It's About Time: Ancient Egyptian Cosmology

Joanne Conman

Abstract

To reconcile what stars actually do with what Egyptian texts say the stars do is possible only if the decanal belt theory of Otto Neugebauer is eliminated. The Egyptian decan system requires a sequence of stars that can be maintained only if one looks at stars in the same place or condition (i.e., rising) at different times of the year. I have discovered a pattern that is in agreement with the New Kingdom tomb texts, the interpretation of those texts given in the Carlsberg Papyri, and with the decan lists of the Asyut coffins. The correct understanding of the counted decan system offers new insight into true ancient Egyptian cosmology and related religious texts.

The Babylonians are thought to have believed that the earth was a hollow mountain[1] or a flat disc[2] surrounded by an ocean that was itself surrounded by a high wall[3]. The firmament, forged out of the body of the monster Tiamat by the creator god Marduk[4], was dome-shaped and rested above the all-enclosing wall. A semicircular passageway was thought to be behind the northern part of the dome with an opening in the east and another in the west. In the morning, the sun emerged from the eastern opening, crossed high over the southern sky, and then sank down to enter the western opening. At night, the sun traveled behind the sky to the eastern opening where it began its journey again the following morning[5].

Leonard Lesko has proposed an Egyptian cosmology that is similar to this Babylonian model[6]. Lesko postulates a solid, probably iron, firmament for the Egyptians, pointing out that the word for firmament (*biꜣ*) is related to the words „wonders“ or „marvels“ (*biꜣw*) and „iron“ (*biꜣt*)[7]. He suggests that the Egyptians believed that the sky was made of the material that fell from it and that stars are actually holes in the firmament resulting from falling meteors. As the sun passes above the dome of the sky at night, the holes left by the falling meteors are lit from behind[8].

A group of coffins, found at El Bersheh and dated to the Middle Kingdom, were decorated with elaborate maps of the sky, accompanied by texts known as the Book of Two Ways[9]. The maps show a blue waterway that Lesko believes is the path of the sun

1 M. Jastrow, The Religion of Babylon and Assyria, 1898, 489.

2 J. Black/ A. Green, Gods, Demons, and Symbols of Ancient Mesopotamia: An Illustrated Dictionary, 1992, 52.

3 S. Arrhenius, The life of the universe as conceived by man from the earliest ages to the present time, translated by Dr. H. Borns, 1909, 20-22.

4 Black/ Green, op.cit., 52; and Jastrow, op.cit., 435.

5 Black/ Green, op.cit., 52; Arrhenius, op.cit, 20-22; and Jastrow, op.cit., 443.

6 L.H. Lesko, „Ancient Egyptian Cosmogonies and Cosmologies“, in: Byron E. Shafer (ed.), Religion in Ancient Egypt: Gods, Myths, and Personal Practice, 1991, 117 ff.

7 Lesko, op.cit., 117.

8 Lesko, op.cit., 117.

9 L.H. Lesko, The Ancient Egyptian Book of Two Ways, 1972, 1-3.

as it traveled under the dome of the sky in the daytime and a black (land) route that he sees as the sun's night path as it traveled behind and above the sky[10]. The New Kingdom Egyptian writer, Amenope, wrote a book in which he claimed to have compiled a list of „everything in the universe". Significantly, Amenope lists the sun, moon, stars, and even weather phenomena[11]; however, he does not include the places found on the El Bersheh coffin maps, places which are also found in later guides to the Afterlife[12]. Amenope's list was apparently limited to everything of *physical reality* in the universe. However, the places described in the Afterlife texts, like the locations on the El Bersheh maps, are not non-existent. Instead, they represent abstract ideas (such as moments in time or conditions) that have a conceptual, rather than a concrete existence[13]. Lesko is correct that some passage, involving the sun in particular, is being tracked in the Book of Two Ways. It is not through physical regions of the sky, but through regions of time. This is true for other guides to the Afterlife.

The Egyptians did not conceive of any underworld. The sun did not orbit the earth, nor did the earth orbit the sun[14]. László Kákosy notes Egyptian texts that indicate the sun's nightly course was believed to run in cosmic space, not in any underworld[15]. Lesko writes that the Egyptians' „universe was ‚all that the sun encircles,' but if this phrase implies that the sun was thought to have gone around the world in a single circular course, then apparently the phrase reflected a cosmology different from [the religious texts he discusses][16]". The problem here is in thinking that the sun can only circle the world in a Ferris wheel-like model, over-head and under the earth. There is another way the sun can encircle the world: attached to a perpetually turning dome as in the ancient Chinese *gai tian* cosmological model. Lesko's cited phrase is actually completely consistent with the rest of the material he uses. A turning sky resolves the major difficulty with Lesko's model, namely that it conceives of the sky as a static background, which does not account for the movement of the stars.

The most ancient of several Chinese cosmologies was the *gai tian* or Celestial Lid theory. The theory is described in a book probably written in the last two centuries BCE called *The Mathematical Classic Concerning the Dial and Gnomon*, which included some material that may date from 1000 BCE[17]. The *gai tian* model conceived of the sky as a concave dome over a convex earth[18]. The sky dome turned from right to left. The

10 L.H. Lesko, Some Observations on the Composition of the Book of Two Ways, in: JAOS 91, 1971, 30.
11 A.H. Gardiner, Ancient Egyptian Onomastica,1947, 4-6.
12 E. Hornung, The Valley of the Kings, transl. by D. Warburton, 1990, 71, 156-157.
13 Cf. E. Hornung, Conceptions of God in Ancient Egypt: the One and the Many, transl. by John Baines, 1982, 183.
14 Lesko, Ancient Egyptian Cosmogonies and Cosmologies, 117-118.
15 L. Kákosy, Decans in Late Egyptian Religions, in: Oikumene 3 1982, 183.
16 Lesko, Ancient Egyptian Cosmogonies and Cosmologies, 117.
17 H. Chatley, The Heavenly Cover: a Study in Ancient Chinese Astronomy, in: Observatory 61, 1938, 11-12.
18 Chatley, op.cit., 10.

sun and moon were attached to the dome, but still had a (much slower) proper motion of their own from left to right[19]. The Chinese calculated the height of heaven and the size of the earth geometrically, based on the length of noontime shadows throughout the year. From the length of the shadows, they determined that the sun at sunset was further away from the earth than it was at noon[20]. At night, the sun was believed to shine on some other section of the earth, beyond the vision of the Chinese observers[21] (see fig. 1). Like the Babylonians, the Chinese pictured the earth surrounded by an ocean; however, instead of seeing the earth as a circular disc or a hollow mountain, the Chinese pictured a square earth to balance with the round sky. That is consistent with Taoist understanding of balance and harmony[22] and, interestingly, similar to the Sumerian idea of a four-sided earth[23]. The Chinese idea of a perpetually turning sky dome has much in common with what ancient Egyptian texts describe.

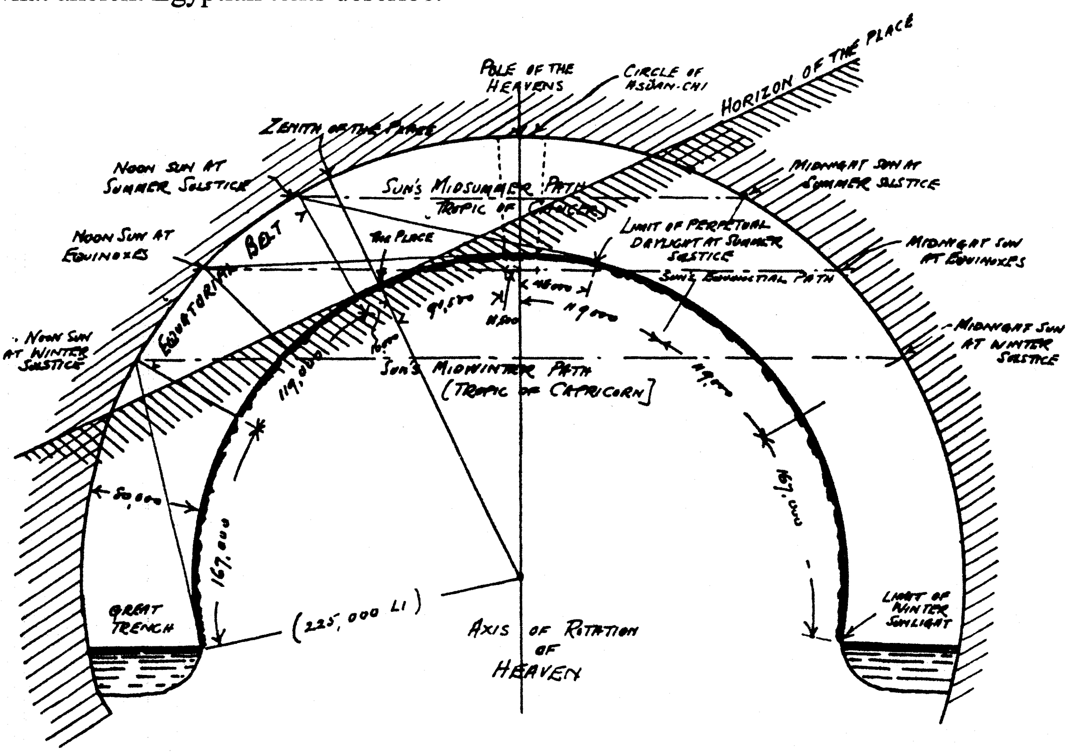


Fig. 1
This illustration first appeared in the article, „The Heavenly Cover" by Herbert Chatley, Observatory 61, No. 764, 1938, 10-21. It is used with the kind permission of the editors of Observatory. (copyright: Observatory Magazine)

19 J. Needham, The Cosmology of Early China, in: C. Blacker/ M. Loewe (eds.), Ancient Cosmologies, 1975, 88.
20 Chatley, op.cit., 15.
21 Needham, op.cit., 88.
22 Needham, op.cit., 89.
23 Black/ Green, op.cit., 52.

For the Egyptians, the sky was not a passive background; it was an active force. They saw the sky as continually turning. The sun moved with or as part of the sky and functioned as a mobile meridian. In the ancient Egyptian language, the sun „comes into existence" at dawn and it „is completed," at sunset[24]. For the Egyptians, direction was a consequence of time, contingent upon the sun's location. The Egyptians had one word that meant both „west" and „right" and another word meaning both „east" and „left"[25]. The Egyptians divided the perpetually turning sky into right and left sides. The sky's right side faced them in the day and its left side faced them at night, as a hymn says, „Deine beiden Augen kreisen Tag und Nacht, dein rechtes ist die Sonnenscheibe, dein linkes der Mond[26]."

In the Egyptian model, the sky apparently undulated as it turned, having two dips and two hills. If we look towards the south, the sun first appears low on our left-side, crosses before us while increasing in elevation, then sinks lower, disappearing on our right-side, before finally reappearing on our left-side with each revolution. If the sun marks a point on a line that bisects the entire sky dome, half the turning sky is ahead of the sun (on our right) and half the sky is behind the sun (on our left). So at dawn, when the sun first appears, the right side of the sky faces us, while at sunset, the left side of the sky faces us. That is why the sun is its right eye and the moon is its left eye. Pyramid texts §1132-37 say the sun descends in order to rise again[27], suggesting the sun is somewhere high while it is out of sight. Reed floats are lowered to ferry Re across the encircling ocean to the other side of the sky[28]. The Carlsberg papyrus I. D. II.32 says the lands of the *dwꜣt* (i.e., the point at which the sun rejuvenated itself at night) are high. The next line (II.33) says the lands of the *dwꜣt* are empty[29], so the *dwꜣt*'s height may be metaphorical. Not of the Nile Valley, the *dwꜣt* was „different, unknown, and mysterious[30]." As such, it may have been equated with foreign or unknown territories, which were associated with mountains[31]. Possibly, height was assumed to balance with the height of the midday sun to be philosophically pleasing, as the square earth was for the Chinese. Still, the texts suggest an undulating motion with two dips (sunrise and sunset) and two high points (midday and the middle of night).

If the sun marks a point on a line that bisects the turning sky dome into right and left sides, we need to determine the point opposite the sun that marks the other end of the bisecting line. The Egyptians had a system of counting stars (which will be explained in

24 V.A. Tobin, Myths, in: D.B. Redford (ed.), The Ancient Gods Speak, 2002, 243.
25 J. Allen, Middle Egyptian, 2000, 21; also Lesko, Ancient Egyptian Cosmogonies and Cosmologies, 117.
26 H. Kees, Hermann, Aegypten, 1928, 13.
27 R.O. Faulkner, The Ancient Egyptian Pyramid Texts, 1969, 185-186.
28 Faulkner, op.cit., 72-5, 252.
29 O. Neugebauer/ R.A. Parker, Egyptian Astronomical Texts I, 1960, 54.
30 Hornung, The Valley of the Kings, 73.
31 J.M. Plumley, The Cosmology of Ancient Egypt, in: C. Blacker/ M. Loewe (eds.), Ancient Cosmologies, 1975, 20.

detail below) that enabled the priests to determine when the point of the sky opposite the sun faced them. The Egyptians observed stars rising in a section of the eastern horizon that they called the *msqt* region[32], that is, the range of the ecliptic on the eastern horizon. Approximately every 10 days, a bright star would rise just before the sun in the *msqt* region, marking the beginning of a new 10-day Egyptian week. The stars are called decan stars or decans from the Greek word for „10". Once a year, a decan star will rise just before the sun rises, which is called its heliacal rise, and once a year, it will rise just after the sun sets, which is called its acronychal rise. There were 36 decans that rose heliacally (just before the sun) over the course of a year. In each 10-day Egyptian week, when a certain star began to rise, the priests knew it was the *wšꜣw* hour, that is, the dark hour of middle night[33]. As I will show, the rising of a particular star, which was called the *šn dwꜣt* star for a given decade of days, signified that the sun had reached a magical time of rejuvenation called the *dwꜣt*. Each night, the sun rejuvenated[34], becoming young so that it could be born again at dawn. This was the time the sun god Re joined Osiris, the lord of eternal life[35]. It also marked the time that the part of the sky opposite the sun faced the Egyptians.

Jan Assmann has written that the Egyptians understood directions as regions of the sky rather than of the earth[36]. But without a stationary sky, our modern conception of absolute directions cannot and does not work. For the Egyptians, direction is dependent upon time and the two cannot be separated. In the ancient Egyptian model, west and east are dependent on *when*; what time it is. Rather than being seen as regions of the sky, directions must be understood as times connected with certain regions of the sky. The right/ west side of the sky is day and the left/ east side is night. For the Egyptian, a direction is quite logically equated with a time or a state of being.

There was no underworld. The false idea of an ancient Egyptian underworld has spawned other erroneous ideas. A misconception that is almost universally held by Egyptologists is that the deceased King in the Pyramid Texts desired to join the circumpolar stars. The faulty equating of setting with death and the non-existent underworld led to an incorrect understanding of the word „imperishable" with regard to certain stars called the „Imperishable Ones" (*iẖm.w-sk*). It was assumed that the „Imperishable Ones" must be stars that do not rise or set, that is, circumpolar stars. In fact, „Imperishable Ones" simply means that stars do not die. When the king sought to join them; he sought not to die. As they live eternally, he wished to live eternally.

32 Neugebauer/ Parker, Egyptian Astronomical Texts I, 50, n. 4-6. Also see the discussion on *msqt* in H. Willems, The Coffin of Heqata (Cairo JdE 36418): A Case Study of Egyptian Funerary Culture of the Early Middle Kingdom, OLA 70, 1996, 263-7. Willems does not consider that *msqt* may be a state of being, a condition, or a process, which it may be, rather than (or in addition to) a location.

33 Neugebauer/ Parker, op.cit., 35.

34 Hornung, Conceptions of God, 161-162.

35 J. Assmann, The Search for God in Ancient Egypt, transl. by D. Lorton, 2001, 79; and M. Müller, Re and Re-Horakhty, in: D.B. Redford (ed.), The Ancient Gods Speak, 2002, 327.

36 Assmann, The Search for God, 62-63.

Pyramid texts §703-5 and §1687-9[37], among others, tell us the king wished to join the sun, which cannot be seen in the northern sky. The goal in one version of the Book of Two Ways was to remain with Osiris, but in all others, the goal of the deceased was to join the sun[38]. In later times, the deceased wished to go to the decan stars[39], which travel with the sun[40]. The hippo shown at the north celestial pole may be linked to Thoeris, who was said to be the mistress of the *wr.t* demons[41]. Pyramid Text §522 provides a spell to repel the hippo[42]. The hippo is connected to Isis[43], whose malicious side is discussed below. The hippo is also linked through Isis to Sepdet[44], who had a menacing side of her own[45]. The stars at the pole, the circumpolar stars, are not free to leave it and travel with the sun. Several Late Period texts, including the Jumilhac papyrus, state that Seth was imprisoned at the north celestial pole, and prevented from entering the *dw3t*[46]. Safe passage through the *dw3t* was essential for eternal life. The deceased did not intend to stay at the frightening celestial pole or even to go into the northern part of the sky. Rather, the deceased wished to access the sky at the *time* it was north. The *dw3t* opens to the north for the path of birds[47]. The „place" was marked by the time the *šn dw3t* star rose each night, the beginning the *wš3w* period. Direction and time are equivalent in ancient Egyptian thought. North was the direction/ time of eternity, immortality, and celestial rebirth because that is where/ when Re rejuvenated. The tombs were oriented so the exit faced north because north was the direction/time of immortality and celestial rebirth. The deceased wanted to rejuvenate in the company of Osiris, as Re did daily, in the place/ time north, but there was no wish to become a circumpolar star.

What about the boats? It is easy to be misled into thinking that the Egyptians meant to indicate that the sun god was moving against the background of a static sky in his boat. A significant clue that that is not the case is found in the „astronomical" tomb art. The sun and the decan stars (which were fixed stars) are portrayed in boats, while not all of the planets are[48]. The moon, which is often excluded in the tomb art, can vary. On the ceiling of the outer hypostyle hall of the temple of Hathor at Denderah, the waning moon is shown in a boat, while the waxing moon is shown on a dais atop a stairway. This implies that the acquisition of a boat occurs for the moon when it is full. That is the time it can be seen to cross the entire sky. Those shown in boats, the sun, the decan stars,

37 Faulkner, op.cit., 132, 250.
38 Lesko, The Ancient Egyptian Book of Two Ways, 135.
39 Kákosy, Decans in Late Egyptian Religions, 183.
40 Neugebauer/ Parker, Egyptian Astronomical Texts I, 47, 55, 61.
41 Kákosy, Decans in Late Egyptian Religions, 185.
42 Faulkner, op.cit., 103.
43 Neugebauer/ Parker, Egyptian Astronomical Texts III, 189-91.
44 Neugebauer/ Parker, Egyptian Astronomical Texts III, 191.
45 L. Kákosy, Die Mannweibliche Natur des Sirius in Ägypten, in: Studia Aegyptica 2, 1976, 42-43.
46 Neugebauer/ Parker, Egyptian Astronomical Texts III, 190-191.
47 Neugebauer/ Parker, Egyptian Astronomical Texts I, 66.
48 Neugebauer/ Parker, Egyptian Astronomical Texts III, pls. 5, 9, 10, 16, 18, 20, 24-6, 28; and Neugebauer/ Parker, Egyptian Astronomical Texts I, pl. 25.

and the outer planets can all be seen to cross the entire sky. Those not shown in boats, Venus, Mercury, and sometimes the moon, are not seen to cross the sky, suggesting that boats represent the attachment of a heavenly body to the sky and/ or a certain kind of movement. Being moved by the turning sky was compared to being ferried or to sailing. Pyramid Text §711 says the sun is conveyed round the horizon by sailors[49]. Reed floats ferried the sun from one side of the sky to other side of the sky[50]. The ecliptic, the apparent path of the sun through the sky during the course of the year, was called *msqt sqdw*, the path of sailing stars[51].

Venus, Mercury, and the moon at times (waxing) were probably considered to have some independent motion. Venus and the moon are compared to birds. Venus, linked with a migrating crane, is called the „the crosser" (possibly meaning a „star which moves back and forth about the sun")[52], while the moon god Khonsu's name means „wanderer"[53]. Pyramid Text §130 appears to allude to the differences in the movement of the sun and moon: „I go round the sky like Re, I traverse the sky like Thoth[54]". Mercury's Egyptian name has never been translated. The oldest attested reference to Mercury being recognized as both an evening and a morning star is from the tomb of Ramses IV (1148-38 BCE). The planet was called Seth in the evening and a god in the morning[55]. The Egyptians knew it could be seen on either side of the sun, but it was not seen to move across the sky.

Interestingly, three deities who are associated with the three heavenly bodies that are not shown in boats all have powerful magic to protect Re from the serpent Apep. Apep, who threatened to destroy the sun at night, may represent the fear that the turning of the sky will go awry. Re was eternally cyclic, coming into existence repeatedly[56]. The outcome of his travel through the *dwꜣt* was not certain. The turning of the sky was magical, not controlled by natural law. Robert A. Ritner writes that the verb *pẖr*, meaning „to go around/ encircle" was equated with enchanting[57]. „Throughout Egypt's history, the magical ritual of encircling is attested from the earliest archaic funeral rituals to the temple ceremonies of the Greco-Roman periods"[58]. The king's coronation procession resembles Re's circuit in that it „both delineates the universe and establishes his sovereignty over it"[59]. But something that controls Re's encircling, as the turning sky

[49] Faulkner, op.cit., 133.
[50] Faulkner, op.cit., 161, 180, 182.
[51] Allen, Middle Egyptian, 21. Allen understands the „path of sailing stars" to mean „Milky Way"; see n. 32 above.
[52] Neugebauer/ Parker, Egyptian Astronomical Texts III, 182; also see 180-1 and pls.s 63-4.
[53] G. Hart, A Dictionary of Egyptian Gods and Goddesses, 1986, 112.
[54] Faulkner, op.cit., 161, 39.
[55] Neugebauer/ Parker, Egyptian Astronomical Texts III, 181.
[56] Assmann, The Search for God, 78.
[57] R. Ritner, The Mechanics of Ancient Egyptian Magical Practice, SAOC 54, 1993, 57.
[58] Ritner, op.cit., 57-58.
[59] Ritner, op.cit., 62.

does, might be expected to have power over Re himself. In fact, Isis, who is linked with the celestial north pole, does have such power. Isis' connection to that dangerous northern part of the sky, explains both her power over Re and her malicious use of that power against him when he was a weak old man (the sun in the *dw3t*)[60]. It should be noted that Isis was also able to repel Apep and could protect Re with her powerful magic[61]; however, Re's safe passage was assured by three other deities linked to the moon and the inner planets.

A hymn to Re says, „Daily Thoth writes Ma'at for thee"[62]. Thoth, a lunar god, determined the course of the sun, something he was able to do because he was „great in magic in the boat of millions of years (name of Re's boat)"[63]. Seth, god of chaos and confusion who was linked with the planet Mercury, was well known for protecting the sun[64]. Seth was able to resist enchanting by the serpent, and to repel the serpent because his magic was stronger than Apep's[65]. Seth specifically enabled the sky to keep turning by forcing Apep to eject the water the serpent had swallowed, which threatened to strand the sun in a dry celestial riverbed[66]. The planet Venus belonged to Osiris[67], whose union with Re was necessary for the sun's daily rejuvenation. The three deities who are connected with the boatless heavenly bodies act to determine Re's course, to repel Re's archenemy Apep, and to restore and renew the sun god himself. The idea of their unique powers may well be linked to their close proximity to the sun and the difference in the way they had apparent freedom of movement, as if not affixed to the turning sky.

Two Roman-period documents, Carlsberg Papyrus I and Carlsberg Papyrus Ia (c. 144 CE), are texts written in Hieratic and Demotic that provide some of the best insight into ancient Egyptian ideas of the cosmos. These texts, apparently written by the same scribe, translate of a number of older texts (many of which no longer exist) into Demotic, accompanied by commentary that provides clarification of the texts. Some of the oldest hieroglyphic texts discussed in the Carlsberg papyri are from the ceiling of the sarcophagus chamber of the Cenotaph of Seti I (1303-1290 BCE) at Abydos and the ceiling of Hall E in the tomb of Ramses IV (1158-1150 BCE) in the Valley of the Kings at Thebes. The tomb texts surround the figure of the goddess Nut and deal with the stars that mark the Egyptian weeks, the decan stars.

60 Hart, A Dictionary of Egyptian Gods and Goddesses, 104-105.
61 Ritner, op.cit., 18-22.
62 C.J. Bleeker, Hathor and Thoth: Two Key Figures in Ancient Egyptian Religion, 1973, 119.
63 Bleeker, op.cit., 119.
64 H. te Velde, Seth, in: D.B. Redford (ed.), The Ancient Gods Speak, 2002, 333.
65 Ritner, op.cit., 65-66.
66 Hornung, The Valley of the Kings, 103-106.
67 Neugebauer/ Parker, Egyptian Astronomical Texts III, 180-182.

The oldest known lists of decan stars, thought to date from the 9th through the 12th dynasties (c. 2000 BCE)[68], were found on the inside lids of a dozen coffins belonging to various high-ranking individuals at Asyut. Alexander Pogo, who studied the decans of the Asyut coffins in the 1930s, speculated that the decan stars were equatorial stars[69]. In the 1940s, Otto Neugebauer, working on the Carlsberg papyri with H.O. Lange, hypothesized that the decan stars were a belt of stars south of the ecliptic, based on his understanding of the papyri[70]. In the 1960s, Neugebauer, with Richard A. Parker, authored a three-volume set on Egypt's „astronomical" texts, in which his decanal belt theory was amended and elaborated. Unfortunately, Neugebauer assumed a cosmology that never existed in the minds of ancient Egyptians. Consequently, these texts have been misunderstood for over 60 years.

The fact that the Egyptians tracked certain stars is *not* evidence of early astronomy! Astronomy is a modern science that deals with concepts of a worldview that did not exist for the Egyptians. The information sought from the stars by the Egyptians dealt with concepts that are as alien to modern thinking, particularly modern secular thinking, as astronomy would have been to ancient Egyptians. For both modern astronomers and ancient Egyptians, the information sought from star observation and the methodology employed to seek that information leads to subsequent questions or a satisfactory conclusion. The understanding that is satisfying in the cosmology of one culture cannot be converted easily into that of another culture. Ancient Egyptians understood the universe as sacred, not mechanical. The Egyptian texts are first and foremost religious texts. They do incorporate some knowledge of the stars gained by observation, but that information was sought and used piously. In the last 20 years, a disturbing trend to ignore[71] or reject[72] the Egyptian astral texts has emerged. Authors with backgrounds in astronomy rely on their own (modern) knowledge and observation of the sky rather than on what Egyptian texts actually say[73]. Certain authors appear to have little appreciation of the

68 Willems, The Coffin of Heqata, 15-25 for Heqata; for others, see 330-1, 331 n. 2005, n. 2006. However, if my reading of the coffins below is correct, the Sothic dating that has been used to date the coffins is invalid.

69 A. Pogo, Three Unpublished Coffins from Asyut, in: Osiris 1, 1936, 500-509.

70 O. Neugebauer, Astronomy and History: Selected Essays, 1983, 208.

71 K. Locher, A Conjecture Concerning the early Egyptian Constellation of the Sheep, in: Archaeoastronomy 3, 1981, S74.

72 R. Böker, Über Namen und Identifizierung der ägyptischen Dekane, in: Centaurus 27, 1984, 190-1.

73 R.A. Wells, The Mythology of Nut and the Birth of Ra, in: SAK 19, 1992, 308-10, 318-20; also R.A. Wells, Sothis and the Satet Temple on Elephantine, in: SAK 12, 1985, 275-7; and K. Locher, Probable Identification of the Ancient Egyptian Circumpolar Constellations", in: Archaeoastronomy 9, 1985, S153.

symbolic nature of Egyptian art[74], pictographs and ideographs[75], or simply neglect what is known of Egyptian thought[76].

It is possible to reconcile what the stars actually do with what the Egyptian texts say the stars do; however, we must first reject Otto Neugebauer's decanal belt theory. Carlsberg Papyrus I E. II.44 - F. III.31 says: „a star dies and a star lives every decade (of days)". Stars are „first" (*tpt*), then they pass 90 days „in the west" before they are „enclosed by the *dwꜣt* „ (*šn dwꜣt*). They spend 70 days in the *dwꜣt* and then are „born" (*ms*). They next pass 80 days „in the east," which is finally followed by a period of 120 days of „working" or „serving" (*bꜣk*) in the middle of the sky[77]. This information is repeated again, phrased in another way, saying that at any time there are 9 stars in the west, 7 in the *dwꜣt*, 8 in the east, and 12 working in the middle of the sky[78]. The star that is „first" (or „first hour") is separated from the star which is coming to the *dwꜣt* by 9 stars, and the star that is „born" is separated from the star that is „first" by 20 stars[79].

Despite the lack of evidence supporting any Egyptian concept of an underworld, Otto Neugebauer equated being „enclosed by the *dwꜣt*" with what he called acronychal setting (i.e., setting just after the sunset)[80]. Some Pyramid Texts do not specify any location of the *dwꜣt*, although others plainly indicate the *dwꜣt* is in the sky[81]; however, not one text places the *dwꜣt* under the earth. In addition, an explicit description given in the Carlsberg

74 Wells, in: SAK 19, 1992, 306-8; Wells simply assumes that the portrayals of Nut must be representations of some visible phenomena in the sky.

75 Locher, Kurt, „The Ancient Egyptian Constellation Group of the Lion between the Two Crocodiles and the Bird," *Archaeoastronomy* Number 15, 1990, S49-S50; also K. Locher, Probable Identification of the Ancient Egyptian Circumpolar Constellations, in: Archaeoastronomy 9, 1985, S153; K. Locher, in: Archaeoastronomy 3, 1981, S73; and K. Locher, New Arguments for the celestial location of the decanal belt and for the origins of the *sꜣḥ* - hieroglyph, Sesto Congresso Internazionale di Egittologia II, 1993, 281; Locher never questions that the figures are anything other than constellations, but offers no support except his own opinion that „imaginary figures" in the sky are constellations.

76 R.A. Wells, Origins of the Hour and the Gates of the Duat, in: SAK 20, 1993, 310, 313; Wells' peculiar notion that the Egyptians were obsessed with being „on time" for precisely timed sacrifices is at odds with everything that is known about the Egyptian understanding of time. Contrast, for example, with: Assmann, The Search for God, 73-80 or A. Bakir, A Further Reappraisal of the Terms *nḥḥ* and *ḏt*, in: JEA 60, 1974, 252-4. Also see Wells, in: SAK 19, 1992, 318. Wells' anthropologically naïve remark („There is little need to impose highly abstract conditions, which only exist in the modern mind, on a primitive society.") is contradicted by the huge body of work on ancient Egyptian thought done by numerous Egyptologists and theologians (i.e., Assmann, Hornung, Bleeker, Brede W. Kristensen, Henri Frankfort, and many others) over the last 60 years.

77 Neugebauer/ Parker, Egyptian Astronomical Texts I, 56-57; also J.F. Quack, Kollation und Korrekturvorschläge zum Papyrus Carlsberg 1, in: P.J. Frandsen/ K. Ryholt (eds.), The Carlsberg Papyri 3: A Miscellany of Demotic Texts and Studies, CNI Publications, 2000, 166-167.

78 Neugebauer/ Parker, Egyptian Astronomical I, 59.

79 Neugebauer/ Parker, Egyptian Astronomical I, 58-59; also Quack, op.cit., 167.

80 Technically, a planet's or star's setting just after sunset is called its heliacal setting; however, I will follow Neugebauer's usage here in discussing his work.

81 Faulkner, op.cit., 67, 75, 79, 144, 155, 164, 188, 189, 253.

papyri does not place the *dw3t* under the earth[82]. The decans' course of 360 days (36 10-day weeks) is quite close to one year. That is an indisputable indication that the decan stars must be quite close to the ecliptic. The Carlsberg papyri say that 7 decans are in the *dw3t* at any given time[83]. The 7 in the *dw3t* (nearly 20% of the 36 decans) must be equal to 70° (nearly 20%) of the ecliptic. Since that much of the ecliptic is not invisible at one time, we have another indication that „enclosed by the *dw3t*" cannot mean setting.

Neugebauer understood correctly that the 9 star separation between the „first hour" star and the star that is about to be „enclosed by the *dw3t*" is one quarter of the 36-star circle. He concluded that the „first" star's position was a midpoint, but erroneously assumed that it must be in the middle of the sky. He thought that this proved the Egyptians had located the meridian. As mentioned above, the Egyptians had one word that meant both „west" and „right." Confronted with a choice between understanding that the „first" star spent 90 days in the west or 90 days on the right side of the sky, Neugebauer, thinking like a modern astronomer, not an ancient Egyptian, chose the former. He understood „first" or „first hour" to mean transit of the meridian in the first hour after sunset and „enclosed by the *dw3t*" to mean setting just after sunset[84].

Building on the faulty assumption that the *dw3t* was under the earth, Neugebauer added another supposition: that of a 70-day period of invisibility for the decan stars following their acronychal setting. This is what led him to conjecture that the decan stars were in a belt slightly south of the ecliptic. Neugebauer wrote of the Carlsberg Papyrus, „...one fact which became clear only through the ancient commentator: all decans are invisible for 70 days between acronychal setting and heliacal rising"[85]. In fact, the original texts do not say or even imply this; it was inferred by Neugebauer. His reconstruction of one text says that a star „enters the *dw3t*. It stops in the House of Geb", and that this takes 70 days[86]. He hypothesized the existence of a decanal belt slightly south of the ecliptic to fit with his understanding of the texts and reconstructed texts to accommodate his misunderstanding. There are numerous statements in the texts asserting that the decan stars rise and set close to the ecliptic[87]. There is no indication that those stars do otherwise. The ancient unknown writer of the Carlsberg Papyrus, in attempting to clarify the tomb texts, was careful to specify the important fact that the sun and the decans were on the same path, and that path (or road) is singular. Neugebauer acknowledged that the repeated references in the texts suggest a close relationship between the decans and the ecliptic. Nevertheless, in reference to mention of the sun being „on the road of the decans", and of the decans setting where the sun sets, he wrote, „This is obviously impossible in the strict sense because the point of sunset at the

[82] Neugebauer/ Parker, Egyptian Astronomical Texts I, 52-54.
[83] Neugebauer/ Parker, Egyptian Astronomical Texts I, 60.
[84] Neugebauer/ Parker, Egyptian Astronomical Texts I, 41.
[85] Neugebauer, 207.
[86] Neugebauer/ Parker, Egyptian Astronomical Texts I, 68.
[87] Neugebauer/ Parker, Egyptian Astronomical Texts I, 47, 55, 60, 61.

horizon varies greatly"[88]. Here a modern accuracy is presumed that is not reasonable to expect of the Egyptians. Neugebauer's own decanal belt, ranging between 10°-50° from the ecliptic[89], would vary even more, and has the added complication of being quite difficult to locate.

Neugebauer gave no suggestion as to how the Egyptians tracked his hypothetical decanal belt, which he supposed had a variable distance from an unstable point. He offered no proposal as to what the Egyptians could have used to mark the southern limit of the belt he conjectures. Without some boundaries, such as those provided by solstice points, how would the Egyptians know where to look for a continually shifting point on the horizon? If the decan stars were fairly close to the ecliptic, as their 36 10-day periods attest, their positions would vary throughout the year, but they would be in accord with the sun's position, making them easy to follow, for while the exact points of both sunset and sunrise do vary greatly, each is contained in an unvarying region on the horizon at any given latitude.

The width of the path that the sun and stars travel is not specified in any text. There is no reason to assume it must be as narrowly precise as a modern astronomer might like. A region on the eastern horizon bounded by the two solstice points would extend from approximately 61.5° to 118° at the latitude of Cairo. Sirius and the Orion stars, the few identified stars of the alleged decan belt, would have been seen in such an ecliptic viewing area. Their observation does not imply a need for a separate belt south of the ecliptic to have been necessary. At the latitude of Cairo, during the New Kingdom, Sirius rose at approximately 110.5° and remained well within the ecliptic viewing region, i.e., the *msqt* region, for the first hour after its rising.

Besides never demonstrating how the Egyptians tracked his decanal belt, Neugebauer never explained why using stars in this hypothetical belt would have been preferable to using ecliptic or equatorial stars, as all other known people have done. The latter can be employed for reckoning time and scheduling religious festivals, in conjunction with the sun and moon or on their own. Neugebauer never offered any rationale to account for the Egyptians disregarding such useful stars in favor of his decanal belt, which seems to serve no other purpose but to support his understanding of the Carlsberg papyri. Nothing like the decanal belt, exclusively south of ecliptic that ignores other stars, was described by anyone anywhere until Neugebauer proposed it.

There is no evidence from ancient sources corroborating that a belt of stars exclusively south of ecliptic was observed or used by the Egyptians. It is remarkable that if the Egyptians, alone of all people on earth, tracked a group of stars that no one else ever did, that fact was never mentioned by any of the ancient authorities whose work has survived. Hephaestion and Maternus both wrote about the Egyptian decans, yet neither of them gave any indication that the decan stars were anywhere but along the ecliptic.

88 Neugebauer/ Parker, Egyptian Astronomical Texts I, 100.
89 Neugebauer/ Parker, Egyptian Astronomical Texts I, 99.

The Egyptian astrologer, Claudius Ptolemy, a contemporary of the Carlsberg Papyrus' unknown commentator, wrote extensively about astronomical ideas. He made changes in Egyptian astrological ideas[90], yet he never mentioned that the Egyptians observed and used a separate set of stars. Ptolemy did note specific stars that were bright enough (i.e., visible at heliacal rising) to be used as astrological ascendant or horoscope stars[91]. These horoscope stars were very likely the decan stars, as I will demonstrate below.

Neugebauer never provided evidence of any kind to support his decanal belt theory. Furthermore, although his hypothesis was testable, it was never tested. From the texts around the picture of Nut from the tomb of Seti I[92], we know what *spdt*, which has been identified as Sirius, is doing during 3 10-day periods in any given year. I constructed a chart of decans from those texts that is sorted by date (see Table I). During one decade of days, Sirius does something the texts call „first.“ During the decade of days Sirius is „first,“ 2 other stars do 2 other things: *ẖntw ḥrw* is „enclosed by the *dwȝt*“ and *srt* is „born.“ In a second decade of days, 90 days later, Sirius is „enclosed by the *dwȝt*;“ that is, doing whatever *ẖntw ḥrw* was doing when Sirius was „first.“ During the decade when Sirius is „enclosed by the *dwȝt*“, *sbššn* is „first“ and *sȝwy qd* is „born.“ In the third decade, 70 days later, Sirius is „born“, doing whatever *srt* was doing when Sirius was „first“ and whatever *sȝwy qd* was doing when Sirius was „enclosed by the *dwȝt*“. When Sirius is „born“, *sšmw* is „first“ and *wšȝti-bkȝti* is „enclosed by the *dwȝt*“. So, for 3 10-day periods in any given year, we know what 7 stars are doing and we know the spacing of the 10-day periods. We can verify that each star is doing the correct thing by comparing what it does in one decade of days to what another star in the same condition, but in another decade, does. For example, if „born“ means heliacal rise, then the 3 stars that are „born“ in these 3 decades should be the heliacal rising stars for their respective decade of days. If that were the case, *srt* would be the heliacal rising star when Sirius is „first,“ and *sȝwy qd* would be the heliacal rising star when Sirius is „enclosed by the *dwȝt*“. The 2 or 3 decans that are identified as stars in Orion will each link to 6 or 9 other stars during 2 or 3 additional decades each. Knowing just 2 stars in Orion plus Sirius gives us clues to identify18 more stars, fully one half of the decans, and also tells us the activities of 21 stars for 90 days out of the year.

Yet, in 1955, Neugebauer wrote: „There would be no point in trying to push the identification of the decans any further. What we now know definitely is that both hypotheses which have found support among scholars, namely that the decans are either ecliptic or equatorial stars (considering the only certain identifications, Sirius and Orion, as ‚exceptions' to confirm the rule), are equally wrong“[93]. Neugebauer declined to identify the decan stars on the basis that only the brightness of Sirius is known. This is false.

[90] Claudius Ptolemy, Tetrabiblos or Quadripartite: Being Four Books of the Influence of the Stars, transl. by J.M. Ashmand, Symbols and Signs, 32-36.

[91] B. Brady, Brady's Book of Fixed Stars, 1998, 330.

[92] Neugebauer/ Parker, Egyptian Astronomical Texts I, 84-6.

[93] Neugebauer, Astronomy and History, 208.

DATE			FIRST	ENCLOSED BY DUAT	BORN
4	*prt*	16	*sšmw*	***wšꜣti-bkꜣti* (3P16)**	*spdt*
4	*prt*	26	*knm*	***ipḏs* (3P26)**	*šṭw*
1	*šmw*	6	*tpy-ꜥ smd*	*sbšsn*	*knmt*
1	*šmw*	16	*smd*	*tpy-ꜥ ḫntt*	*ẖry ḫpd knmt*
1	*šmw*	26	*srt*	*ḫntt ḥrt*	*ḥꜣt ḏꜣt*
2	*šmw*	6	*sꜣwy srt*	*ḫntt ẖrt*	***pḥwy ḏꜣt* (2S16)**
2	*šmw*	16	*ẖry ḫpd srt*	*ṯms n ḫntt*	***tmꜣt ḥrt-ẖrt* (?26)**
2	*šmw*	26	*tpy-ꜥ ꜣḫwy*	*spty-ḫnwy*	*wšꜣti-bkꜣti*
3	*šmw*	6	*ꜣḫwy*	*ḥry-ib wiꜣ*	***ipḏs* (3S5)**
3	*šmw*	16	*tpy-ꜥ bꜣwy*	*sšmw*	*sbšsn*
3	*šmw*	26	*bꜣwy*	*knm*	***tpy-ꜥ ḫntt* (4S26)**
4	*šmw*	6	*ḫntw ḥrw*	*tpy-ꜥ smd*	*ḫntt ḥrt*
4	*šmw*	16	*ḫntw ẖrw*	*smd*	***ḫntt ẖrt* (4S26)**
4	*šmw*	26	***sꜣwy ḳd* (3S26)**	*srt*	***ṯms n ḫntt* (P?)**
1	*ꜣḫt*	6	*ḫꜣw*	***sꜣwy srt* (?)**	***spty-ḫnwy* (1A26)**
1	*ꜣḫt*	16	***ꜥryt* (15)**	***ẖry ḫpd srt* (15)**	***ḥry-ib wiꜣ* (2A6)**
1	*ꜣḫt*	26	*rmn ḥry*	***tpy-ꜥ ꜣḫwy* (?)**	***sšmw* (2A16)**
2	*ꜣḫt*	6	*ṯs ꜥrḳ*	*ꜣḫwy*	***knm* (2A26)**
2	*ꜣḫt*	16	*wꜥrt*	*tpy-ꜥ bꜣwy*	*tpy-ꜥ smd*
2	*ꜣḫt*	26	*tpy-ꜥ spdt*	*bꜣwy*	***smd* (2A16)**
3	*ꜣḫt*	6	*spdt*	*ḫntw ḥrw*	***srt* (2A26)**
3	*ꜣḫt*	16	*šṭw*	*ḫntw ẖrw*	*sꜣwy srt*
3	*ꜣḫt*	26	***knmt* (4A16)**	***sꜣwy ḳd* (3S26)**	*ẖry ḫpd srt*
4	*ꜣḫt*	6	***ẖry ḫpd knmt***	*ḫꜣw*	***tpy-ꜥ ꜣḫwy* (3A -?)**
4	*ꜣḫt*	16	*ḥꜣt ḏꜣt*	*ꜥryt*	***ꜣḫwy* (3A -?)**
4	*ꜣḫt*	26	*pḥwy ḏꜣt*	*rmn ḥry*	***tpy-ꜥ bꜣwy* (3A -?)**
1	*prt*	6	***tmꜣt ḥrt-ẖrt* (?)**	*ṯs ꜥrḳ*	*bꜣwy*
1	*prt*	16	***wšꜣti-bkꜣti* (?26)**	*wꜥrt*	*ḫntw ḥrw*
1	*prt*	26	*ipḏs*	*tpy-ꜥ spdt*	*ḫntw ẖrw*
2	*prt*	6	*sbšsn*	*spdt*	*sꜣwy ḳd*
2	*prt*	16	*tpy-ꜥ ḫntt*	*šṭw*	*ḫꜣw*
2	*prt*	26	*ḫntt ḥrt*	*knmt*	*ꜥryt*
3	*prt*	6	*ḫntt ẖrt*	*ẖry ḫpd knmt*	*rmn ḥry*
3	*prt*	16	*ṯms n ḫntt*	*ḥꜣt ḏꜣt*	*ṯs ꜥrḳ*
3	*prt*	26	*spty-ḫnwy*	***pḥwy ḏꜣt* (3P16)**	*wꜥrt*
4	*prt*	6	*ḥry-ib wiꜣ*	***tmꜣt ḥrt-ẖrt* (?)**	*tpy-ꜥ spdt*

This table was made using the data on pages 84 - 86 of Egyptian Astronomical Texts Volume I by Otto Neugebauer and Richard A. Parker, Brown University Press, 1960. The data came from the Nut picture in the tomb of Seti I that is in their book as plates 30-33. I have used Arabic numbers rather than Roman for the months, for example 4 *prt* 16, rather than IIII *prt* 16. Certain cells indicate places where Neugebauer and Parker reported scribal errors. I have abbreviated each error in parenthesis. For example, the scribe wrote II *šmw* 16 in error for the birth of the decan *pḥwy ḏꜣt*, so I put the decan where it belonged in II *šmw* 6, and noted (2S16) after its name. © Joanne Conman

TABLE I

The well-known star catalog of Claudius Ptolemy dates from about the time of the commentator of the Carlsberg papyri and provides useful contemporaneous descriptions of the stars. Neugebauer never produced any list of stars that followed the pattern he claimed to have discerned, and thus never proved the existence of his hypothetical belt. He could not identify the stars of his decanal belt for the simple reason that he was wrong.

The failure of Neugebauer's hypothesis and the cosmology it assumes is revealed by looking at a sequence of the few identified decanal belt stars from their acronychal setting through their heliacal rising. Using SkyMap Pro 6 software[94], I tested Neugebauer's decanal belt hypothesis, choosing 1300 BCE[95] (for its proximity to Seti I) at the location of Cairo. Sirius set acronychally on May 12. The next star to set acronychally 10 days after Sirius set was δ Monocerotis, a low magnitude star with no proper name, on May 22. This star would probably have been invisible in less than total darkness, but there is no other star in the area that sets at that time. Neugebauer suggests that Sirius is at the outer limit of his belt[96], so stars to its south must be excluded. Procyon was the next to set on May 31, 9 days after δ Monocerotis set, and 19 days after Sirius set (see figs. 2-4). When Sirius rose heliacally after 63 (not 70) days of invisibility on July 14, Procyon had already risen heliacally, a week earlier. On July 6, Procyon rose at the same time as δ Monocerotis. Procyon's invisibility period was a mere 35 days, off from Neugebauer's required invisibility time by half, and δ Monocerotis' invisibility period, assuming it could have been seen, was just 44 days, nearly ome month less than required. The 3 stars that set sequentially in 3 10-day periods did not rise sequentially in 3 10-day periods. Nor were they invisible for the required time of 70 days (see figs. 5 and 6). Sirius' period of invisibility of 63 days is the closest to the required 70 days is at the latitude of Cairo; however, the invisibility period would be shorter in latitudes farther south.

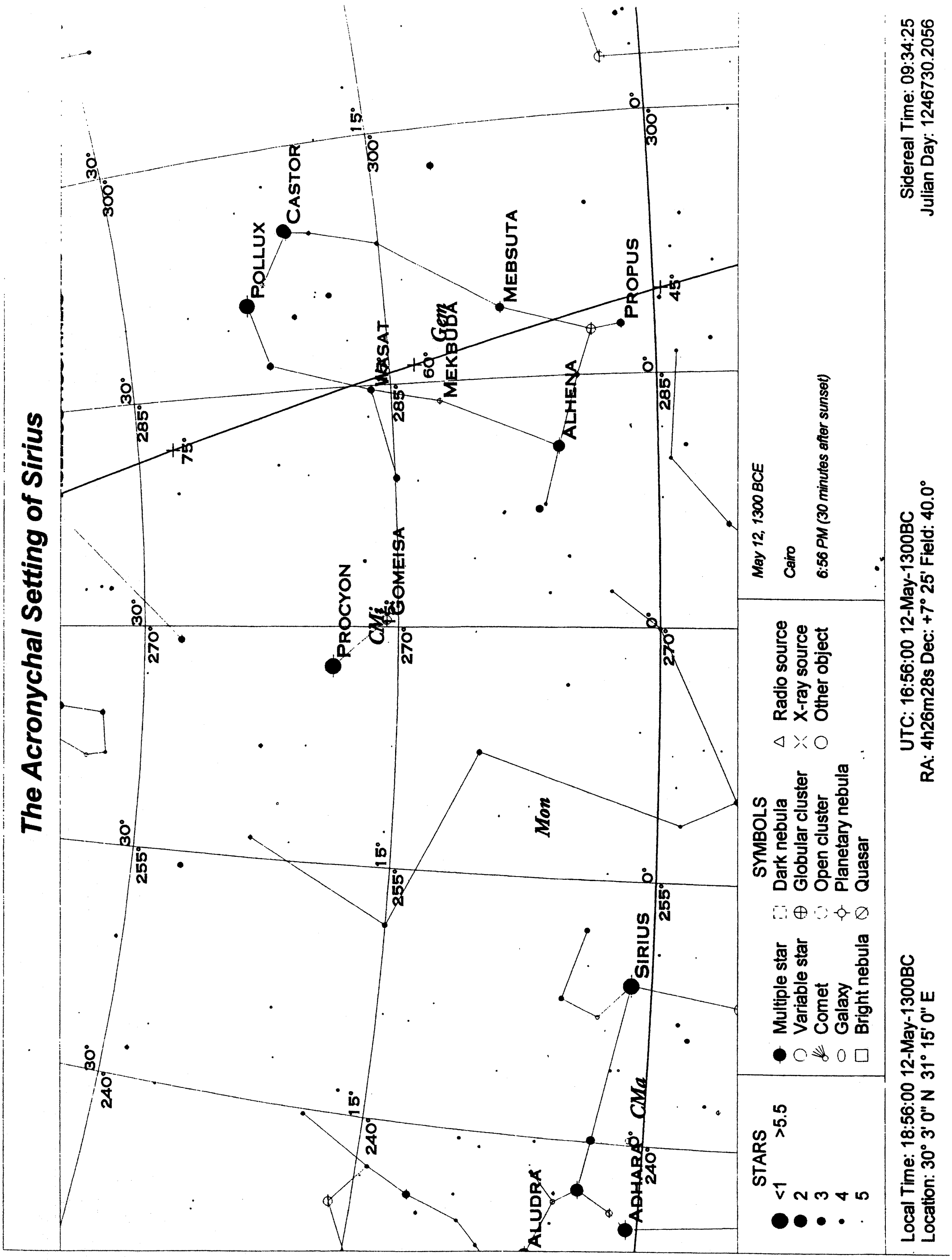
This can be further demonstrated with stars in modern Orion. Rigel sets first, on April 20, Bellatrix and Saiph set together, 7 days later, and Betelgeuse is last to set, 7 days after Bellatrix and Saiph. The first to rise before the sun is Bellatrix on June 8, having been invisible for only 42 days, nearly one month less than Neugebauer's interpretation of the texts required. It is followed 6 days later by Betelgeuse, which has a period of 48 days invisibility. Rigel rises next, 4 days after Betelgeuse, having been invisible for 52 days, still nearly 3 weeks (or 2 decades of days) less than required. Finally, Saiph rises 9 days after Rigel, having been invisible for 61 days (see figs. 7-10). Again, that is in latitude of Cairo; farther south the invisibility periods are even shorter. Not a single star is invisible for the 70-day „enclosed by the *dw3t*" period about which the Carlsberg texts are so emphatic[97].

94 A home astronomy program, even one of the best, has limitations when it comes to precise accuracy of the calculations. All times used in this research should be close to approximate, but not absolutely guaranteed. The times are close enough, however, to demonstrate a pattern, and that was my goal.

95 This is the astronomic year, corresponding to 1301 BCE historically. All dates are Julian.

96 Neugebauer/ Parker, Egyptian Astronomical Texts I, 99.

97 Neugebauer/ Parker, Egyptian Astronomical Texts I, 68, 73-74, 78.



The Acronychal Setting of Sirius
CASTOR
POLLUX
MEBSUTA
PROPUS
Gem
MEKBUDA
WASAT
ALHENA
PROCYON
CMi
GOMEISA
Mon
SIRIUS
CMa
ADHARA
ALUDRA
May 12, 1300 BCE
Cairo
6:56 PM (30 minutes after sunset)
STARS
<1 2 3 4 5 >5.5
SYMBOLS
Multiple star
Variable star
Comet
Galaxy
Bright nebula
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 18:56:00 12-May-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 16:56:00 12-May-1300BC
RA: 4h26m28s Dec: +7° 25' Field: 40.0°
Sidereal Time: 09:34:25
Julian Day: 1246730.2056

Fig. 2

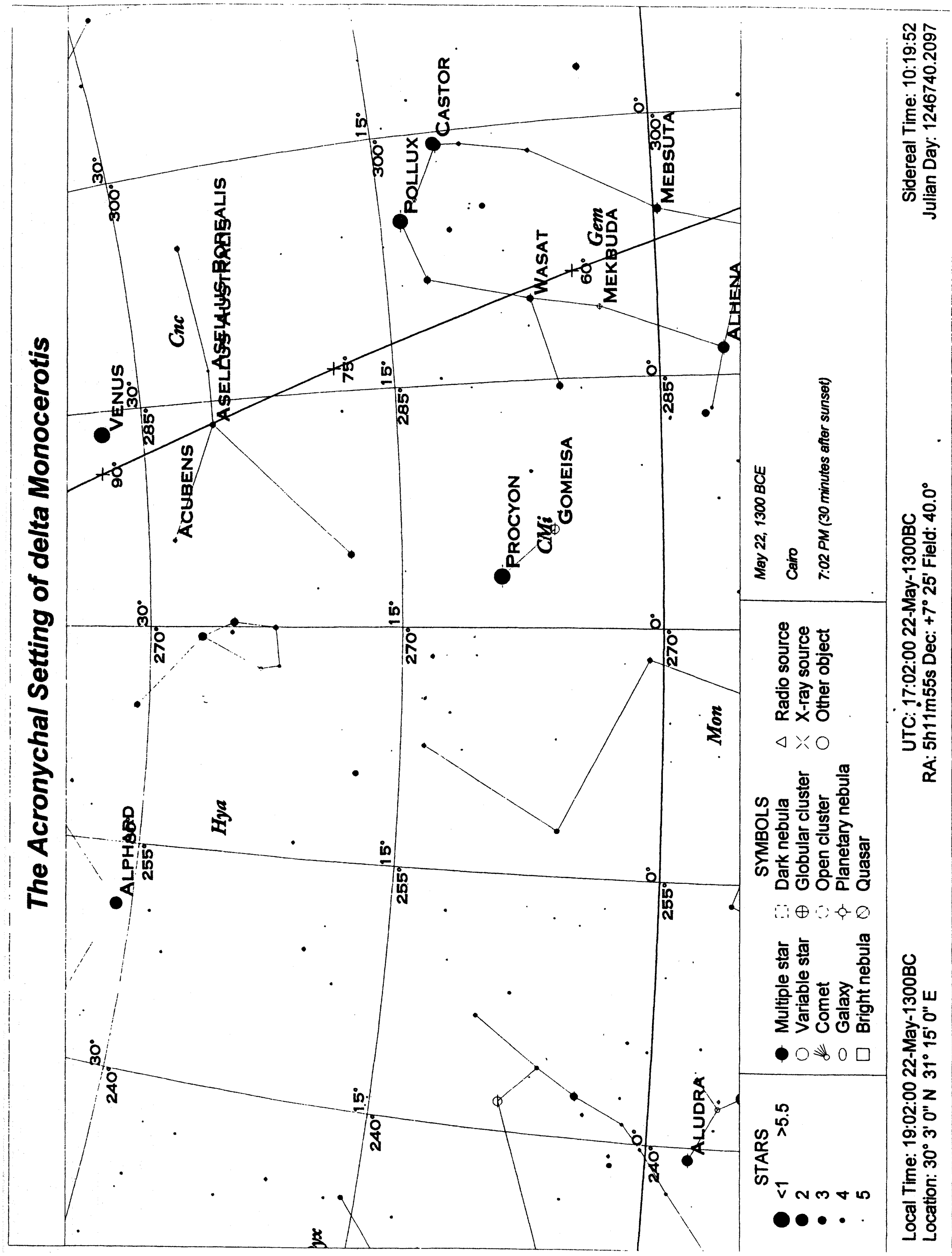

The Acronychal Setting of delta Monocerotis
VENUS
ASELLUS BOREALIS
ASELLUS AUSTRALIS
ACUBENS
Cnc
POLLUX
CASTOR
WASAT
Gem
MEKBUDA
MEBSUTA
ALHENA
PROCYON
GOMEISA
CMi
Mon
Hya
ALPHARD
ALUDRA
May 22, 1300 BCE
Cairo
7:02 PM (30 minutes after sunset)
STARS
<1
2
3
4
>5.5
Multiple star
Variable star
Comet
Galaxy
Bright nebula
SYMBOLS
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 19:02:00 22-May-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 17:02:00 22-May-1300BC
RA: 5h11m55s Dec: +7° 25' Field: 40.0°
Sidereal Time: 10:19:52
Julian Day: 1246740.2097

Fig. 3

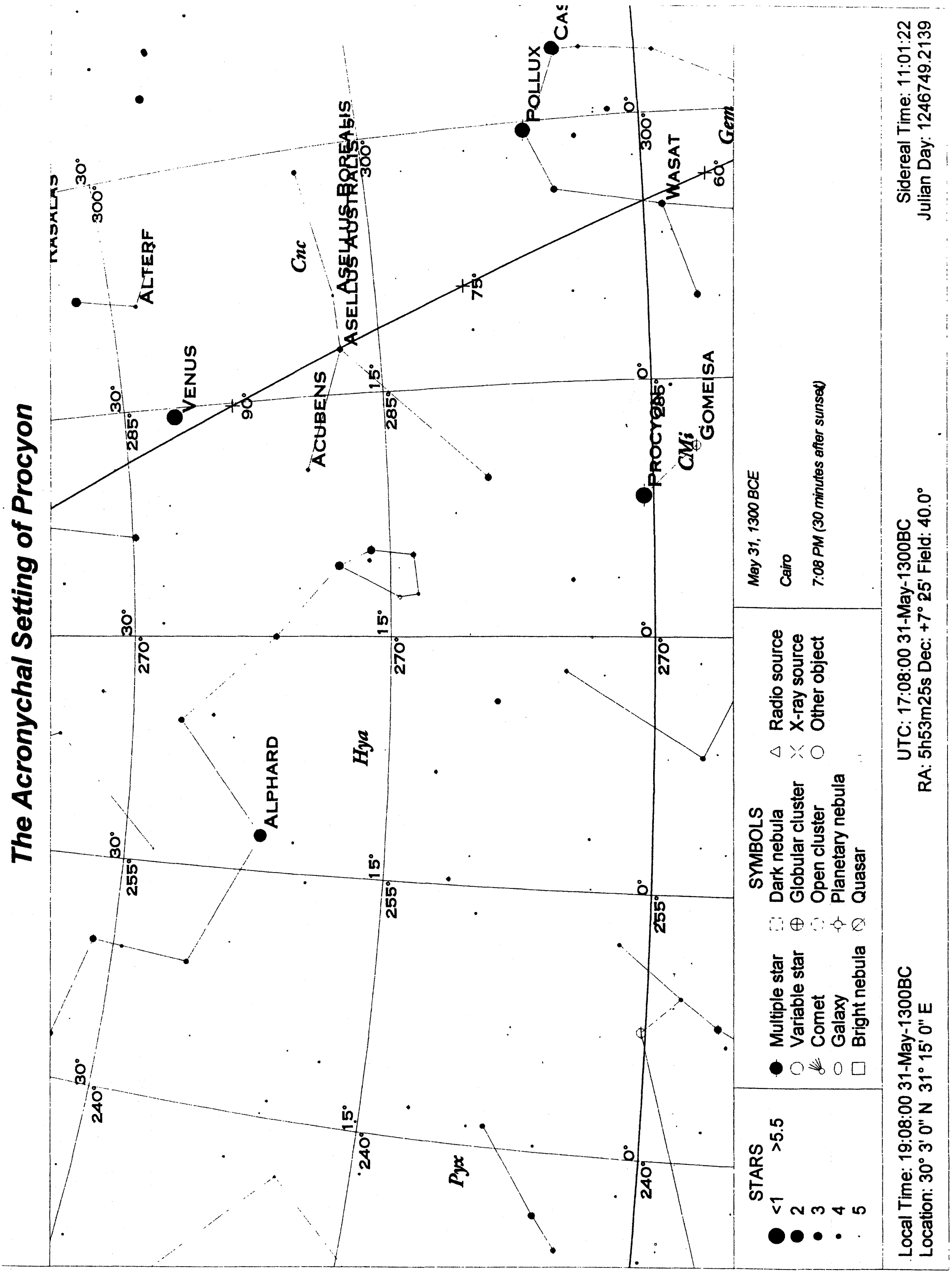

The Acronychal Setting of Procyon
POLLUX
CAS
WASAT
Gem
ASELLUS BOREALIS
ASELLUS AUSTRALIS
ALTERF
Cnc
VENUS
ACUBENS
GOMEISA
PROCYON
CMi
ALPHARD
Hya
Pyx
May 31, 1300 BCE
Cairo
7:08 PM (30 minutes after sunset)
STARS
<1 2 3 4 5 >5.5
SYMBOLS
Multiple star
Variable star
Comet
Galaxy
Bright nebula
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Sidereal Time: 11:01:22
Julian Day: 1246749.2139
UTC: 17:08:00 31-May-1300BC
RA: 5h53m25s Dec: +7° 25' Field: 40.0°
Local Time: 19:08:00 31-May-1300BC
Location: 30° 3' 0" N 31° 15' 0" E

Fig. 4

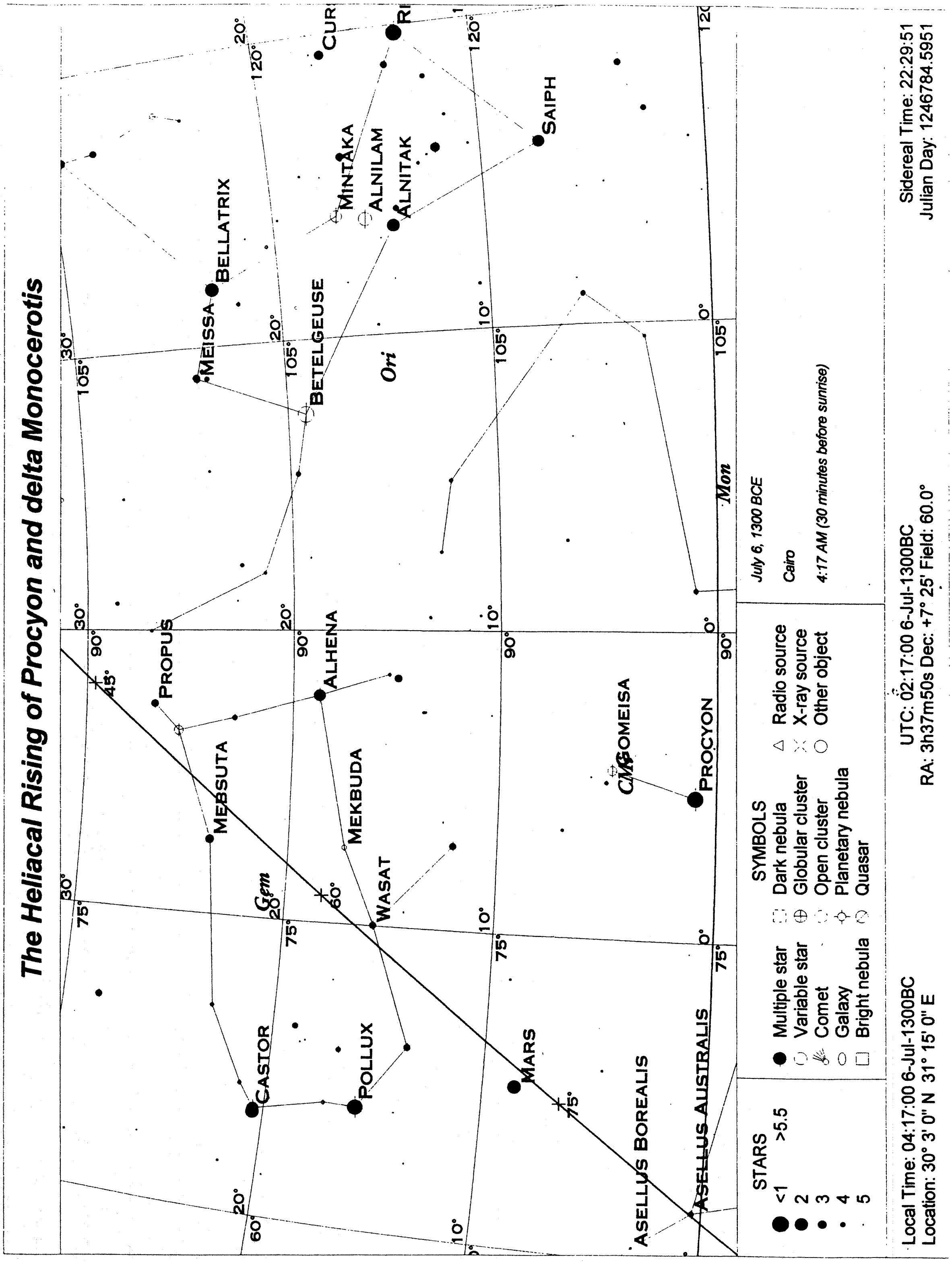

The Heliacal Rising of Procyon and delta Monocerotis
BELLATRIX
MEISSA
BETELGEUSE
MINTAKA
ALNILAM
ALNITAK
SAIPH
Ori
Mon
PROPUS
ALHENA
MEBSUTA
MEKBUDA
WASAT
Gem
GOMEISA
CMi
PROCYON
CASTOR
POLLUX
MARS
ASELLUS BOREALIS
ASELLUS AUSTRALIS
July 6, 1300 BCE
Cairo
4:17 AM (30 minutes before sunrise)
STARS
<1
2
3
4
5
>5.5
SYMBOLS
Multiple star
Variable star
Comet
Galaxy
Bright nebula
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 04:17:00 6-Jul-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 02:17:00 6-Jul-1300BC
RA: 3h37m50s Dec: +7° 25' Field: 60.0°
Sidereal Time: 22:29:51
Julian Day: 1246784.5951

Fig. 5

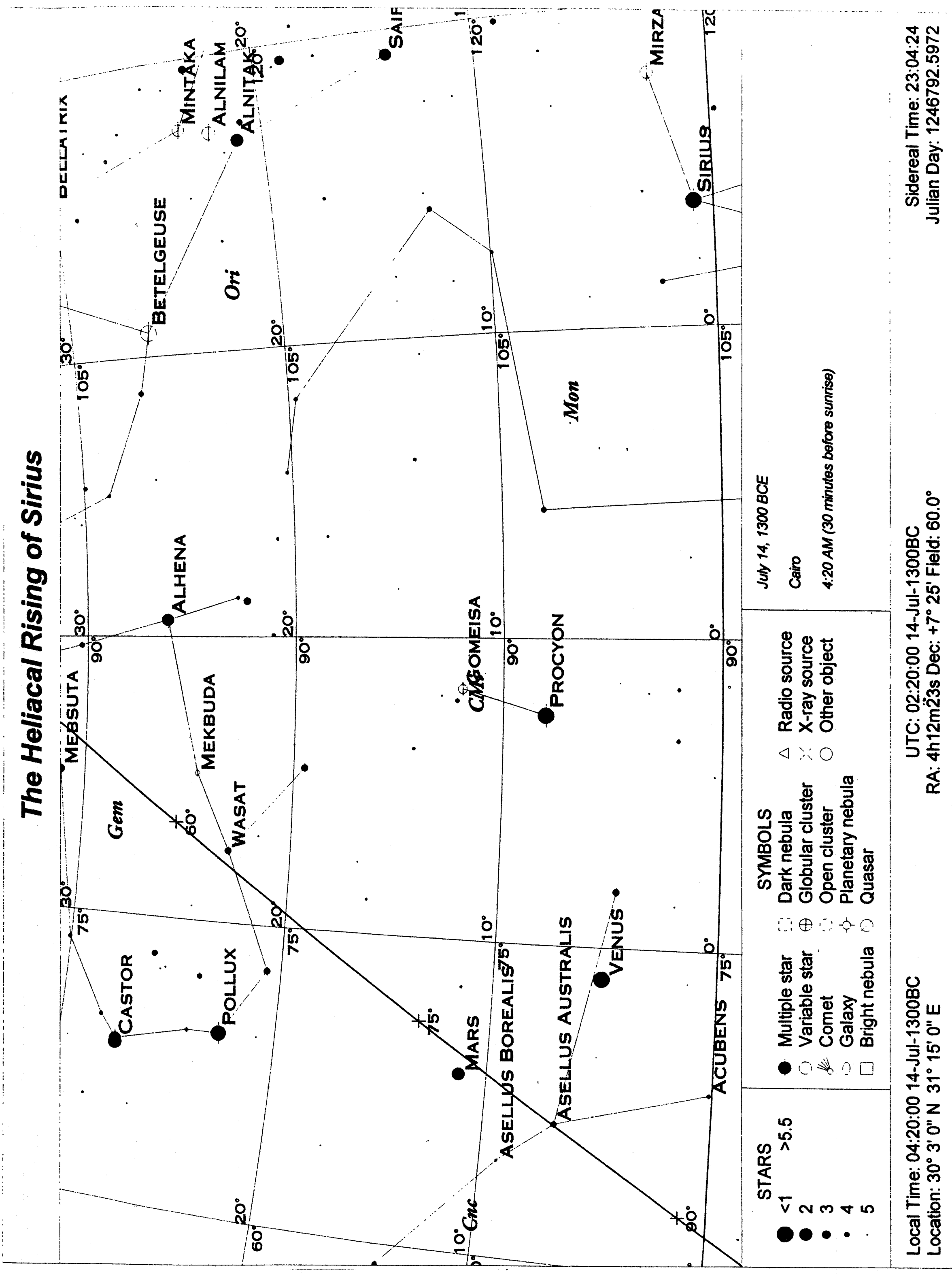

The Heliacal Rising of Sirius
MINTAKA
ALNILAM
ALNITAK
SAIF
SIRIUS
BETELGEUSE
Ori
Mon
ALHENA
MEBSUTA
MEKBUDA
WASAT
GOMEISA
CMi
PROCYON
Gem
CASTOR
POLLUX
MARS
ASELLUS BOREALIS
ASELLUS AUSTRALIS
VENUS
ACUBENS
Cnc
July 14, 1300 BCE
Cairo
4:20 AM (30 minutes before sunrise)
STARS
<1 2 3 4 5 >5.5
SYMBOLS
Multiple star
Variable star
Comet
Galaxy
Bright nebula
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 04:20:00 14-Jul-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 02:20:00 14-Jul-1300BC
RA: 4h12m23s Dec: +7° 25' Field: 60.0°
Sidereal Time: 23:04:24
Julian Day: 1246792.5972

Fig. 6

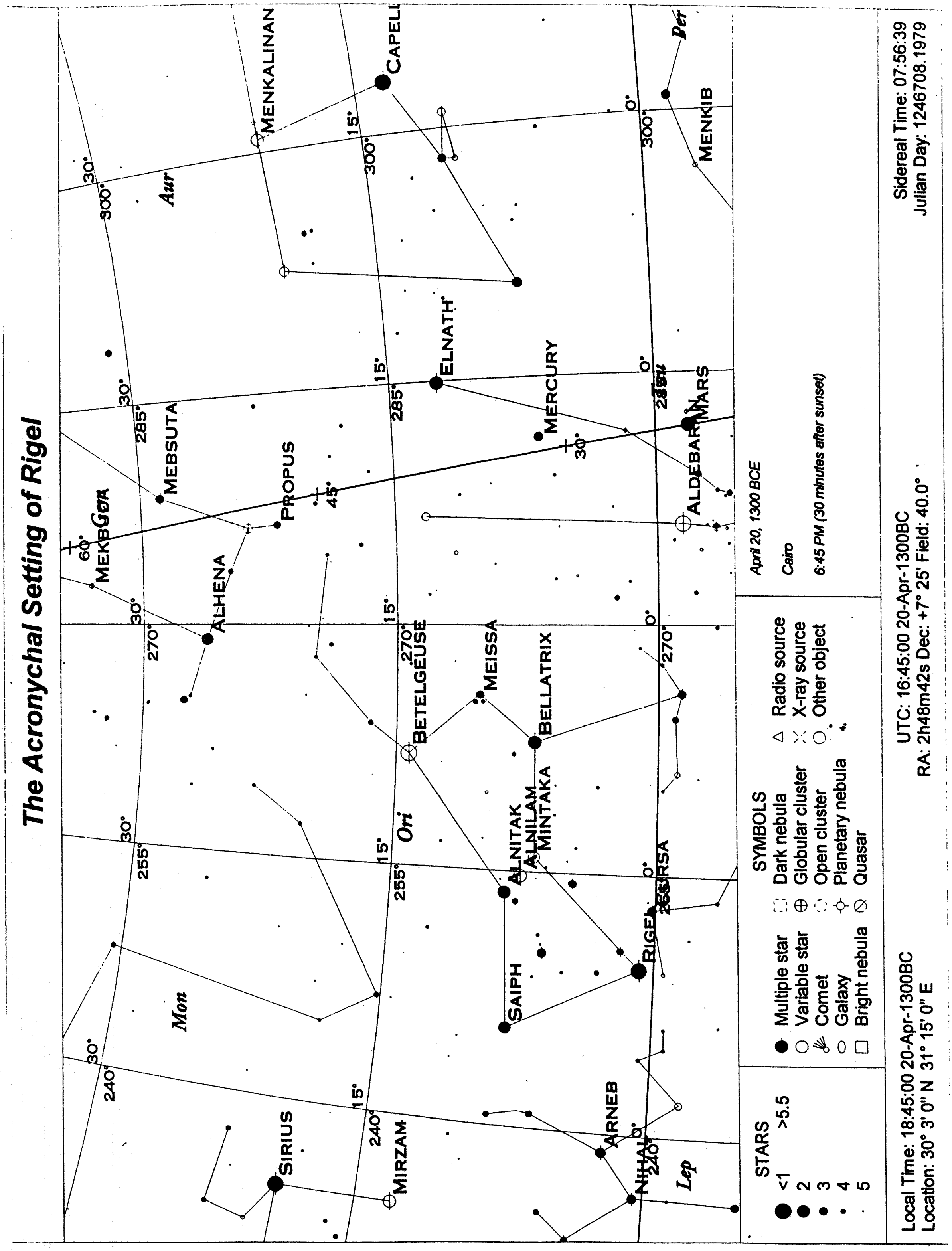

The Acronychal Setting of Rigel
April 20, 1300 BCE
Cairo
6:45 PM (30 minutes after sunset)
STARS
<1
2
3
4
5
>5.5
SYMBOLS
Multiple star
Variable star
Comet
Galaxy
Bright nebula
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 18:45:00 20-Apr-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 16:45:00 20-Apr-1300BC
RA: 2h48m42s Dec: +7° 25' Field: 40.0°
Sidereal Time: 07:56:39
Julian Day: 1246708.1979
CAPELLA
MENKALINAN
MENKIB
ELNATH
MERCURY
MARS
ALDEBARAN
MEBSUTA
PROPUS
MEKBUDA
ALHENA
BETELGEUSE
MEISSA
BELLATRIX
ALNITAK
ALNILAM
MINTAKA
SAIPH
RIGEL
CURSA
ARNEB
NIHAL
SIRIUS
MIRZAM
Aur
Per
Gem
Tau
Ori
Mon
Lep

Fig. 7

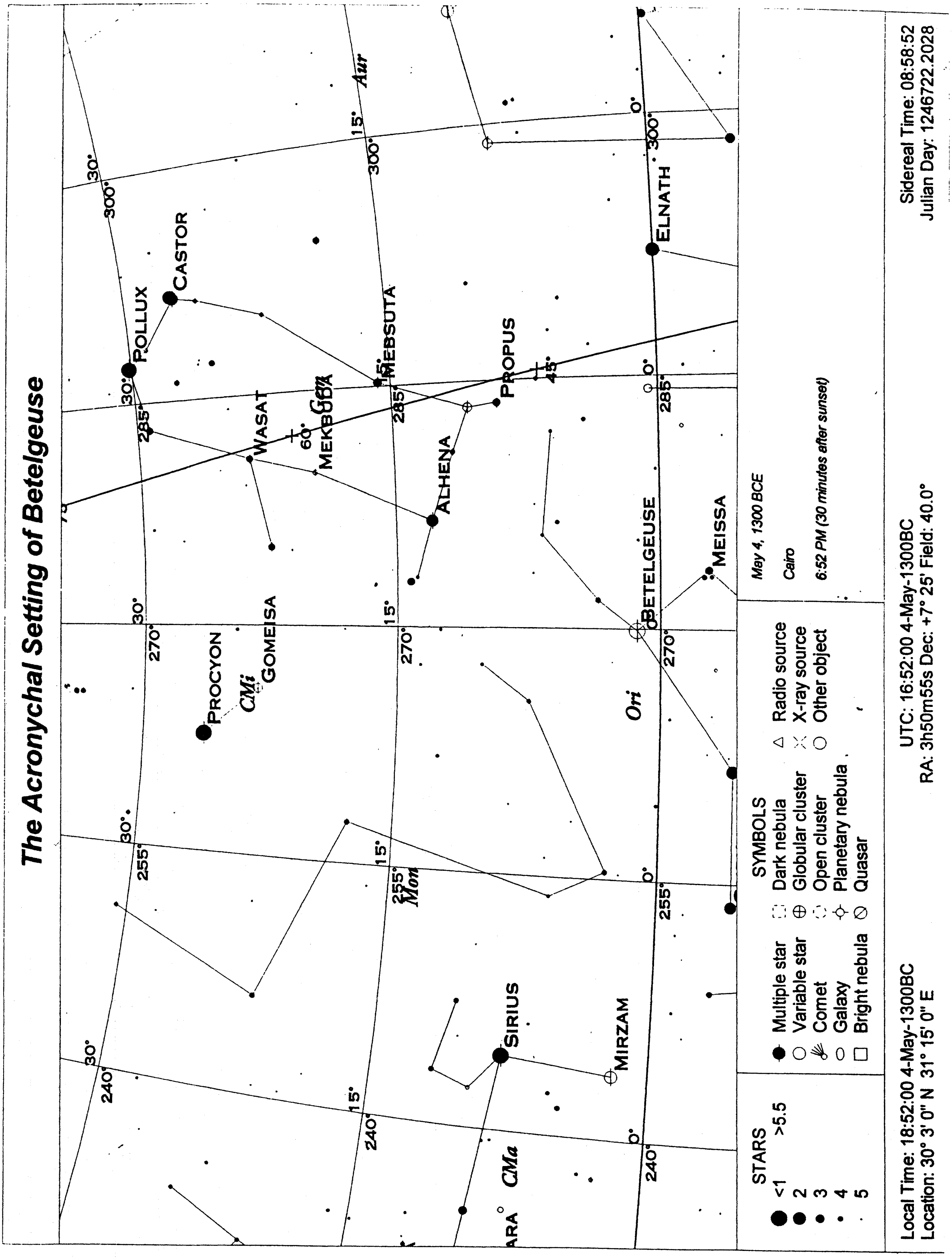

The Acronychal Setting of Betelgeuse
POLLUX
CASTOR
MEBSUTA
PROPUS
ELNATH
WASAT
MEKBUDA
Gem
ALHENA
BETELGEUSE
MEISSA
PROCYON
CMi
GOMEISA
Ori
Mon
SIRIUS
MIRZAM
CMa
ARA
Aur
May 4, 1300 BCE
Cairo
6:52 PM (30 minutes after sunset)
STARS
<1
2
3
4
5
>5.5
Multiple star
Variable star
Comet
Galaxy
Bright nebula
SYMBOLS
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 18:52:00 4-May-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 16:52:00 4-May-1300BC
RA: 3h50m55s Dec: +7° 25' Field: 40.0°
Sidereal Time: 08:58:52
Julian Day: 1246722.2028

Fig. 8

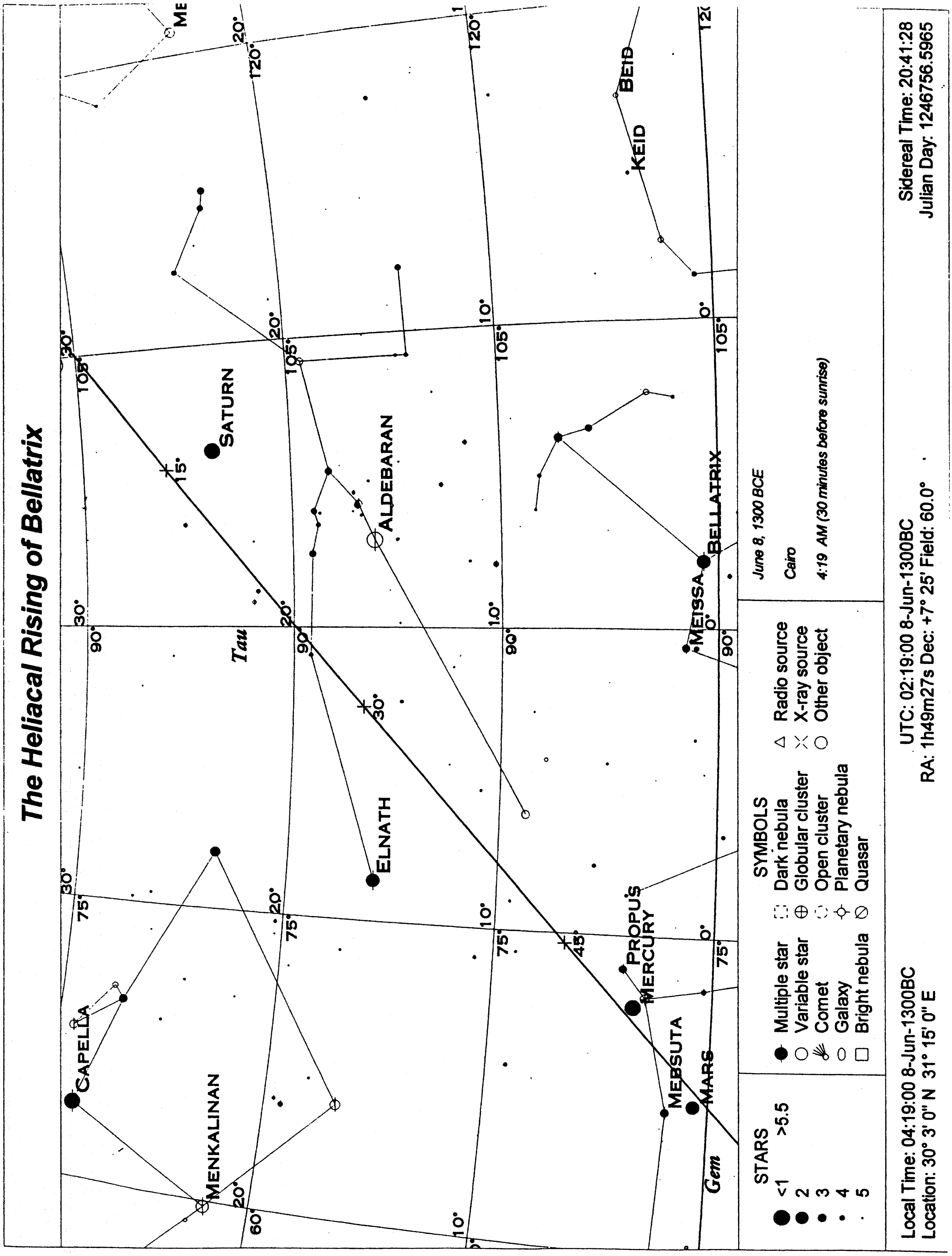

The Heliacal Rising of Bellatrix
June 8, 1300 BCE
Cairo
4:19 AM (30 minutes before sunrise)
SATURN
ALDEBARAN
ELNATH
CAPELLA
MENKALINAN
BELLATRIX
MEISSA
PROPUS
MERCURY
MEBSUTA
MARS
KEID
BEID
Tau
Gem
STARS
SYMBOLS
Multiple star
Variable star
Comet
Galaxy
Bright nebula
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 04:19:00 8-Jun-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 02:19:00 8-Jun-1300BC
RA: 1h49m27s Dec: +7° 25' Field: 60.0°
Sidereal Time: 20:41:28
Julian Day: 1246756.5965

Fig. 9

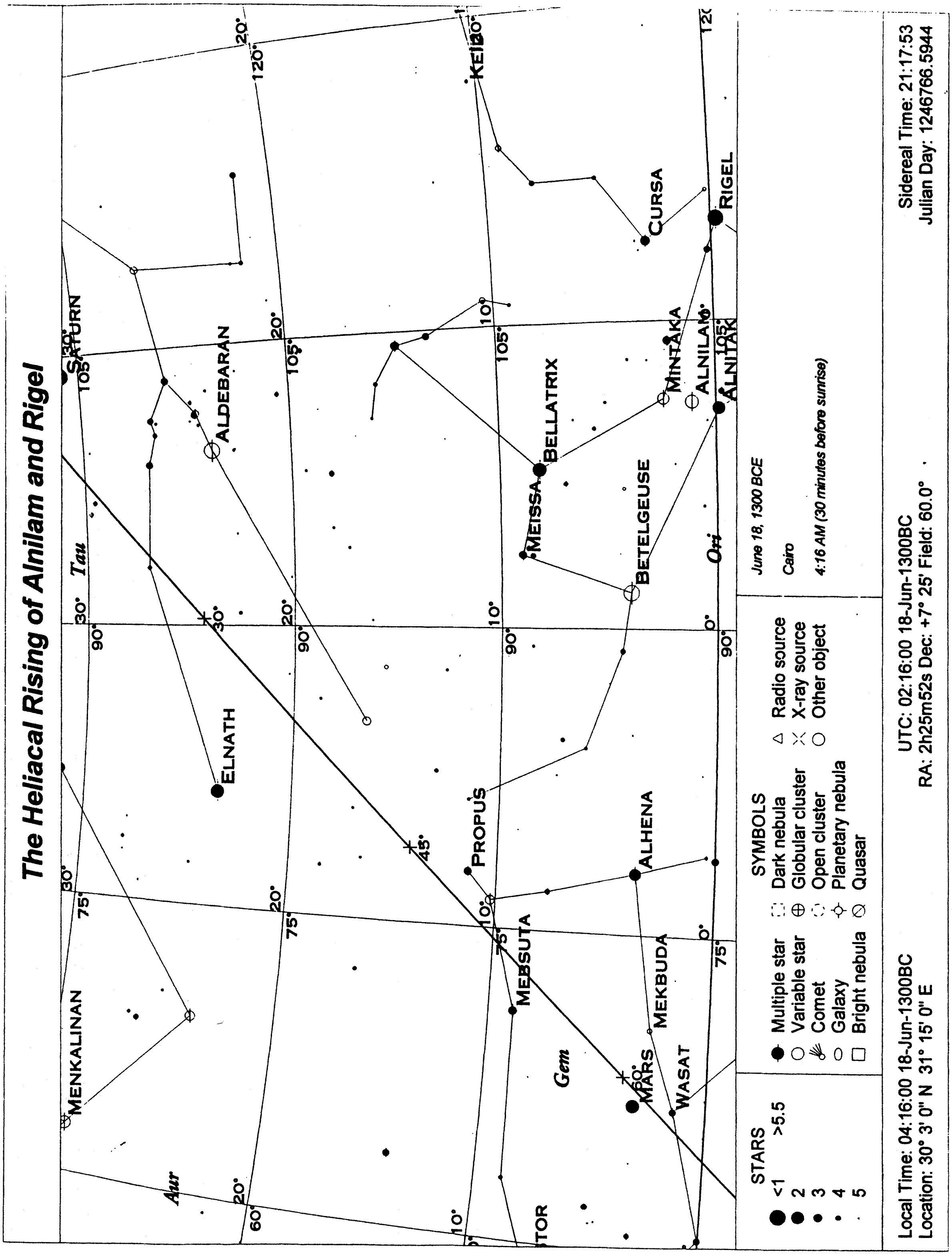

The Heliacal Rising of Alnilam and Rigel
June 18, 1300 BCE
Cairo
4:16 AM (30 minutes before sunrise)
STARS
<1
2
3
4
>5.5
5
SYMBOLS
Multiple star
Variable star
Comet
Galaxy
Bright nebula
Dark nebula
Globular cluster
Open cluster
Planetary nebula
Quasar
Radio source
X-ray source
Other object
Local Time: 04:16:00 18-Jun-1300BC
Location: 30° 3' 0" N 31° 15' 0" E
UTC: 02:16:00 18-Jun-1300BC
RA: 2h25m52s Dec: +7° 25' Field: 60.0°
Sidereal Time: 21:17:53
Julian Day: 1246766.5944
SATURN
ALDEBARAN
ELNATH
MENKALINAN
KEID
CURSA
RIGEL
MINTAKA
ALNILAM
ALNITAK
BELLATRIX
MEISSA
BETELGEUSE
PROPUS
MEBSUTA
ALHENA
MEKBUDA
MARS
WASAT
Tau
Ori
Gem
Aur

Fig. 10

The texts are explicit about the decan stars maintaining one and only one sequence[98]. They also provide information on the timing of the decans: „a star dies and a star lives every decade (of days)"[99]. Simple observation shows Sirius and the stars in Orion, which Neugebauer (and Parker) identified as belonging to the decanal belt[100], do not follow the sequential acronychal setting, 70-day invisibility period, and heliacal rising pattern required by Neugebauer's interpretation of the texts[101]. The stars do not set in the same sequential pattern in which they rise. The Egyptian decan system insists on a sequence of stars that can only be maintained if one looks at the stars in the same place in the same condition (i.e., rising) at different times.

I began searching for candidates for Seti's decans by looking at stars rising in the east in the region of the ecliptic at Cairo in 1300 BCE using SkyMap Pro 6 software. I looked at the sky one half hour after sunset and one half hour before sunrise, spaced at 10-day intervals, paying attention to bright stars known to the ancients, especially those on Ptolemy's list, and to stars whose names or lore suggested any connection to decan names. I assembled 2 tentative lists of stars by recording the dates the stars were at identical degrees of elevation from an artificial horizon; one for heliacal risings and the other for acronychal risings. The dates I recorded represent the first day a star rose through the day before the next star rose. For example, the stars Markab, Schedar, and Ruchbah, which I identify as the decan *srt*, rose acronychally on July 18, 1300 BCE. On July 28, 10 days later, the star Alpheratz rose acronychally, so I allotted July 18-July 27 for the decan *srt* on the acronychal rise list. The same stars rose heliacally January 31-February 9, 1299 BCE, so I allotted that time for the decan *srt* on the heliacal rise list. Some rising periods are slightly more or less than 10 days, and my final lists reflect this fact. After I had a final list for acronychal rising periods and another for heliacal rising periods, I combined them, matching the dates as closely as possible. They do not line up perfectly (see Table II). There is as much as a 5-day difference; however, this is the best match. Comparing the table of decans from Seti's tomb (Table I) with my star-rising Table II, I discovered a match.

The text in Seti's tomb listed the decan *sšmw* as „first" at *spdt*'s „birth." Sirius rose heliacally July 14-26, 1300 BCE. Markab, Schedar, and Ruchbah, stars I identified as the decan *srt*, were the stars rising acronychally at about the same time (July 18-27). These stars were preceded for the first 4 days of *spdt*'s heliacal rising by the stars Sadalmelik and Deneb Algedi, which I identified as the decan *smd*. Neither matched Seti's text. Checking December 24, 1300, BCE, the date of Sirius' acronychal rise, I found the stars Dabih and Algedi rose heliacally that day. My list of successive risings identified Dabih and Algedi as the decan *sšmw*. December 24, 1300 matched the date IIII Peret 16 from Seti's list perfectly, but only if „born" is understood to mean

98 Neugebauer/ Parker, Egyptian Astronomical Texts I, 56-57, 68, 73-74, 78, 84-86.
99 Neugebauer/ Parker, Egyptian Astronomical Texts I, 56.
100 Neugebauer/ Parker, Egyptian Astronomical Texts I, 24-25, 97.
101 Neugebauer/ Parker, Egyptian Astronomical Texts I, 41.

	Heliacal Rise		Acronychal Rise		
Stars	**Decan**	**Date**	**Date**	**Decan**	**Stars**
		1300 BCE	**1300 BCE**		
Dabih, Algedi	*sšmw*	Dec 24 - Jan 1	Dec 24 - Jan 6	*spdt*	**Sirius**, Mirzam
		1299 BCE	**1299 BCE**		
dark, stars of Equuleus	*knm*	Jan 2 - Jan 10	Jan 7 - Jan 15	*štw*	**Regulus**, Adhara
Enif & Sadalsuud	*tpy-ʿ smd*	Jan 11 - Jan 20	Jan 16 - Jan 25	*knmt*	**Alphard**, Zosma
Sadalmelik, Deneb Algedi, Scheat	*smd*	Jan 21 - Jan 30	Jan 26 - Feb 4	*ẖry ḫpd knmt*	**Denebola**
Markab, Schedar, Ruchbah	*srt*	Jan 31 - Feb 9	Feb 5 - Feb 14	*ḥꜣt ḏꜣt*	Alkes, ν Hydra
Alpheratz	*sꜣwy srt*	Feb 10 - Feb 20	Feb 15 - Feb 24	*pḥwy ḏꜣt*	Vindemiatrix, **Canopus**
Mirach, **Fomalhaut**	*ẖry ḫpd srt*	Feb 21 - Mar 2	Feb 25 - Mar 4	*ṯmꜣt ḥrt-ẖrt*	**Arcturus**
Almach	*tpy-ʿ ꜣḫwy*	Mar 3 - Mar 12	Mar 5 - Mar 15	*wšꜣti-bkꜣti*	**Spica**
Mirfak	*ꜣḫwy*	Mar 13 - Mar 22	Mar 16 - Mar 25	*ipḏs*	**Alphecca** ..
Hamal, Sheratan, **Algol**	*tpy-ʿ bꜣwy*	Mar 23 - Apr 4	Mar 26 - Apr 9	*sbššn*	**Zubeneschamali, Zubenelgenubi**
Deneb Kaitos	*bꜣwy*	Apr 5 - Apr 14	Apr 10 - Apr 19	*tpy-ʿ ḫntt*	Graffias, Yed Prior, Acrux
Capella	*ḫntw ḥrw*	Apr 15 - Apr 24	Apr 20 - Apr 26	*ḫntt ḥrt*	**Antares, Rigel Kentaurus**
Alcyone, **Menkalinan**	*ḫntw ẖrw*	Apr 25 - May 4	Apr 27 - May 5	*ḫntt ẖrt*	Sabik, Ras Alhague
Menkar, Hassaleh	*sꜣwy ḳd*	May 5 - May 16	May 6 - May 17	*ṯms n ḫntt*	**Wega**, Lesath, Shaula
Aldebaran, El Nath	*ḫꜣw*	May 17 - May 26	May 18 - May 29	*spty-ḫnwy*	Kaus Australis, Kaus Borealis, Kaus Media
Al Hecka, Rana	*ʿryt*	May 27 - Jun 7	May 30 - Jun 10	*ḥry-ib wiꜣ*	**Altair, Deneb**
Castor, Mebsuta, Propus, **Bellatrix**, Zaurak	*rmn ḥry*	Jun 8 - Jun 17	Jun 11 - Jun 20	*sšmw*	Dabih, Algedi
Pollux, Wasat, Alhena, **Betelgeuse**, **Alnilam**, **Rigel**	*ṯs ʿrk*	Jun 18 - Jun 26	Jun 21 - Jun 28	*knm*	dark, stars of Equuleus
Saiph	*wʿrt*	Jun 27 - Jul 5	Jun 29 - Jul 7	*tpy-ʿ smd*	Enif & Sadalsuud

TABLE II

	Heliacal Rise			**Acronychal Rise**	
Stars	**Decan**	**Date**	**Date**	**Decan**	**Stars**
		1299 BCE	**1299 BCE**		
Procyon	*tpy-ꜥ spdt*	Jul 6 - Jul 13	Jul 8 - Jul 17	*smd*	Sadalmelik, Deneb Algedi, Scheat
		1300 BCE	**1300 BCE**		
Sirius, Mirzam	*spdt*	Jul 14 - Jul 26	Jul 18 - Jul 27	*srt*	Markab, Schedar, Ruchbah
Regulus, Adhara	*štw*	Jul 27 - Aug 4	Jul 28 - Aug 6	*sꜣwy srt*	**Alpheratz**
Alphard, Zosma	*knmt*	Aug 5 - Aug 14	Aug 7 - Aug 16	*ḥry ẖpd srt*	Mirach, **Fomalhaut**
Denebola	*ḥry ẖpd knmt*	Aug 15 - Aug 24	Aug 17 - Aug 26	*tpy-ꜥ ꜣḫwy*	Almach
Alkes, v Hydra	*ḥꜣt ḏꜣt*	Aug 25 - Sep 2	Aug 27 - Sep 3	*ꜣḫwy*	**Mirfak**
Vindemiatrix, **Canopus**	*pḥwy ḏꜣt*	Sep 3 - Sep 13	Sep 4 - Sep 11	*tpy-ꜥ bꜣwy*	Hamal, Sheratan, **Algol**
Arcturus	*ṯmꜣt ḥrt-ẖrt*	Sep 14 - Sep 22	Sep 12 - Sep 22	*bꜣwy*	Deneb Kaitos
Spica	*wšꜣti-bkꜣti*	Sep 23 - Oct 2	Sep 23 - Oct 2	*ḫntw ḥrw*	**Capella**
Alphecca	*ipḏs*	Oct 3 - Oct 12	Oct 3 - Oct 11	*ḫntw ẖrw*	Alcyone, **Menkalinan**
Zubeneschamali, Zubenelgenubi	*sbššn*	Oct 13 - Oct 24	Oct 12 - Oct 22	*sꜣwy ḳd*	Menkar, Hassaleh
Graffias, Yed Prior, Acrux	*tpy-ꜥ ḫntt*	Oct 25 - Nov 3	Oct 23 - Nov 5	*ḫꜣw*	**Aldebaran**, El Nath
Antares, Rigel Kentaurus	*ḫntt ḥrt*	Nov 4 - Nov 10	Nov 6 - Nov 15	*ꜥryt*	Al Hecka, Rana
Sabik, Ras Alhague	*ḫntt ẖrt*	Nov 11 - Nov 19	Nov 16 - Nov 25	*rmn ḥry*	**Castor**, Mebsuta, Propus, **Bellatrix**, Zaurak
Wega, Lesath, Shaula	*ṯms n ḫntt*	Nov 20 - Dec 1	Nov 26 - Dec 7	*ṯs ꜥrḳ*	**Pollux**, Wasat, Alhena, **Betelgeuse, Alnilam, Rigel**
Kaus Australis, Kaus Borealis, Kaus Media	*spty-ẖnwy*	Dec 2 - Dec 13	Dec 8 - Dec 15	*wꜥrt*	Saiph
Altair, Deneb	*ḥry-ib wiꜣ*	Dec 14 - Dec 23	Dec 16 - Dec 23	*tpy-ꜥ spdt*	**Procyon**

note: names in boldface are stars from Ptolemy's list.

TABLE II

acronychal rise and „first“ is understood to mean heliacal rise. In the text from Seti's tomb, the decan *wš3ti-bk3ti* was „enclosed by the *dw3t*“ on IIII Peret 16. My list of successive risings identified *wš3ti-bk3ti* as Spica. Dabih and Algedi, as heliacal rising stars (what „first“ must mean), were separated by 9 stars from Spica and by 20 stars from Sirius, the acronychal rising star (what „born“ must mean), exactly as the Carlsberg Papyrus' unknown commentator described[102]. Spica was the *šn dw3t* star for that decade of days. Logically, whatever Spica did on December 24, 1300 BCE, must be what stars that are „enclosed by the *dw3t*“ do. Spica disappeared, encompassed by the dawn light, in the middle of the sky that day[103]. Its rising time was about 10:52 PM the night before.

As stated above, the Carlsberg text says stars are „first“ (*tpt*), spend 90 days „in the west,“ and then are „enclosed by the *dw3t*“ (*šn dw3t*) for 70 days. Next, they are „born“ (*ms*), spend 80 days „in the east,“ and finally „work“ (*b3k*) for 120 days. To understand the texts, it is important to understand what the stars do. They rise earlier each day. For example, in my model year 1300-1299, Sirius' heliacal rise, when it is „first,“ is at 4:20 AM on July 14. On the first day of the decade of days that it is „enclosed by the *dw3t*“, October 13, Sirius rises at 10:19 PM, nearly 6 hours earlier than its heliacal rising time. It continues rising earlier until finally, at 5:35 PM on December 24, it is the acronychal rising star, when it is „born.“ It will not be seen to rise (in the sense of crossing the horizon) again until its first hour of visibility, when it rises first before the sun, the following July. That is because for approximately the next 200 days, it rises during daylight hours. After the sun sets, when the next decan rises acronychally, Sirius will be seen in the sky at a higher elevation, above that next decan. At each successive decan's acronychal rise, Sirius will appear at a higher elevation in the sky, as if climbing a ladder, while its risings (horizon crossings) are unseen. Eventually, it will rise and set entirely in daylight hours and will not be seen at all until it begins the cycle again with its next heliacal rise. (This is what Neugebauer and Parker understood as being enclosed by the *dw3t.*) The pattern that fits all the stars in Table II and that is consistent with the Carlsberg papyri is one of a heliacal rise approximately160 days before an acronychal rise and an acronychal rise approximately 200 days before the next heliacal rise.

The word „first“ has three logical meanings that describe the star that rises just before the sun. The heliacal rising star is first ahead of the sun, in its first hour of visibility after a period of invisibility, and has its first visible (horizon crossing) rising as it begins its phase of visible horizon crossing risings. The epithet „star of the evening“ applied to this

102 Neugebauer/ Parker, Egyptian Astronomical Texts I, 58.

103 A similar pattern can be found in which the star in the middle of the sky at dawn is in the middle of the sky at sunset, but in order to follow the sequence from the tomb of Seti, there is only one correct pattern. For example, when Spica is in the middle of the sky at sunset, Dabih and Algedi are the rising stars, just as they are at dawn. To agree with the table from the tomb of Seti, Sirius (*spdt*) must rise that day, and that happens only when Sirius is the star rising acronychally. When Dabih and Algedi rise acronychally, the stars that rise heliacally are Castor, Bellatrix, and the stars I identify as the decan *rmn ḥry*, not *spdt*.

star refers to the fact that the star is now in the stage of its life where its risings will be seen. It is in its evening- or night-rising phase, as opposed to its day-rising phase. The star does not pass 90 days „in the west" because it is to the west of the meridian. It passes 90 days on the right-hand side of the sun. It will be seen in the pre-dawn sky (the right side of the turning sky) for the next three months, consistent with Carlsberg texts.

The star that is *šn dwȝt* or „enclosed by the *dwȝt*" is the one that is nine places ahead of the rising star at sunrise. A star spends 70 days in the *dwȝt* before it is born as the acronychal rising star. The time of the risings of the stars that are enclosed by the *dwȝt* corresponds with the beginning of the *wšȝw* period of night[104]. It is between 4 and 6.5 hours after sunset (or 3 and 5.5 hours after dark), depending on the time of year. The *wšȝw* time begins when the *šn dwȝt* star for that decade of days begins to rise (see Table III). Carlsberg Papyrus I F. III.40-3 says that Nut swallows the sun at the third hour of night: „It is by her mouth in the hour *sḥtp.n.s* <of> [even]ing that the god enters – that is to say, it is by her mouth in the third hour of evening that the god enters… [He] becomes glorious, he becomes beautiful in the arms of his father, Osiris"[105]. The tomb text of Seti I says: „He enters her … in the night in the hour of middle night (nb: the *wšȝw* hour) and he travels in the <darkness>, these stars with him[106]." The tomb text of Ramses IV says: „He enters her … in the night and he travels in the darkness, these stars <with him>"[107]. To our way of thinking, the stars are with Re temporally, not spatially, but this distinction did not exist for the Egyptians. The *šn dwȝt* star marks the time Re rejuvenates in the *dwȝt* in the company of Osiris, when the back of the turning sky, the point opposite the sun, faced the Egyptians.

Signaling the time the sun is in the *dwȝt* was probably a time of special magical power for the stars. The name of the dark hour of night, *wšȝw*, the time the *šn dwȝt* decan rose, is a pun on the word „utter". The texts say the name of a decan that is „enclosed by the *dwȝt*" is not spoken for 70 days[108]. The *šn dwȝt* star is encompassed by the dawn's light in the middle of the sky. The word *dwȝt* may be related to the words for morning[109]; however, it is more likely that „enclosed by the *dwȝt*" means enclosed or protected by praises; a praised one[110]. The star is in a non-astronomically determinable, magical state.

104 Neugebauer/ Parker, Egyptian Astronomical Texts I, 35.

105 Neugebauer/ Parker, Egyptian Astronomical Texts I, 62-63, the parentheses indicate an addition in the text by Neugebauer and Parker; the brackets indicate a restoration; the word <of> is their emendation. See the notes on VI. I for a variation this text indicating Nut swallows the sun in the second hour of night, also on page 63.

106 Neugebauer/ Parker, Egyptian Astronomical Texts I, 62, the word <darkness> is an emendation by Neugebauer and Parker.

107 Neugebauer/ Parker, Egyptian Astronomical Texts I, 62, the words <with him> are emendations by Neugebauer and Parker.

108 Neugebauer/ Parker, Egyptian Astronomical Texts I, 69, 73.

109 Lesko, Ancient Egyptian Cosmogonies and Cosmologies, 120.

110 Neugebauer/ Parker, Egyptian Astronomical Texts I, 57, n. 3. See the discussion of the alternative translation.

Stars	Decan	Date Decan Enclosed by the Duat 1300 - 1299 BCE	Decan Rises	Time of Sunset on First Day of Decade	Time Between Sunset and Decan Rise
Spica	*wšꜣti-bkꜣti*	Dec 24 - Jan 1	22:52	17:04	5:48
Alphecca	*ipds*	Jan 2 - Jan 10	23:06	17:08	5:58
Zubeneschamali, Zubenelgenubi	*sbšsn*	Jan 11 - Jan 20	23:30	17:13	6:17
Graffias, Yed Prior, Acrux	*tpy-ꜥ hntt*	Jan 21 - Jan 30	23:55	17:20	6:35
Antares, Rigel Kentaurus	*hntt hrt*	Jan 31 - Feb 9	23:55	17:28	6:27
Sabik, Ras Alhague	*hntt hrt*	Feb 10 - Feb 20	23:40	17:36	6:04
Wega, Lesath, Shaula	*tms n hntt*	Feb 21 - Mar 2	23:33	17:44	5:49
Kaus Australis, Kaus Borealis, Kaus Media	*spty-hnwy*	Mar 3 - Mar 12	23:56	17:50	6:06
Altair, Deneb	*hry-ib wiꜣ*	Mar 13 - Mar 22	0:18	17:56	6:22
Dabih, Algedi	*sšmw*	Mar 23 - Apr 4	0:35	18:01	6:34
dark, stars of Equuleus	*knm*	Apr 5 - Apr 14	0:35	18:08	6:27
Enif & Sadalsuud	*tpy-ꜥ smd*	Apr 15 - Apr 24	0:18	18:12	6:06
Sadalmelik, Deneb Algedi, Scheat	*smd*	Apr 25 - May 4	0:11	18:17	5:54
Markab, Schedar, Ruchbah	*srt*	May 5 - May 16	0:15	18:22	5:57
Alpheratz	*sꜣwy srt*	May 17 - May 26	0:08	18:29	5:39
Mirach, **Fomalhaut**	*hry hpd srt*	May 27 - Jun 5	0:08	18:35	5:33
Almach	*tpy-ꜥ ꜣhwy*	Jun 8 - Jun 17	23:42	18:42	5:00
Mirfak	*ꜣhwy*	Jun 18 - Jun 26	23:31	18:48	4:43
Hamal, Sheratan, **Algol**	*tpy-ꜥ bꜣwy*	Jun 27 - Jul 5	23:23	18:52	4:31
Deneb Kaitos	*bꜣwy*	Jul 6 - Jul 13	23:10	18:54	4:16
Capella	*hntw hrw*	Jul 14 - Jul 26	23:15	18:56	4:19
Alcyone, **Menkalinan**	*hntw hrw*	Jul 27 - Aug 4	22:50	18:54	3:56
Menkar, Hassaleh	*sꜣwy kd*	Aug 5 - Aug 14	22:31	18:51	3:40
Aldebaran, El Nath	*hꜣw*	Aug 15 - Aug 24	22:31	18:46	3:45
Al Hecka, Rana	*ꜥryt*	Aug 25 - Sep 2	22:34	18:38	3:56
Castor, Mebsuta, Propus, **Bellatrix**, Zaurak	*rmn hry*	Sep 3 - Sep 13	22:34	18:29	4:05
Pollux, Wasat, Alhena, **Betelgeuse, Alnilam, Rigel**	*ts ꜥrk*	Sep 14 - Sep 22	22:29	18:18	4:11
Saiph	*wꜥrt*	Sep 23 - Oct 2	22:29	18:07	4:22
Procyon	*tpy-ꜥ spd*	Oct 3 - Oct 12	22:22	17:55	4:27
Sirius, Mirzam	*spdt*	Oct 13 - Oct 24	22:19	17:43	4:36
Regulus, Adhara	*štw*	Oct 25 - Nov 3	22:33	17:30	5:03
Alphard, Zosma	*knmt*	Nov 4 - Nov 10	22:33	17:20	5:13
Denebola	*hry hpd knmt*	Nov 11 - Nov 19	22:46	17:14	5:32
Alkes, ν Hydra	*hꜣt dꜣt*	Nov 20 - Dec 1	22:56	17:08	5:48
Vindemiatrix, **Canopus**	*phwy dꜣt*	Dec 2 - Dec 13	22:55	17:03	5:52
Arcturus	*tmꜣt hrt-hrt*	Dec 14 - Dec 23	23:00	17:02	5:58

Note: the times are close approximations of actual time, but not guaranteed to be precise

TABLE III

The only way to know which star is *šn dw3t* is to count from the heliacal or acronychal rising stars. The correct star will be nine stars ahead of the one that is rising first and eight stars behind the star that is born. There is no astronomical significance to the *šn dw3t* star at the time it enters this state. The priests could distinguish it from other stars because they knew where to begin counting.

The word „born" means acronychal rise. The star that was the first to rise in the east after sunset was the star that was born[111]. After being born at acronychal rise, the stars begin a new phase in which their risings will not be seen, but they will be seen at higher elevations as each succeeding decan rises. This is consistent with the notion of „withdrawing to the sky" after having been in the *dw3t*. „<They> go forth from the Duat. It is their going forth from the Duat, and they withdraw to the sky, and they withdraw to the sky – that is to say, and they rise in the sky, becoming distant from earth[112]". Stars rise (in the sense of being seen to cross the horizon) for 10 days at their acronychal birth, „going forth" after having been in the *dw3t*. This is followed by rising (in the sense of becoming higher in elevation) or „withdrawing to the sky" for the next several months. The notion of becoming more distant from earth was likely equated with not being seen to cross the horizon.

A dramatic text from Seti's tomb is consistent with my model, implying that stars are born at sunset[113]; however, in Neugebauer and Parker's model there is no place for a star's acronychal rise. For them, the sunset birth must be understood as a daily, rather than a yearly, event. The text says that Nut gives birth to the stars as she gives birth to Re daily, and that stars are at her hindquarters every day. Immediately the text then begins to discuss the star's yearly birth after having been in the *dw3t*, something Neugebauer and Parker interpret as an out of place error in the text. Instead, the passage should be understood to explain that Nut gives birth to the stars in the same *manner* in which she gives birth to Re. But while she gives birth to Re each day and she gives birth to one decan each day, she does not give birth to all the decans every day. For a star, birth is something that happens once a year, for a decade of days. That is why the births are specially recorded.

The stars at their heliacal rise enter a phase where they will be seen to rise each night. After being born at acronychal rise, they begin a second phase in which their risings will not be seen, but they will be seen at higher elevations as each succeeding decan rises. There are two distinct ways that stars exist in the sky and the Egyptians differentiated those two ways. The difference is described metaphorically as a quarrel between the deities Geb and Nut. In my model, it is in their visible rising phase that the decan stars

[111] Neugebauer/ Parker, Egyptian Astronomical Texts I, 68. Neugebauer and Parker state in a footnote: „The stars, like the sun, are born daily from Nut in the east, though not at the same time. It must be assumed, though the text does not state it, that the stars are born at sunset."

[112] Neugebauer/ Parker, Egyptian Astronomical Texts I, 76. The word <they> is an emendation by Neugebauer and Parker.

[113] Neugebauer/ Parker, Egyptian Astronomical Texts I, 68-69.

enter the *dw3t*, which is called the House of Geb[114]. This suggests that the 160-day visible rising phase was „Geb," or „evening/ night (rising)" time and that the 200-day „withdrawing to the sky" phase was „Nut," or „day (rising)" time. The „Nut/ day time" phase is when the stars disappear from the sky altogether. This is the most likely explanation of Nut's swallowing her star children. Like birth, it was a yearly, not a daily event. The passage concerning Nut swallowing her star children was amended and altered by Neugebauer and Parker to fit with their interpretation of the facts. They insert the word „daily" repeatedly when it is not in the original text[115]. Geb becomes a prince of the decan stars because he commands them to rise. He causes the stars to return to life[116] after they have been swallowed. He is responsible for the heliacal risings of the decans. Considered an earth god, Geb has a distinctly non-chthonic side that includes an existence in the sky[117]. He controls the doors to the sky[118] and he opens the earth[119], which links him to visible risings and with what is seen to cross the horizon. Though called a sky goddess, Nut is in fact the personification of time, manifesting through the sky. „Nut was not so much in the sky as what the sky did, giving birth to the heavenly bodies and hiding them within herself[120] ...". Time turns the heavens, time swallows the sun and stars, and, in time, the sun and stars come into existence again.

Following its acronychal rise, a star spends 80 days on the left-hand side of the sun, after which, the star changes its state to „working" (*b3k*) for the next four months. During this time, stars disappear from the sky altogether, rising and setting in daylight. The oldest known lists of decan stars, from the Asyut coffins, track stars in this phase of their existence. The coffins' decoration typically consists of 12 rows of 36 columns, plus 4 extra columns, with an offering prayer to certain decans and sky deities between rows 6 and 7. There is also a wide column placed in the middle of the decan columns that depicts four deities. A line indicating one decade of days in the civil calendar over each of the first 36 columns is found in the 9 oldest coffins. Beneath those dates, the decans are listed in sequential order, to be read from top to bottom and from right to left, beginning with the decan *ṯm3t ḥrt* (see fig. 11). The 3 youngest coffins have no date list and have different names for some of the decans. Those different names are identical to decan names on later New Kingdom decan lists such as the list on the tomb ceiling of Senmut (c.1450 BCE)[121].

The decan lists from the Asyut coffins were thought to be „star-clocks" that showed star risings during an idealized 12-hour night, beginning with the acronychal rising star

[114] Neugebauer/ Parker, Egyptian Astronomical Texts I, 69.
[115] Ibid.
[116] Neugebauer/ Parker, Egyptian Astronomical Texts I, 77-78.
[117] C. Simon, , „Geb," in: D.B. Redford (ed.), The Ancient Gods Speak, 2002, 155.
[118] Faulkner, The Ancient Egyptian Pyramid Texts, 170.
[119] E.A. W. Budge, The Book of the Dead, 1960 (1898), 447.
[120] Assmann, 81.
[121] Neugebauer/ Parker, Egyptian Astronomical Texts III, 158-9.

Layout of the Decans on the Asyut Coffins

Dateline showing one 10-day week to each column; three weeks to each month

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4 Extra Col.				*4 šmw*			*3 šmw*			*2 šmw*			*1 šmw*			*4 prt*			*3 prt*				*2 prt*			*1 prt*			*4 3ḥt*			*3 3ḥt*			*2 3ḥt*			*1 3ḥt*		
A	25	13	1	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19		18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
B	26	14	2		36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20		19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
C	27	15	3			36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	NUT	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3
D	28	16	4				36	35	34	33	32	31	30	29	28	27	26	25	24	23	22		21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4
E	29	17	5					36	35	34	33	32	31	30	29	28	27	26	25	24	23	LEG	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5
F	30	18	6						36	35	34	33	32	31	30	29	28	27	26	25	24		23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6
	OFFERING LIST TO THE ASTRAL DEITIES																																							
G	31	19	7							36	35	34	33	32	31	30	29	28	27	26	25		24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7
H	32	20	8			TRIANGLE					36	35	34	33	32	31	30	29	28	27	26	SAH	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8
J	33	21	9									36	35	34	33	32	31	30	29	28	27		26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9
K	34	22	10			DECANS							36	35	34	33	32	31	30	29	28	SPD	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10
L	35	23	11											36	35	34	33	32	31	30	29		28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11
M	36	24	12	L	K	J	H	G	F	E	D	C	B	A	36	35	34	33	32	31	30		29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12

Fig. 11

and ending with the heliacal rising star[122]. They were thought to have been failed attempts at early time-keeping that were abandoned when the meridian was discovered and „transit“ decans began to be used[123]. In fact, the coffin star tables cannot work for telling time at night as has been theorized[124]. The decan stars rise every 10 days throughout a 365-day year, which means they cannot rise or culminate every hour, but every 40 minutes, a problem first commented on by B. L. van der Waerden a half century ago[125]. But even if we allow for 40-minute hours, the Asyut coffin decans cannot represent the stars' acronychal and heliacal risings. It is clear that whatever is being indicated about the stars on the coffins is spaced 120 days apart. That pattern is established by the star that is on the bottom row of column 1 and subsequently moves into the top row of column 12 (see fig. 12). Whatever the star in the top row of a given column does during the decade of days that it is highlighted, will be done by the bottom star in that same column 120 days later.

As I have shown in Table II, the interim between a star's acronychal and heliacal risings in Egypt is much greater than 120 days. Throughout Egypt, between 160 and 170 days must pass between a star's heliacal rise and its acronychal rise. Approximately 200 days must pass between a star's acronychal rise and its heliacal rise. The decan tables from the Asyut coffins obviously cannot be charting the heliacal and acronychal risings of stars. What these coffins illustrate is probably the stars' heliacal risings following their 120-day period of work. The top line indicates the decan star that is rising heliacally during a given decade of days and the bottom line indicates the decan star that began its time of work during the previous decade of days. A star that has just begun its time of work in column 1 (bottom line) rises heliacally in column 12 (top line), 120 days later. The Asyut coffins diagram a yearly pattern that can be used to track a working star over the 120-day period when its risings are not visible as well as to predict when it will next rise heliacally.

It is possible that the coffin tables reflect an older system that evolved into the schema that was used from the New Kingdom forward and was described in the Carlsberg texts. The date that Sirius moves into the top line in most coffins is the first week of III *šmw*. That corresponds to III *šmw* 6 in Seti's tomb, the date Sirius begins work in that model. The dates given on the coffins and in the tombs of Seti and Ramses are obviously not actual observation dates. It is curious that both groups have the same artificial date linked to the same star. The Asyut coffins could be noting the dates 120 days after a star's heliacal rise and 120 days before its next heliacal rise. The latter 120-day period, then, would have evolved into the work period that is found after the time of Seti I. In either case, these tables are linked to the 120-period of work for stars. They are

122 A. Pogo, Calendars on coffin lids from Asyut, in: Isis 17, 1932, 6-24.

123 P. Mengoli, Some Considerations of Egyptian Star-Clocks, in: Archiv der Geschichte der Naturwissenschaften, 22/23/24, 1988, 1127-32.

124 Neugebauer/ Parker, Egyptian Astronomical Texts I, 95-96, 100-101.

125 B. L. van der Waerden, Babylonian Astronomy II: The Thirty-Six Stars, in: JNES 8, 1949, 8.

Layout of the Decans on the Asyut Coffins

Dateline showing one 10-day week to each column; three weeks to each month

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4 šmw			3 šmw			2 šmw			1 šmw			4 prt			3 prt				2 prt			1 prt			4 3ḫt			3 3ḫt			2 3ḫt			1 3ḫt			
36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19		18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	← Heliacal Rising Star
	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20		19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	
		36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	NUT	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	
			36	35	34	33	32	31	30	29	28	27	26	25	24	23	22		21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	
				36	35	34	33	32	31	30	29	28	27	26	25	24	23	LEG	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	
					36	35	34	33	32	31	30	29	28	27	26	25	24		23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	
OFFERING LIST TO																			THE ASTRAL DEITIES																		
						36	35	34	33	32	31	30	29	28	27	26	25		24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	
TRIANGLE							36	35	34	33	32	31	30	29	28	27	26	SAH	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	
								36	35	34	33	32	31	30	29	28	27		26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	
DECANS									36	35	34	33	32	31	30	29	28	SPD	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	
										36	35	34	33	32	31	30	29		28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	
											36	35	34	33	32	31	30		29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	← Star that began work previous decade of days

The diagonal black line tracks a star through its 12 decades of days of work, from the first decade of days after its change of status to "work" through its change of status to "first" (its heliacal rise).

Fig. 12

not clocks and do *not* represent a failed or abandoned system of telling time at night. Instead, the coffins' tables appear to be surviving fragments of a larger body of astral knowledge that may have been used continuously from the First Intermediate Period to the Late Period time of the Carlsberg Papyri.

In summary, the Egyptians had no conception of an underworld. They understood that time manifests itself through the continually changing sky, a concept that was personified by the goddess Nut. The constantly turning sky was not a stationary background but an active force that moved the sun and stars around. The sun was attached to the sky and functioned as a mobile meridian, so that time and direction were not easily separable concepts in ancient Egyptian thought. The star model from the tombs of Seti I and Ramses IV, as explained in the Carlsberg papyri, works properly only if stars are observed in the same location (the *msqt* region) in the same state (rising) at different times of the year. The Asyut coffins' decan lists are part of this same system, tracking stars during their „work" phase. Ancient Egyptian sacred texts were not and should not be mistaken for „primitive" astronomy, nor should abstract conceptions be mistaken for astral simulacra or locations in the sky.

DATE			FIRST	ENCLOSED BY DUAT	BORN	WORK
4	*prt*	16	***sšmw***	*wšꜣti-bkꜣti*	*spdt*	*ḫntw ẖrw*
4	*prt*	26	*knm*	*ipḏs*	*štw*	*sꜣwy ḳd*
1	*šmw*	6	*tpy-ꜥ smd*	*sbšsn*	*knmt*	*ḫꜣw*
1	*šmw*	16	*smd*	*tpy-ꜥ ḫntt*	*ẖry ḥpd knmt*	*ꜥryt*
1	*šmw*	26	*srt*	*ḫntt ḥrt*	*ḥꜣt ḏꜣt*	*rmn ḥry*
2	*šmw*	6	*sꜣwy srt*	*ḫntt ẖrt*	*pḥwy ḏꜣt*	*ṯs ꜥrḳ*
2	*šmw*	16	*ẖry ḥpd srt*	*ṯms n ḫntt*	*ṯmꜣt ḥrt-ẖrt*	*wꜥrt*
2	*šmw*	26	*tpy-ꜥ ꜣḫwy*	*spty-ḫnwy*	*wšꜣti-bkꜣti*	*tpy-ꜥ spdt*
3	*šmw*	6	*ꜣḫwy*	*ḥry-ib wiꜣ*	*ipḏs*	*spdt*
3	*šmw*	16	*tpy-ꜥ bꜣwy*	*sšmw*	*sbšsn*	*štw*
3	*šmw*	26	*bꜣwy*	*knm*	*tpy-ꜥ ḫntt*	*knmt*
4	*šmw*	6	*ḫntw ḥrw*	*tpy-ꜥ smd*	*ḫntt ḥrt*	*ẖry ḥpd knmt*
4	*šmw*	16	*ḫntw ẖrw*	*smd*	*ḫntt ḥrt*	*ḥꜣt ḏꜣt*
4	*šmw*	26	*sꜣwy ḳd*	*srt*	*ṯms n ḫntt*	*pḥwy ḏꜣt*
1	*ꜣḫt*	6	*ḫꜣw*	*sꜣwy srt*	*spty-ḫnwy*	*ṯmꜣt ḥrt-ẖrt*
1	*ꜣḫt*	16	*ꜥryt*	*ẖry ḥpd srt*	*ḥry-ib wiꜣ*	*wšꜣti-bkꜣti*
1	*ꜣḫt*	26	*rmn ḥry*	*tpy-ꜥ ꜣḫwy*	*sšmw*	*ipḏs*
2	*ꜣḫt*	6	*ṯs ꜥrḳ*	*ꜣḫwy*	*knm*	*sbšsn*
2	*ꜣḫt*	16	*wꜥrt*	*tpy-ꜥ bꜣwy*	*tpy-ꜥ smd*	*tpy-ꜥ ḫntt*
2	*ꜣḫt*	26	*tpy-ꜥ spdt*	*bꜣwy*	*smd*	*ḫntt ḥrt*
3	*ꜣḫt*	6	*spdt*	*ḫntw ḥrw*	*srt*	*ḫntt ẖrt*
3	*ꜣḫt*	16	*štw*	*ḫntw ẖrw*	*sꜣwy srt*	*ṯms n ḫntt*
3	*ꜣḫt*	26	*knmt*	*sꜣwy ḳd*	*ẖry ḥpd srt*	*spty-ḫnwy*
4	*ꜣḫt*	6	*ẖry ḥpd knmt*	*ḫꜣw*	*tpy-ꜥ ꜣḫwy*	*ḥry-ib wiꜣ*
4	*ꜣḫt*	16	*ḥꜣt ḏꜣt*	*ꜥryt*	*ꜣḫwy*	***sšmw***
4	*ꜣḫt*	26	*pḥwy ḏꜣt*	*rmn ḥry*	*tpy-ꜥ bꜣwy*	***knm***
1	*prt*	6	*ṯmꜣt ḥrt-ẖrt*	*ṯs ꜥrḳ*	*bꜣwy*	***tpy-ꜥ smd***
1	*prt*	16	*wšꜣti-bkꜣti*	*wꜥrt*	*ḫntw ḥrw*	***smd***
1	*prt*	26	*ipḏs*	*tpy-ꜥ spdt*	*ḫntw ẖrw*	***srt***
2	*prt*	6	*sbšsn*	*spdt*	*sꜣwy ḳd*	***sꜣwy srt***
2	*prt*	16	*tpy-ꜥ ḫntt*	*štw*	*ḫꜣw*	***ḥry ḥpd srt***
2	*prt*	26	*ḫntt ḥrt*	*knmt*	*ꜥryt*	***tpy-ꜥ ꜣḫwy***
3	*prt*	6	*ḫntt ẖrt*	*ẖry ḥpd knmt*	*rmn ḥry*	***ꜣḫwy***
3	*prt*	16	*ṯms n ḫntt*	*ḥꜣt ḫꜣw*	*ṯs ꜥrḳ*	***tpy-ꜥ bꜣwy***
3	*prt*	26	*spty-ḫnwy*	*ḥꜣt ḏꜣt*	*wꜥrt*	***bꜣwy***
4	*prt*	6	*ḥry-ib wiꜣ*	*pḥwy ḏꜣt*	*tpy-ꜥ spdt*	***ḫntw ḥrw***

This table was created from the material in Seti's tomb. It is identical to Table I, except that I have eliminated the references to the errors noted by Neugebauer and Parker, and I have added a column for "Work" as described in the Carlsberg papyrus. Taking *sšmw* as an example, I have highlighted its time of work followed by its heliacal rise, showing what is consistent with what is tracked by the Asyut coffin tables.

SUPPLEMENTAL TABLE IV

The Life Cycle of a Decan Star

DATE			FIRST	ENCLOSED BY DUAT	BORN	WORK
4	*prt*	16	Heliacal Rise 1			
4	*prt*	26	2			
1	*šmw*	6	3			
1	*šmw*	16	4			
1	*šmw*	26	5			
2	*šmw*	6	6			
2	*šmw*	16	7			
2	*šmw*	26	8			
3	*šmw*	6	9			
3	*šmw*	16		Enclosed by Duat 1		
3	*šmw*	26		2		
4	*šmw*	6		3		
4	*šmw*	16		4		
4	*šmw*	26		5		
1	*ꜣḫt*	6		6		
1	*ꜣḫt*	16		7		
1	*ꜣḫt*	26			Acronychal Rise 1	
2	*ꜣḫt*	6			2	
2	*ꜣḫt*	16			3	
2	*ꜣḫt*	26			4	
3	*ꜣḫt*	6			5	
3	*ꜣḫt*	16			6	
3	*ꜣḫt*	26			7	
4	*ꜣḫt*	6			8	
4	*ꜣḫt*	16				Work 1
4	*ꜣḫt*	26				2
1	*prt*	6				3
1	*prt*	16				4
1	*prt*	26				5
2	*prt*	6				6
2	*prt*	16				7
2	*prt*	26				8
3	*prt*	6				9
3	*prt*	16				10
3	*prt*	26				11
4	*prt*	6				12

This table shows the life cycle of a decan star as described in the Carlsberg Papyri I and Ia.

SUPPLEMENTAL TABLE V

Proper name	Bayer letter
Acrux	α Crucis
Adhara	ε Canis Majoris
Al Hecka	ζ Tauri
Alcyone	η Tauri
Aldebaran	α Tauri
Algedi	α Capricorni
Algol	β Persei
Alhena	γ Geminorium
Alkes	α Crateris
Almach	γ Andromedae
Alnilam	ε Orionis
Alphard	α Hydrae
Alphecca	α Coronae Borealis
Alpheratz	α Andromedae
Altair	α Aquilae
Antares	α Scorpii
Arcturus	α Bootis
Bellatrix	γ Orionis
Betelgeuse	α Orionis
Canopus	α Carinae
Capella	α Aurigae
Castor	α Geminorium
Dabih	β Capricorni
Deneb	α Cygni
Deneb Algedi	δ Capricorni
Deneb Kaitos	β Ceti
Denebola	β Leonis
El Nath	β Tauri
Enif	ε Pegasi
Fomalhaut	α Piscis Austrini
Graffias	β Scorpii
Hamal	α Arietis
Hassaleh	ι Aurigae
Kaus Australis	ε Sagittarii
Kaus Borealis	λ Sagittarii
Kaus Media	δ Sagittarii

Proper name	Bayer letter
Lesath	υ Scorpii
Markab	β Pegasi
Mebsuta	ε Geminorium
Menkalinan	β Aurigae
Menkar	α Ceti
Mirach	β Andromedae
Mirfak	α Persei
Mirzam	β Canis Majoris
Pollux	β Geminorium
Procyon	α Canis Minoris
Propus	η Geminorium
Rana	δ Eridani
Ras Alhague	α Ophiuchi
Regulus	α Leonis
Rigel	β Orionis
Rigel Kentaurus	α Centauri
Ruchbah	δ Cassiopeiae
Sabik	η Ophiuchi
Sadalmelik	α Aquarii
Sadalsuud	β Aquarii
Saiph	κ Orionis
Scheat	β Pegasi
Schedar	α Cassiopeiae
Shaula	λ Scorpii
Sheratan	β Arietis
Sirius	α Canis Majoris
Spica	α Virginis
Vindemiatrix	ε Virginis
Wasat	δ Geminorium
Wega	α Lyrae
Yed Prior	δ Ophiuchi
Zaurak	γ Eridani
Zosma	δ Leonis
Zubenelgenubi	α Librae
Zubeneschamali	β Librae

Star List