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MUL.APIN
An Astronomical Compendium in Cuneiform

by

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Place and Time of the Composition of MUL.APIN

It will be clear from what follows that MUL.APIN is a composite text with many sources, and that even some sections are derived from others. The fact that source HH was copied in -686 gives a firm terminus ante quem for the final compilation. It is the date of the star-catalogues, and the closely related questions of the identifications of the star-names and the meaning of such technical features as *ziqpu* stars and the paths of Enlil, Anu, and Ea, that have evoked a debate concerning the date of this portion of the text, or of the astronomical observations that lie behind it, and concerning the place in which these observations were made.

In recent years three theories have been set forth. That proposed by van der Waerden (JNES 8 14-17; cf. *Die Anfänge der Astronomie* 64-74) is based on the calendar in MUL.APIN which gives in sequence the dates within an ideal calendar of the heliacal risings of certain constellations (I ii 36 - iii 12). He computed the intervals between heliacal risings of particular stars which he chose as the "first stars" of these constellations for -1000 and the latitude of Babylon, and concluded that the observations upon which the calendar is based were probably made between -1400 and -900, in Babylon rather than in Assyria. We do not quarrel with the date, but believe that lists III and V (see below pp. 140ff.) point to Assyria as the place.

Papke (Die Keilschriftserie MUL.APIN), on the other hand, recognized that one must deal with groups of stars rather than single stars, but also bases his calculations on "first stars", though a somewhat different set from van der Waerden's. Some of the first twenty of these are selected because they are the "normal stars" of Seleucid texts, and others for a variety of reasons. From the data in the calendar, and using these "first stars", he computes that the observations were most probably made in Babylon in about -2300. Then, depending on this date and place, he changes the identifications of fourteen stars previously arrived at. We question the terrestrial latitude which Papke assumes, and his choice of "first stars". His use of the much later "normal stars", his acceptance of rigidly defined declination circles as the boundaries between the three "paths", his insistence upon basing such an important chronological conclusion on stars rather arbitrarily selected to fit his theory, and his essentially ignoring the data provided in lists III and V all militate against his conclusions. So also does the fact that he dates these rather sophisticated records long before any others found in cuneiform texts - indeed, a millennium or so before the more primitive Astrolabe texts.

In fact, one can reconstruct a succession of texts from the list of seventeen stars in the path of Ea found in the "Prayer to the Gods of the Night", a composition of the Old Babylonian period, through the simple Astrolabe lists and the more elaborate list in section B of Astrolabe B, a tablet of ca. -1100, to the much more complex catalogue in MUL.APIN (see BPO 2 72-75). Not only are these lists of increasing accuracy in the sequence of heliacal risings of the stars they name; the last two have drawn upon the same mythological source associating constellations with deities. It is not impossible that the authors of the Old Babylonian text and of the Astrolabes ignored the superior data of the MUL.APIN list if it was in fact long before their times but the probability is that they would not have done so.

More recently van der Waerden (AHES 29 109-112) has argued in favor of Papke's theses. He notes that in MUL.APIN I ii 42-43 the rising of the Arrow, the Snake, and the Lion is said to occur on IV 15, and that the longest day and shortest night (i.e., the summer solstice) are recorded on the same date. He correctly observes that, if the Arrow were Sirius, its heliacal rising would not occur on the day of the summer solstice in -1100 but some twenty days later. His solution is Papke's: to take the "first star" of Arrow to be Procyon (Alpha Canis Minoris) and the date -2300; according to my calculation, the longitude of the Sun was about 85° on the day that Procyon was first visible in the morning at Babylon in -2500, while it was about 103° on the day that Procyon was first visible in the morning at a latitude of 36° N in -1000.

The trouble is that these calculations are not very significant. We know that the constellation Arrow was the figure of a man holding a bow and shooting an arrow (see Pingree and Walker, Memorial volume for A. Sachs); when that constellation - much larger than imagined by Papke and van der Waerden - was thought by the Babylonians to rise we have no way of knowing without knowing its precise limits.

But even more dubious than using Procyon as the criterion is the assumption that the ideal calendar which records the intervals between risings of constellations in terms of artificial time units and the location of the equinoxes and solstices on the fifteenth day of months I, IV, VII, and X have the same origin. It seems more sensible to us to regard the "dating" of an equinox or solstice on the fifteenth day of an artificial month - i.e., in its middle - as equivalent to recording that, with intercalation, it will fall within that month. In other words, our calendar contains two sets of data: one consists of the approximate intervals between the risings of constellations on the assumption that the Hired Man (Aries) rises on I 1 and that each month contains exactly thirty days, the other consists of the months within which the solstices and equinoxes will occur.

Confirmation of this interpretation is found in two passages in MUL.APIN. The first is I iii 8-9 where we read that the Arrow becomes visible in the evening on X 15, which is also when the shortest day and longest night (i.e., the winter solstice) takes place. In fact, Procyon's acronychal rising at Babylon in -2500 took place some thirty-five days before the winter solstice; the same error is evident, e.g., in Table VIII where we used Sirius. This demonstrates that the dates for both the heliacal and acronychal risings of the Arrow are only schematically associated with the fifteenth of months IV and X respectively, and should caution us against trying to squeeze the data of the text too closely. Note that in the Old Babylonian text published in the Appendix the equinoxes and solstices are said to fall on day 15 of months XII, III, VI, and IX!

The second passage is II i 9-18, wherein the days of the equinoxes and solstices are described. Again the heliacal rising of the Arrow is dated on IV 15, its acronychal rising on X 15; but otherwise this passage is more informative. On VII 15 (the fall equinox) the Sun is said to rise with the Scales while the Moon stands in front of the Stars behind the Hired Man. This records an observation of Full Moon near the time of the equinox; it is simply reversed for I 15 (the spring equinox). Table XII shows that in -1000 the Moon between the Stars (Pleiades) and the Hired Man was at a longitude of about 0° while the Sun was in the Scales (Libra). Further, the text states that on IV 15 the Sun rises to the north with the head of the Lion and on X 15 to the south with the head of the Great One (i.e., Aquarius; one must correct UR.GU.LA to GU.LA). Again, Table XII shows that the Sun was near ε Leonis at the summer solstice in -1000 and near ν Aquarii at the winter solstice. These coincidences are not precise; nor do we expect them to be. But they are completely consistent with a date of ca. -1000, but not for one of -2300; for at the latter date the Full Moon of the autumn equinox between Aries and the Pleiades would not yet be at Aries 0°, nor would ε Leonis be near Cancer 0°, nor ν Aquarii close to Capricorn 0°.

Reiner and Pingree (BPO 2) attempted to identify the constellations roughly on the basis of visual analogues of the motion of the sphere, using lists III and V as their basic data. They arrived at the conclusion that the date of this material is ca. -1000, but found that the simultaneously rising and setting stars of list III and the simultaneously culminating and rising/setting stars of list V fit a terrestrial latitude of ca. 36° N. The declinations of the *ziqpu* stars in list V also point to this latitude, as does the close fit between MUL.APIN's intervals of visibility in the morning for twenty-four constellations and those for bright stars in the same constellations computed by Ptolemy for the latitude 36° N (see Table VIII below p. 145.