DIAGONAL STAR TABLES ON COFFINS A1C AND S2HIL: A NEW TRIANGLE DECAN AND A REVERSED TABLE

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ABSTRACT

We present updates for two ancient Egyptian diagonal star tables on coffins A1C and S2Hil. A1C reveals a new triangle decan, *ḥ3t s3bw*, which brings the total number of triangle decans to 13 and the total number of unique triangle decans to 12 (because of the duplication of *nṯr ḏ3 pt*). We discuss its relevance, why it has likely remained hidden for so long, and why it may have been lost on other star tables. S2Hil is re-examined with new photographs provided by the Roemer- und Pelizaeus-Museum, Hildesheim. We find several striking features of this table that make it unique among the current collection, and also present more information of this table not previously identified.

Introduction

Diagonal star tables (also known as 'diagonal star clocks' or 'diagonal star calendars') are generally found on the underside of a subset of ancient Egyptian coffin lids, mostly from Asyut. The first major study of these objects was undertaken by Neugebauer & Parker (1960) in their 'Egyptian Astronomical Texts Vol 1' (hereafter, EAT 1), and included 13 tables (their coffins 1-12, and the occurrence in the Osireion). Since then, a further 12 tables have been discovered (Eggebrecht, 1990, 1993; Kahl *et al.*, 2005; Lapp, 1985; Locher, 1983, 1992, 1998; Symons & Cockcroft, 2013; Symons, 2002, In Press).

Diagonal star tables show the sequence of stars moving across the sky at various times of the year. An ideal table (see tables 1 and 2) contains 40 columns and 12 rows of decans (stars or asterisms). The first 36 columns are split into the 12 months of the ancient Egyptian seasons, with each month comprising three decades (ten-day periods). One decade is therefore represented by one column, with the first column as the first decade of the year. The final four columns simply list all decans used in the pre-

ceding 36 columns, with one extra decan in the final cell that only ever occurs in this location. The rows within each column represent different times of the night, with the top and bottom rows representing the first and last parts of the night, respectively. As the group of visible stars on any one particular night changes throughout the course of the year, so the list of decans within each column changes. In particular, as one advances from one decade to the next the decan in the first row is removed, the remaining eleven decans move up one cell, and another decan is placed in the last row. Over the course of the entire year, the diagonal pattern that gives this type of object its name is rendered.

To complete an ideal star table, 48 unique decans are required. These can be split into two groups: 36 ordinary decans and 12 triangle decans. The latter group is so called because they fill an area of the table that forms a triangle; they also compose the entire fourth list column.

The study of diagonal star tables is not complete; there are new tables probably awaiting discovery, as indicated by the latest unearthing of a fairly complete table (noted in Zitman, 2010; described in Symons & Cockcroft, 2013), and already-known tables undergoing re-examination (*e.g.*, this paper). As there are relatively few diagonal star tables, each example is important and has the potential to increase our understanding of these objects.

A New Decan

The diagonal star table T8 (also known as Coffin 8 in EAT 1; see Symons & Cockcroft, 2013 for an index of star tables and coffin sigla) occurs on a coffin with siglum A1C. This siglum denotes a coffin found in Aswan (A) in the collection of the Egyptian Museum, Cairo (C), which is misleading because the coffin is now on public display in the Nubian Museum in Aswan. It is a wooden coffin belonging to *ḥḳ3t3* (Zitman, 2010) or *ḥḳ3t*. The lid is displayed to the side of the coffin in an orientation which means that the diagonal star table is upside down. The date it was created is uncertain, but is believed to be

	5 days			IV Shemu	III Shemu	II Shemu	I Shemu	IIII Peret	III Peret	II Peret	I Peret	IIII Akhet	III Akhet	II Akhet	I Akhet	DR
A	25	13	1	36	33	30	27	24	21	18	15	12	9	6	3	1
B	26	14	2	A	34	31	28	25	22	19	16	13	10	7	4	2
C	27	15	3	B	35	32	29	26	23	20	17	14	11	8	5	3
D	28	16	4	C	36	33	30	27	24	21	18	15	12	9	6	4
E	29	17	5	D	A	34	31	28	25	22	19	16	13	10	7	5
F	30	18	6	E	B	35	32	29	26	23	20	17	14	11	8	6
																HS
G	31	19	7	F	C	36	33	30	27	24	21	18	15	12	9	7
H	32	20	8	G	D	A	34	31	28	25	22	19	16	13	10	8
I	33	21	9	H	E	B	35	32	29	26	23	20	17	14	11	9
J	34	22	10	I	F	C	36	33	30	27	24	21	18	15	12	10
K	35	23	11	J	G	D	A	34	31	28	25	22	19	16	13	11
L	36	24	12	K	H	E	B	35	32	29	26	23	20	17	14	12
	C4	C3	C2	C1	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	VS	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

► Table 1. A schematic of an ideal diagonal star table. DR, HS and VS represent the date row, horizontal strip and vertical strip, respectively. Columns C1-C4 are the list columns. The date row contains the names of the twelve months, each with three 10-day periods.

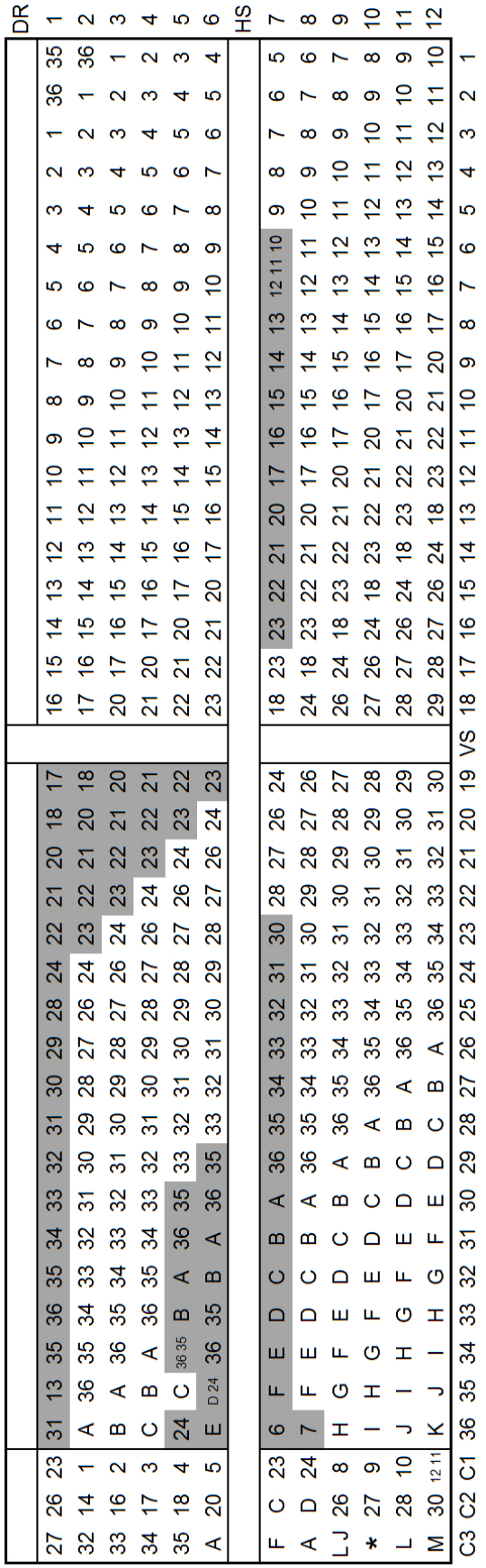
T	Decan Name	EAT 1
1	*wšt bk3t*	3
1a	*wš3ti*	3a
1b	*bk3ti*	3b
2	*ipḏs*	4
3	*sbšsn*	5
4	*ḫntt ḥrt*	6
5	*ḫntt ḫrt*	7
6	*ṯms n ḫntt*	8
7	*ḳdty*	9
8	*"ḫnwy"*	10
9	*ḥry-ib wi3*	11
10	*"crew"*	12
11	*knm*	13
12	*smd srt*	14
12a	*smd*	14a
13	*srt*	15
14	*s3wy srt*	16
15	*ḫry ḫpd srt*	17
16	*tpy-ʿ 3ḫwy*	18
17	*imy-ḫt 3ḫwy*	20
18	*3ḫwy*	19
19	*b3wy*	21
20	*ḳd*	22
21	*ḫ3w*	23
22	*ʿrt*	24
23	*ḫry ʿrt*	25
24	*rmn ḥry*	26
25	*rmn ḫry*	27
26	*ʿbwt*	28
27	*ḫrt wʿrt*	29
28	*tpy-ʿ spd*	30
29	*spd*	31
30	*knmt*	32
31	*s3wy knmt*	33
32	*ḫry ḫpd n knmt*	34
33	*ḥ3t ḫ3w*	35
34	*pḥwy ḫ3w*	36
35	*ṯm3t ḥrt*	1
36	*ṯm3t ḫrt*	2

T	Decan Name	EAT 1
A	*smd rsy*	A
B	*smd mḥty*	B
C	*nṯr ḏ3 pt*	C
D	*rmn ḫry*	D
E	*ḫ3w 2*	E
F	*tpy-ʿ spd*	F
G	*imy-ḫt spd*	G
H	*3ḫwy*	H
I	*ḫ3w*	J
J	*nṯr ḏ3 pt*	K
K	*pḥwy s3bw*	M
L	*s3bw*	L
M	*ḥ3t s3bw*	-

Table 2. Key to decan names and numbers in list T (Symons, 2007) for tables 1, 3 and 4. The decans are split into two groups: ordinary decans on the left, and triangle decans on the right. The EAT 1 numbers are shown for comparison purposes.

around the beginning of the 12th Dynasty (Willems, 1988, 1995; Zitman, 2010). It is the only diagonal star table so far to have been found in Aswan; the majority of the others come from Asyut.

We reiterate some of T8's general characteristics and then focus on features relevant to the discovery of the previously unknown decan. For a more detailed overview of diagonal star table structure and terminology, see Symons (2007). For a schematic of the diagonal star table, see table 3. The table T8 has twelve rows split evenly by the horizontal strip and surmounted with a date row. There are 36 columns of decans in addition to three (not four) list columns. The 36 columns are also split in half by the vertical strip. There are two battens (pieces of wood fixed across coffin lid planks



to hold the lid together) one at the beginning and one at the end of the star table, that do not contain any part of the table; the first appears blank apart from two small inscriptions, and the one at the end of the table contains a coffin text. All the ink on the underside of the lid is black and is painted onto a pale background lightly covering the surface of the wood. The cells are separated by single thin black lines and do not contain star symbols (as is common in other diagonal star tables). Instead, there are two columns of stars after columns 18 (immediately before the vertical strip) and C3 (the final column in the table).

The quadrants, split by the vertical and horizontal strips, have differing amounts of disorder. The top right quadrant, at the start of the table, is completely orderly in that the diagonal patterns are maintained throughout. The two bottom quadrants are fairly ordered except for row 7, the row directly beneath the horizontal strip. The majority of the decans in row 7 do not follow the diagonal associated with their decan, but are instead displaced by one cell. In the bottom right quadrant this appears to be because the decan 'crew' was probably missed during copying and re-supplied afterwards straddling the cell boundary, which is still clearly marked, between *ḥry-ib wi3* and *knmw*. In rows 7 and 8 of column 36, we also have two intrusive decans (*ṯms n ḥntt* and *ḳdty*). The top left quadrant, corresponding to the earlier parts of the night for the second half of the year, is the most disordered. The top row is again displaced by one or two decans from its associated diagonal strip, and there is also disorder in the areas to the left of the vertical strip and above the horizontal strip. The list columns are also disordered. Decans are inserted, omitted, repeated, and sometimes appear together in single cells. Part of the reason for this confusion may stem from the fact that there are only three list columns instead of the usual four that would be needed to list the full complement of decans occurring in the table.

◀ Table 3. The schematic of T8, on coffin A1C. Shaded areas indicate disorder (*i.e.*, deviation from the regular diagonal pattern of star tables). DR, HS and VS represent the date row, horizontal strip and vertical strip, respectively. C1-C3 are the list columns. The cell (C3,10) marked with a * is written as a *pḥwy* similar to the occurrences of *pḥwy* in the date row. It is not a decan by itself; see the text for discussion about this cell.

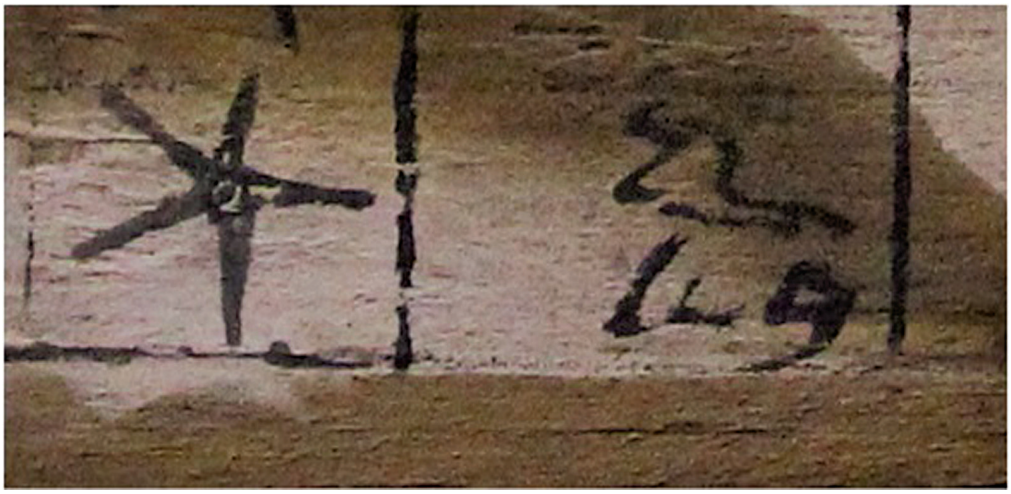


Figure 1. Photograph of the new decan, *ḥ3t s3bw* (M; see text for discussion), located in cell (C3,12) of diagonal star table T8, A1C. Note the darker region, perhaps a water stain, across the top of this decan name that causes this part of the decan to become difficult to read – especially in black and white photographs, but less so in person and in colour photographs. Photograph by the authors.

The table's final cell (C3,12) (indicating column C3, row 12; see figure 1) contains a combination of hieroglyphs not previously seen on any other diagonal star table. Neugebauer & Parker (1960) identify the decan in this cell as *pḥwy s3bw*. Willems (1995) does not dispute this in his commentary on the table. Pogo (1936), who first published this table, does not comment on this decan or those in the surrounding cells. Neugebauer & Parker (1960) were working with black and white photographs of the table (as reproduced in EAT 1) and the edge of what looks like a water stain makes reading this cell difficult because the contrast between stain and ink is poor. In person and in colour photographs, however, it is clear that the sign before *s3bw* in this cell is definitely not *pḥwy*. Comparison with other writings of signs in the rest of the table (see figures 2 and 3) indicates that the reading should be *ḥ3t s3bw*, an entirely new decan not seen elsewhere. Following the T-list numbering scheme (Symons, 2007), we label *ḥ3t s3bw* as decan M, with the result that there are now thirteen triangle decans, including the repetition of *nṯr ḏ3 pt* (decans C and J), or twelve unique triangle decan names.

There are four tables where both the triangle and the list columns are preserved: T1, T6, T7 and T8. Based on these four tables, Neugebauer & Parker proposed a 37-column theory for an ideal table where the first 36 columns each represent a decade and the final column of the list columns represents a five-day period at the end of the year. The other list columns on an ideal table repeat the decan names in the order that they appear in the decade at the beginning of each season (Cockcroft & Symons, In Press).

The eleventh decan of the triangle in T1, T6, T7 and T8 is *pḥwy s3bw*. However, Neugebauer & Parker asserted that this decan was misplaced; it should have been the twelfth decan. This assertion was supported by T8 only, where they saw two occurrences of *pḥwy s3bw* in the final three cells of the final list column. They then inserted *s3bw* as the 11th triangle decan, hinging on their interpretation of the list columns from T6 and T8: in both cases, *s3bw* is placed in a cell beside *nṯr ḏ3 pt* (*s3bw* first then *nṯr ḏ3 pt* in T6 but *nṯr ḏ3 pt* then *s3bw* in T8). The reconstruction of *s3bw* as eleventh decan and *pḥwy s3bw* as twelfth decan means that the hindquarters (*pḥwy*) precede the creature or object to which it belongs, which seems logical initially.

Symons (2007) questioned the 37-column theory because of the lack of convincing evidence for a twelfth unique decan. Here, we disagree with Neugebauer & Parker's reading of T8's final cell, and their reconstruction of the order of 12 triangle decans, but we have now found new evidence (*i.e.*, the new decan *ḥ3t s3bw*) to support their 37-column theory.

The part of the table where *ḥ3t s3bw* occurs is notoriously difficult to study because even on a complete table there would only be one occurrence of the final decan: in the final cell (C3,12). Hence, it would be very easy for this decan to be lost – for example, if this corner of the table became damaged or illegible. Given the expect-

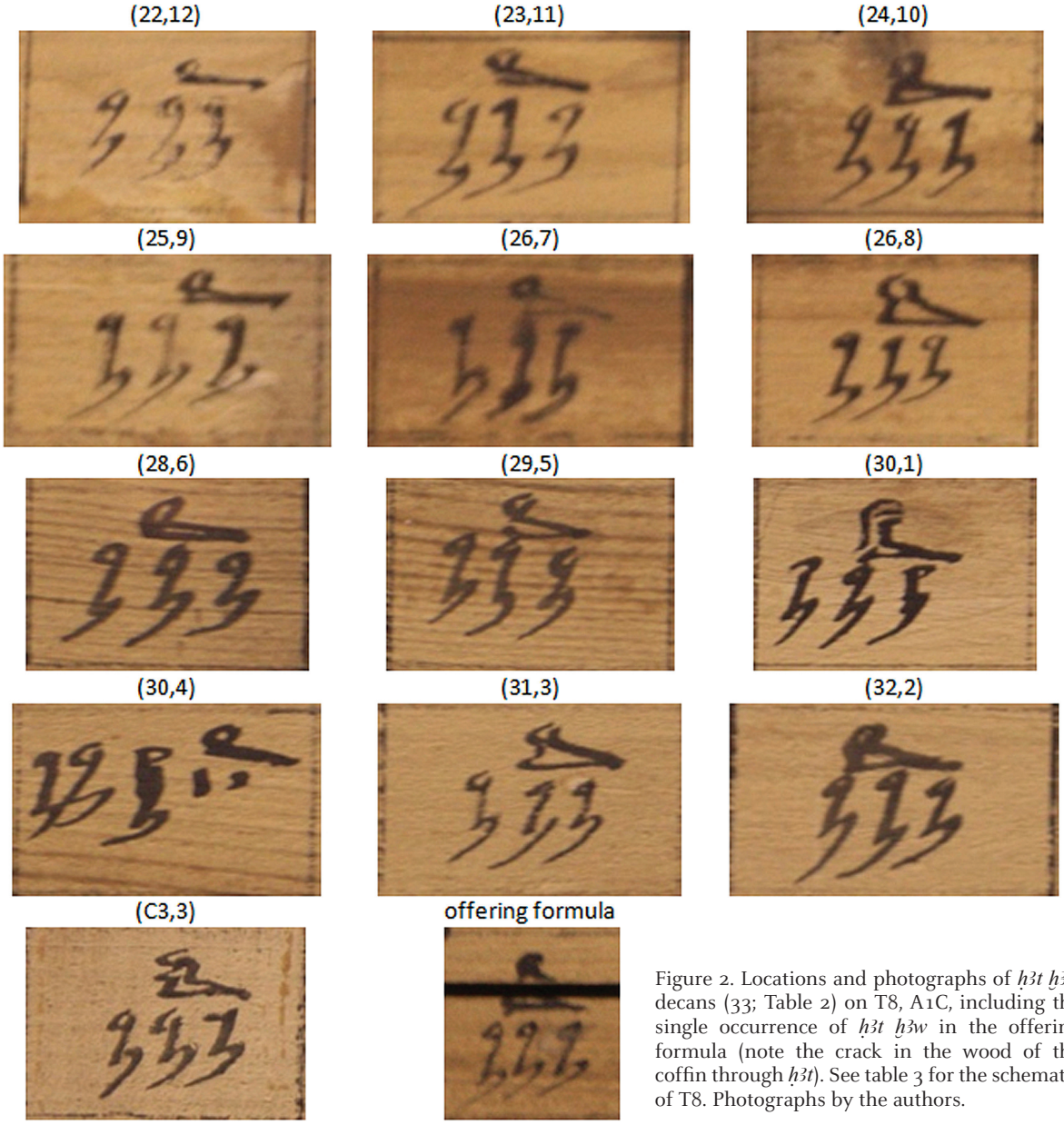


Figure 2. Locations and photographs of *ḥ3t ḫ3w* decans (33; Table 2) on T8, A1C, including the single occurrence of *ḥ3t ḫ3w* in the offering formula (note the crack in the wood of the coffin through *ḥ3t*). See table 3 for the schematic of T8. Photographs by the authors.

ed rarity of this particular decan, it is useful to discuss it in the context of the final four cells, (C3,9) to (C3,12); see figure 4.

Neugebauer & Parker read the cells in the following order: *s3bw* and *nṯr ḏ3 pt* together (C3,9), *pḥwy* (C3,10), *s3bw* (C3,11) and *pḥwy s3bw* (C3,12) – this last cell we now read as *ḥ3t s3bw,* as previously discussed. We suggest that there is ambiguity about which *s3bw* belongs to the *pḥwy* in (C3,10). In our reading, the small *s3bw* in (C3,9) belongs to the *pḥwy* immediately below in (C3,10) to become *pḥwy s3bw*. With the new decan, a logical order for the decans in the last four cells emerges: *nṯr ḏ3 pt*, *pḥwy s3bw*, *s3bw* and *ḥ3t s3bw*. The resulting decanal order means that the rear of *s3bw* rises before the front, which is possible depending on the orientation of the constellation in the sky (*i.e.*, celestial animals and humanoids may not be oriented such that they rise face first).

The writing of the word *pḥwy* in (C3,10), using three signs (*pḥ* + *w* + *y*), is the same as it is in the date row (where it is used to denote the final decade of the month). However, all other writings of *pḥwy* in decan names are written with a single sign (*pḥ*). This epigraphical feature is also present in T7 where the *pḥwy* in the epagomenal column (C3,10) is written with three characters. In contrast, in *pḥwy s3bw* (36,12), in the date row, and in all the writings of *pḥwy ḫ3w* in the main body of T7 a single *pḥ* character is used.

Figure 3. Locations and photographs of the decans containing *pḥwy* in T8 (see table 3 for the schematic of T8.) Most photographs show occurrences of *pḥwy ḫ3w* (34; table 2); however, (C3,10), (36,12), and (33,DR) show *pḥwy, pḥwy s3bw* (L; table 2), and an example of a *pḥwy* in the date row, respectively. The single occurrence of *pḥwy ḫ3w* in the offering formula is also shown (note again the crack in the wood of the coffin that separates the two characters in this row). Photographs by the authors.

Given that the area in which the new decan *ḥ3t s3bw* occurs is highly disordered, we must consider another possibility that instead of *ḥ3t s3bw* being a new decan the scribe simply miswrote this particular decan and accidentally combined components of other decans. However, if we consider our proposed new reading order, *nṯr ḏ3 pt, pḥwy s3bw, s3bw, ḥ3t s3bw*, the sequence seems natural, and the pairing of a *ḥ3t* (a forepart) with a *pḥwy* (hind part) is not unexpected.

We note that if *ḥ3t s3bw* was lost at some time during the (re-)production of the star tables, the repetition of *nṯr ḏ3 pt* may have been an effort to ensure there were sufficient triangle decans (12) to complete the entire final list column. This idea is similar to the duplication theory of the *ṯm3t* decans; the simplest and most likely explanation for the appearance of *ṯm3t ḥrt* and *ṯm3t ḫrt* at both the beginning and end of the ordinary decans is that their occurrence was required to "fill" the table because of two missing

Figure 4. The final six cells (rows 7 to 12) of T8 in column C3 below the horizontal strip. Note the contents of the final four cells: a small version of *s3bw* is included with *ntr d3 pt* in cell (C3,9). The word *pḥwy* stands alone in (C3,10); we suggest that the small *s3bw* above belongs to this *pḥwy*. Next, *s3bw* is written once more, alone, in (C3,11). The new decan *ḥ3t s3bw* completes the last cell of the table in (C3,12). Note again the darker stained region across the cells (C3,11) and (C3,12) that obscures the top of *ḥ3t s3bw*. The table terminates in a column of stars (left). Photograph by the authors.

ordinary decans, hypothesized to be *b3wy* and *rmn ḫry* (Symons, 2007). The loss of *ḥ3t s3bw* can neatly explain why the duplication of *ntr d3 pt* may have been necessary; however, we note that there are still two occurrences of *ntr d3 pt* both in the main part of the table and in the list columns of T8, where *ḥ3t s3bw* also appears.

The discovery of a new decan on T8 is intriguing. We believe that it remained undetected because there is only one occurrence expected on an ideal full table, and on this table in particular there is a stain across the top part of the cell obscuring the first part of the decan name. T8 again illustrates the rarity of complete star tables (and thus list columns in particular), the difficulty in discerning the complete set of decans, and ultimately, deducing their astronomical origins and use.

Comments on a Reversed Table

T11 (see figure 5 and table 4) is located in the Roemer- und Pelizaeus-Museum, Hildesheim, and occurs on a coffin with siglum S2Hil whose owner was *Wp-w3wt-nḫti*, as noted by Locher (1998) who published the table. The wooden lid is covered with white plaster or paint over which the star table is painted. Each column of decans is followed by a column of blue stars, outlined in black. The border of every cell is also black. The first and middle battens are not present on the lid, although their intended positions are clearly visible; the third batten is present. T11 is an extreme-

	D						D	D	D	D	D	D	D	D	D	1	[ ]	D	DR
											6		7		2	2			1
											7	3	8						2
											8						4/5		3
													10	8	[7]	5	4	[2]	4
																			HS
23	22	21	20	16			14	14			11	10	8		[9]	8	7			5
24	23	22	21	20	16		14				12	11	9	13	10	9	8	7		6
	24	23	22	21	17						13	12	10	14	11	10	9	8		7
			23	22							14	14	11	15	13		[10]		[8]	8
				23		9		16				14		16	14			10	9	9
19	18	17	16	15	14	VS	13	12	11	10	9	8	7	6	5	4	3	2	1	

Table 4. The schematic of T11, S2Hil, shown with conventional orientation for ease of comparison. The actual star table is reflected so that column 1 is on the left. The darkest cells are illegible. The white cells containing letters or numbers were previously identified (Locher, 1998). Lighter shaded areas are newly presented decans/date row cells. A number within square brackets indicates that the observable fragments are consistent with the decan name indicated, but the whole decan name cannot be clearly seen. DR, HS and VS represent the date row, horizontal strip and vertical strip, respectively. The empty square bracket in (2,DR) denotes that this cell contains a decan name as indicated by its blue paint, and does not contain a date which would have red paint, but the decan name is illegible.

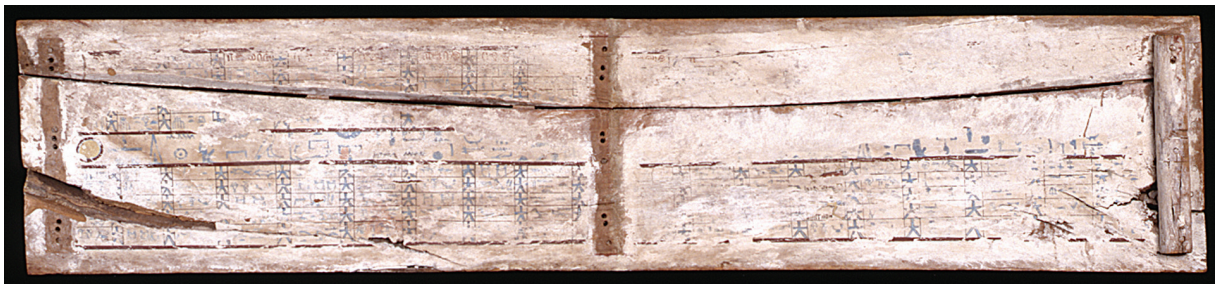


Figure 5. The lid of coffin 6000 in the *Roemer- und Pelizaeus-Museum, Hildesheim* (siglum S2Hil) which contains star table T11. The large red dot which begins the offering formula is visible on the left at the beginning of the table. In all other coffin lid tables, the star table and the offering formula start on the right. Photograph reproduced by kind permission of the *Roemer- und Pelizaeus-Museum, Hildesheim.*

ly interesting example of a diagonal star table as it has several unique features when compared to the other known star tables of this type which we note here.

T11's 'directional' features are immediately striking. The whole table appears to have been reflected through a vertical axis; all other diagonal star tables begin with the first decan of I Akhet in the cell at the top right of the table, but T11 has its first cell in the top left.

The horizontal strip also displays an unusual directionality. It begins on the left with a large red dot, a characteristic feature of the offering formula of most other diagonal star tables. However, not all diagonal star tables necessarily have this feature (it is omitted, for example, in T6, T7, and T8). The hieroglyphs within T11's strip are nearly all blue. The strip and the dot are bordered by a thick dark red line, as are the top and bottom of the whole table. The unique property of T11's horizontal strip is that the hieroglyphs are facing away from the red dot, although the strip is still read starting from this feature (*i.e.*, it is written left-to-right on T11, whereas it is written right-to-left on all other tables). Each individual sign is therefore written backwards with respect to the direction of the formula itself.

Looking in more detail at other contents of the table, we also see that the directions of certain hieroglyphs are also oppositely oriented. The direction of signs in the date row is also inconsistent. For example, the preserved *tp* (human head) signs are in two instances facing the red dot and in one instance facing away.

The table has 19 columns: 13 before the vertical strip and 6 following it. Locher (1998) noted there was a date row, but did not indicate which (if any) of the cells he could read. We identify seven new date row entries. In addition, we also note that there are at least two cells in this row where we instead observe decans (*wšt bk3t* in one; the other is illegible) painted in blue. The table therefore has either nine or ten rows, depending on whether or not there is a decan in the top row. This row is not the only area of the table where we find intrusive decans. The vertical strip also includes one occurrence of *ḥry-ib wi3* in a cell at the bottom, in line with the bottom row of the table's other decans.

In addition to the above unique qualities, we also present new contents of T11. In total, we add 35 new cells to those already published by Locher (1998), and six decans (*wšt bk3t, ipḏs, sbšsn, ḳdty, ḫry ḫpd srt* and *rmn ḥry*) not previously noted to be present. The diagonal pattern seen on other diagonal star tables is generally preserved here, although there does appear to be some confusion with the order of the decans in certain individual cells.

One of the newly-included decans, *ipḏs*, is written as *ipsḏ* in one cell (4,2) but may be written correctly in another cell (3,2) which is harder to read. Another epigraphical point of interest is that T11 has the only-known instances of depicting 'crew' as three pairs of people instead of two. Of the six occurrences of crew on this table, there are two with three pairs in (2,9) and (5,6) and three with two pairs (the sixth occurrence in (3,8) has fragments that are consistent with 'crew', but do not allow us to determine whether there are two or three pairs). All pairs in T11 are presented side by side ('horizontal'), similar to writings in tables T1, T2, T4, T9 and T12. T6 and T7 have pairs one above the other ('vertical'); T3 has all horizontal pairs except for one; T8 has eight vertical occurrences and five horizontal.

It is interesting to consider the significance, if any, of T11's signs and its entire table being

reversed compared to the usual direction. These directional features make T11 unique among the current collection of star tables.

Acknowledgments

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