assume that the sun's daily progress follows a scheme of System B type, i.e., that it is represented as zig-zag function. Unfortunately, all that is preserved belongs to the descending branch, so it is impossible to say with certainty what the function's characteristic parameters are, excepting the difference of 0;0,1,43,42,13,20 degrees per day.

However, some guesses can be made. The period of such a function must clearly be one year; we have attested Babylonian values of 6,5;14,44,51 days[3] and 6,5;15,36, ... days[4] (the latter from 12;22,8 mean synodic months per year). The amplitude Δ of a zig-zag function, i.e., the difference between its maximum M and its minimum m is half its period times its difference d; thus we find, using the two values for the year:

$$\Delta = M - m \sim \begin{cases} 0;5,15,38, \ldots \\ 0;5,15,46, \ldots \end{cases}$$

Now, attested Babylonian mean values u for daily solar progress are 0;59,9 and 0;59,8. The extrema M and m are:

$$u \pm \frac{\Delta}{2}$$

Thus we get $$M \sim \begin{cases} 1;1,45, \ldots \\ 1;1,46, \ldots \end{cases}$$

and $$m \sim \begin{cases} 0;56,30, \ldots \\ 0;56,31, \ldots \end{cases}$$

Daily Solar Progress (*ACT No. 200, 8*)	
♊	m = 0;55,32°
♉ ♋	0;56,44
♈ ♌	0;57,56
♓ ♍	u = 0;59,8
♒ ♎	1;0,20
♑ ♍	1;1,32
♐	M = 1;2,44

Table 3

These extrema do not agree with those from ACT No. 200 (Table 3), yet, from a modern point of view, they are perhaps better. Further, they make the maximum value from ACT No. 200d, i.e., 1;1,45, appear reasonable, even if taken as degrees per day, and not per tithi. It is, however, clearly too small to serve exactly as M for the zig-zag function, for this would imply a year of 363 days. (I may add that assuming that our text employs tithis does not help matters, for though not changing Δ much, it would lower u so much that 1;1,45 is quite out of the question.)

It is a plausible consequence of the assumption of a System B scheme for daily progress that the table contained longitudes for a full year; it would require 4-5 columns to a side, for we have seen that the length of Col. I Obv. is 45 lines. To restore the text much further than I have done, however, require more hyptheses than I can comfortably make.

There is one obstacle to the assumption that our text gives solar positions computed according to System B, and it is that the text's one preserved zodiacal sign is a *pa* (Sagittarius) in line 2 of Col. I. Obv. This would make the mean daily progress occur roughly in the middle of Capricorn (see Col. II. Obv.) and hence the maximum in the middle of Libra which is two signs too soon, both from a modern point of view, and compared with other Babylonian evidence (see, e.g., Table 3). If one believes the *pa* to be correct, it is therefore barely possible that the text describes daily progress of Venus. Our fragment would then preserve part of the stretch where Venus is near its greatest elongation as a morning star, for in this situation Venus mimics the behaviour of the Sun some 45° farther on in the ecliptic for period of 2-3 months.
However, as already mentioned, the *pa* is partially erased, and the scribe's intent can only be learnt if we find more of the tablet.

Thus my interpretation of the text is of necessity inconclusive and unsatisfactory, yet it makes it plausible that we have here a piece of a more refined scheme for daily solar progress than hitherto attested and that the text further belongs to a growing class of texts exhibiting longitudes, but no dates, for a whole period.

The following references and details have been added:

[1] Aaboe, Asger. "A Seleucid Table of Daily Solar(?) Positions," *Journal of Cuneiform Studies,* Volume 18, 1964:31-34.

[2] Neugebauer, Otto. *Astronomical Cuneiform Texts,* (ACT) Lund Humpreys, London, 1995.

[3] ACT 210, Section 3, Obv. II, Line 11: "1,4]9,34;25,27,18 days of 18 years of the sun." (6574.42425/18 = 365.24579167 days)

[4] 12;22,8 synodic months of 29;31,50,8,20 days (365.2606377 days).