MOVABLE \( w^{3}gj \) AND NUMERATION OF LUNAR DAYS IN ANCIENT EGYPT

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The ancient Egyptians celebrated the \( w^{3}gj \) feast, an integral part of the Osirian cult. Data from the Illahun archive evidence that there were two instances of it: a fixed one, which fell on a specific civil date, and a movable one associated with a specific phase of the moon. There is disagreement about the lunar day and month on which the movable feast took place. The aggregation of the Illahun lunar dates into a ‘date net’ indicates that the disagreement is due both to peculiarities of the datasets of previous studies and to the incorrect numeration of lunar days in Parker’s list, which has been the standard for more than 70 years. Analysis of the lists of lunar days from the Ptolemaic Period also reveals the erroneous position of one of the days; when it is set to the proper position, the symmetry of the phases relative to the day of full moon improves. Based on the corrected numeration of lunar days, it is concluded that the movable \( w^{3}gj \) in the original list fell on the 17th day of the second month after the emergence of Sopdet (the heliacal rising of Sirius in modern terms). Further research is needed to examine the effect of the proposed correction on the chronology of the Middle Kingdom.

**Keywords:** movable \( w^{3}gj \) feast, \( w^{3}gj \) dates, lunar month, lunar days numeration, moon, phases, Sirius, heliacal rising
The earliest attestations for \( w^3gj \) occur in feast lists from private tombs of the 4\(^{th} \) Dynasty. Two different instances\(^1 \) of it are recorded in the Illahun archive: a civil one, fixed on I 3\( h t \) 17/18\(^2 \); and a lunar one, which fell on different civil days; therefore, it is often called ‘movable’. The lunar \( w^3gj \) follows \( prt Spdt \) in the Middle Kingdom lists, and its dates were calculated by the Egyptians according to certain rules that need to be clarified.

Days of the lunar month (LM) had names, some of which denote the phase of the moon: 3\( bd \) – ‘new crescent day’; 4\( njt \) – ‘first/last quarter day’; while some others contain a numeral corresponding to the ordinal number of the lunar day (LD): 5\( nst \) – ‘6\(^{th} \) day’; 6\( mDdj-nt \)\(^3 \) – ‘15\(^{th} \) day’, ‘day of full moon’ [Parker 1950, 11–12, §36–41].

The movable \( w^3gj \) dates are not accompanied by information about the corresponding lunar day, but pBerlin 10016 indicates that the feast took place two days after the full moon (2-\( nw n m\ddj-nt \) [Krauss 2006b, 425], and pBerlin 10165 reports a three-day interval between these events (II 5\( smw \) 19 and II 5\( smw \) 22, respectively) [Luft 1992, 101; Krauss 1994a, 8; Depuydt 2000, 177]. Thus, in the first case, the feast falls on LD 17 (= 15 + 2), and in the second, on LD 18 (= 15 + 3).

Due to the scarcity of documentary evidence, there is no consensus about the day of the movable \( w^3gj \) among scholars: Krauss [1998, 53; 2006, 425; 2021, 95] believes that the feast falls on LD 17 (two days difference from the full moon); Luft’s [1992, 201–202] ‘date net’ indicates that it was LD 18 (whereas the full moon unexpectedly falls on LD 16; two days difference); Depuydt [2000, 177] and Spalinger [1994, 49; 2013, 620] accept LD 18 (three days difference) following Luft.

\(^1\) pBerlin 10007 lists two different \( w^3gj \) in the same year: a movable one preceded by \( prt Spdt \) (recto, lines 18–19; see [Borchardt 1935, 9]) and a civil one preceded by \( wp rnpt \) (recto, lines 22–23; see [Krauss 1985, 90–91]; for the hieroglyphic transcription see [Luft 1992, 45]).


\(^3\) \( smdt \) – traditional transcription [Parker 1950, 11]; \( m\ddj-nt \), ‘15(10+5)-th’ – ordinal (see [Parker 1950, 71, n. 39; Luft 1992, 163]).
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The method used by Luft [1992, 201; 1994, 40–41] to find the lunar day number is to calculate the distance between LD 1, $psd(n)tjw$, and the sought phase/event. The distance method sounds good, but three date selection rules should be applied to obtain accurate results:

1. an original date of the phase from the document should be used, not a calculated one, since the calculation assumes a known fixed interval between phases, and this is not always true$^4$;

2. a document with conflicting dates (a discrepancy of two or more days) should be excluded;

3. dates of the same phase/event must be consistent within the acceptable error margin (less than one day), i.e., they must correspond approximately to the same lunar day.

Four sets of dates need to be checked:

I. $psd(n)tjw$. The event is mentioned$^5$ in pBerlin 10090, pBerlin 10056 (presumably as the end of a month interval [6 times]$^6$) and 10056a, pBerlin 10006 (presumably as the end of a month interval$^7$). The dates from pBerlin 10003, pBerlin 10248 and pBerlin 10282 used by Luft to calculate $psd(n)tjw$ are $3bd$ originally and therefore they cannot be used (rule 1). There are no significant discrepancies in the dates. The dataset passes consistency check (Table 1).

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$^4$“The time that must elapse after conjunction for [new crescent] visibility to be possible is variable” [Parker 1950, 4, §11], so, for example, subtracting 1 day from $3bd$ to get $psd(n)tjw$ will affect the accuracy of the calculation (Table 5).

$^5$pBerlin 10090: King = [Amenemhat III], Year = 3, Date = III $\smw$ 17; pBerlin 10056: King = [Amenemhat III], Year = 30, Date = III $\smw$ 25; pBerlin 10056a: Year = 8, Date = III $\ht$ 26; pBerlin 10006: King = [Amenemhat III], Year = 32, Date = III $\ht$ 7. See [Krauss 2006b, 424–426] for more details on the dates.

$^6$ It is safe to use only the first of the six date pairs from this document, as the rest may not be related to observations, but be calculated [Depuydt 1997, 180–182].

Table 1. $Psd(n)ijw$ dataset consistency check. Legend: $\Delta LM$ – difference in lunar months; $\Delta LM = \Delta D$ [diff. in days] : $29.53059 \text{D/LM}$. Dev. – deviation in days from the expected same phase (row). Dev. = ($\Delta LM – \text{Round}(\Delta LM)) \times 29.53059 \text{D/LM}$. Avg. dev. – adjustment value in days to bring the examined date (col.) into line with other dates (negative/positive = earlier/later dates).

II. 3bd. The event is mentioned in pBerlin 10003, pBerlin 10248, pBerlin 10056 (presumably as the start of a month interval [6 times]; see n. 6), pBerlin 10006 (presumably as the start of a month interval), pBerlin 10282a and 10282b. The 3bd – smdt pair from pBerlin 10282b shows significant inconsistency and should be excluded (rule 2). The dataset passes consistency check (Table 2).

Table 2. 3bd dataset consistency check.

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8 pBerlin 10003: King = [Senusret III], Year = 9, Date = III $prt$ 10; pBerlin 10248: King = Senusret III, Year = 14, Date = II $3ht$ 18; pBerlin 10056 (see n. 5): Date = II $smw$ 26; pBerlin 10006 (n. 5): Date = II $3ht$ 9; pBerlin 10282a: King = [Senusret III], Year = [6], Date = II $3ht$ 14; pBerlin 10282b: Date = III $3ht$ 13. The 19-year duration of the reign of Senusret III is used [Schneider 2006, 172].

9 There are two dates, III $3ht$ 13 (3bd) and III $3ht$ 29 (smdt), referring to the same year (presumably Year 6 of Senusret III) in pBerlin 10282b. Since the interval between LD 2 and LD 15 is less than 14 days, these dates should be excluded, because they are separated by a two-day longer interval (29 – 13 = 16 days) (see also [Depuydt 1997, 150; Depuydt 2000, 179]).
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III. smdt. The event is mentioned in pBerlin 10003, pBerlin 10165, pBerlin 10016, pBerlin 10282a and 10282b. The date from pBerlin 10282b should be excluded (see 3bd). The consistency check (Table 3) indicates that the date from pBerlin 10165 needs to be corrected (II šmw 19 → II šmw 20).

<table>
<thead>
<tr>
<th></th>
<th>10282a</th>
<th>10003</th>
<th>10165</th>
<th>10016</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔLM</td>
<td></td>
<td>ΔLM</td>
<td>ΔLM</td>
<td>ΔLM</td>
</tr>
<tr>
<td>Dev.</td>
<td></td>
<td>Dev.</td>
<td>Dev.</td>
<td>Dev.</td>
</tr>
<tr>
<td>10282a</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>10003</td>
<td>43.006</td>
<td>0.18</td>
<td>82.965</td>
<td>1.03</td>
</tr>
<tr>
<td>10165</td>
<td>82.965</td>
<td>-1.03</td>
<td>39.959</td>
<td>-1.21</td>
</tr>
<tr>
<td>10016</td>
<td>156.990</td>
<td>-0.30</td>
<td>113.983</td>
<td>-0.50</td>
</tr>
</tbody>
</table>

Avg. dev. -0.38 -0.63 +0.994 +0.02

Table 3. Smdt dataset consistency check.

IV. w3gj. The event is mentioned in pBerlin 10165, pBerlin 10016, pCairo 58065. There are no significant discrepancies in the dates. The dataset passes consistency check (Table 4).

<table>
<thead>
<tr>
<th></th>
<th>10165</th>
<th>10016</th>
<th>58065</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔLM</td>
<td></td>
<td>ΔLM</td>
<td>ΔLM</td>
</tr>
<tr>
<td>Dev.</td>
<td></td>
<td>Dev.</td>
<td>Dev.</td>
</tr>
<tr>
<td>10165</td>
<td>–</td>
<td>-73.991</td>
<td>0.27</td>
</tr>
<tr>
<td>10016</td>
<td>73.991</td>
<td>-0.27</td>
<td>–</td>
</tr>
<tr>
<td>58065</td>
<td>197.998</td>
<td>-0.06</td>
<td>124.007</td>
</tr>
</tbody>
</table>

Avg. dev. -0.16 +0.24 -0.07

Table 4. W3gj dataset consistency check.

The distance method can now be applied to the selected dates to calculate the average LD for 3bd, smdt, w3gj, if psd(n)twj is LD 1 (see Table 5).

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10 pBerlin 10282a (see n. 8): Date = I 3ht 29; pBerlin 10282b (n. 8): Date = III 3ht 29; pBerlin 10003 (n. 8): Date = III prt 24; pBerlin 10165: King = [Senusret III], Year = [12], Date = II šmw 19; pBerlin 10016: King = [Senusret III], Year = 18, Date = II šmw 15.

11 pBerlin 10165 (n. 10): Date = II šmw 22; pBerlin 10016 (n. 10): Date = II šmw 17; pCairo 58065: King = [Amenemhat III], Year = 9, Date = II šmw 29.
### Table 5. Average LD calculation for $3bd$, $smdt$ and $w3gj$, if $psd(n)tjw$ is taken as LD 1. Legend: $\Delta D$ – difference in days; $\Delta LM$ – difference in lunar months; $\Delta LM = \Delta D : 29.53059$ D/LM; LD – lunar day number. The $3bd – psd(n)tjw$ pairs from pBerlin 10056 and pBerlin 10006 have been excluded from the calculation to achieve greater accuracy\(^{12}\).

\(^{12}\) Krauss [2021, 94; and private communication] points out the incorrectness of dividing the interval between events by the average lunar month. This is true for short intervals, but the error becomes negligible for long intervals, because the longer the sequence of months, the better it fits the average month. Two short intervals in Table 5 (pairs from pBerlin 10056 and pBerlin 10006) should therefore be excluded (pBerlin 10056: $\Delta LM = -29 : [29.25(\text{min.})/29.53(\text{avg.})/29.83(\text{max.})] = [-0.99/-0.98/-0.97]).
The results obtained explain the aforementioned contradictions: firstly, the three-day interval between smd and w3gj from pBerlin 10165 turns out to be inconsistent with the rest of the data; secondly, as can be seen from Table 5, for all four psd(n)tjw dates, taken as LD 1, the same pattern of relative positions of 3bd / smd / w3gj (see ‘Avg. LD’ rows) is observed: 3bd / 3bd + 14 / 3bd + 16, where 3bd varies from 1.36 to 1.96, therefore the full moon occurs at both LD 15 and LD 16, and w3gj two days after it, respectively. The discovered pattern indicates that if psd(n)tjw is taken as the reference point, then the same phase is distributed between two adjacent days of the lunar cycle, and if 3bd is the reference point, then the phase falls on the same day. How to explain such a distribution for the standard psd(n)tjw = LD 1?

It is necessary to remember that Parker’s [1950, 11–12, §36] list of days of the lunar month consists of 30 names, one for each lunar day. However, we know that a synodic month averages 29.53059 days (varies from 29.25 to 29.83 days), that is, if from the beginning of the lunar month the days are sequentially called by names from the list, then after two or three months a loss of synchronization with actual phases will be found. Therefore, in order to maintain synchronicity, the Egyptians had to skip one day in some13 months. What day could they skip? It is easy to demonstrate that this was one of the days of invisibility of the moon14, prt Mn and psd(n)tjw, namely the second of them.

If the observer does not know exactly when the new lunar month will begin, he must turn to observations. Uncertainty regarding the phase exists only when the moon is not visible, and therefore, without calculations, it is not known exactly when a new crescent will appear – today or a day later15. Thus, the first appearance of a new crescent is an obvious synchronization point, and in order for the lunar month to correspond to reality, the Egyptians had to use a simple rule: if today is the turn of the second day of the moon’s invisibility, psd(n)tjw, but the new crescent has already appeared, psd(n)tjw is

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13 See [Parker 1950, 6, §18] for details.
14 “In Egyptian latitudes the new crescent appears in ca. 70 % of the cases after a single day of invisibility, in ca. 30 % of the cases after invisibility lasting two days” [Krauss 2006a, 388].
skipped, and the current day becomes 3bd (and possibly vice versa). With this scheme, the new crescent always fell on 3bd; psd(n)τjw functioned as an intercalary day, and its top position in the list of lunar days can be explained by the fact that the Egyptians regarded intercalary days as hrjw days – ‘which are upon’, ‘which are higher’ [Erman and Grapow 1929 (Wb. III), 133] (for example, the epagomenal days of the civil calendar were called hrjw-rnpt, ‘those over the year’).

Obviously, the numbering of the days of the lunar month, starting from the intercalary day, does not make sense, while the numbering from the first day of the new crescent visibility, 3bd, is, on the contrary, natural. Moreover, this numbering explains the temple service month intervals and the absence of psd(n)τjw in early private feast lists [Krauss 2006a, 386]; the month-feast, 3bd, turns out to coincide with the real beginning of the corresponding month, and not with its second (or even third) day; the other phases are not delayed relative to the corresponding days, as in Parker’s scheme [1950, 14, Fig. 10–11; 3rd day]. In the light of the foregoing, the sequence of days in Parker’s list should not begin with number one, but with an unnumbered intercalary (Table 6).

Continuing the analysis of Parker’s list, it should be noted that two instances of the quarter, dnjt (LD 7, LD 23), are separated by an overly long interval, 16 days, instead of the expected average interval of 16 days. If it is 3bd’s turn, but the new crescent is still not visible, psd(n)τjw continues.

The 3bd dates from pBerlin 10282a and pBerlin 10006 (see corresponding rows in Table 5) illustrate two opposite cases when intercalary day is skipped and not skipped, respectively.

“All that we know of ancient and modern time-reckoning leads to the conclusion that lunar months begin with some observable phase of the moon. “As always,” says Nilsson, “the concrete phenomenon is the starting point”. Most peoples (both ancient and modern) who use a lunar calendar start the month with the new crescent; a few count from full moon; while two East African tribes […] begin with the moon invisibility” [Parker 1950, 9, §25].

Temple service months in pBerlin 10056 start with 3bd and end with psd(n)τjw [Krauss 2006b, 426]. The pair of dates from pBerlin 10006 seems to be a misidentified 3bd–prt Mn pair that corresponds to a non-intercalary 29-day temple service month.

Derstine [2016, 42–45] proposes a different scheme using the same arguments.
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29.53059 : 2 = 14.765 \approx 15\) days; and two instances of the unknown phase, \(s\beta w\) (LD 14, LD 17), are not symmetrical with respect to the full moon: they are one and two days apart from it. This effect can only be caused by a superfluous day within the ranges of these two pairs, namely, the incorrect position of LD 16, \(mspr\ 2-nw\), which got there by mistake. The list has an element with a similar name, \(mspr\), so putting them side by side results in a sequence of \(mspr\, mspr\ 2-nw\) being the first and second ‘rib’ days\(^{21}\). The corrected list of lunar days is as follows (Table 6, right side):

<table>
<thead>
<tr>
<th>Parker</th>
<th>New proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD</td>
<td>Name</td>
</tr>
<tr>
<td>-----</td>
<td>------------</td>
</tr>
<tr>
<td>1</td>
<td>(psd(n))tjw</td>
</tr>
<tr>
<td>2</td>
<td>(tp) (3bd)</td>
</tr>
<tr>
<td>3</td>
<td>(mspr)</td>
</tr>
<tr>
<td>4</td>
<td>(prt\ \sm)</td>
</tr>
<tr>
<td>5</td>
<td>(jh\ t h\ \h^{3}\wt)</td>
</tr>
<tr>
<td>6</td>
<td>(snt)</td>
</tr>
<tr>
<td>7</td>
<td>(dnjt)</td>
</tr>
<tr>
<td>8</td>
<td>(tp)</td>
</tr>
<tr>
<td>9</td>
<td>(k^{3}p)</td>
</tr>
<tr>
<td>10</td>
<td>(sij)</td>
</tr>
<tr>
<td>11</td>
<td>(stt)</td>
</tr>
<tr>
<td>12</td>
<td>?</td>
</tr>
<tr>
<td>13</td>
<td>(m^{33})stj</td>
</tr>
<tr>
<td>14</td>
<td>(s\beta w)</td>
</tr>
<tr>
<td>15</td>
<td>(tp) (smdt)</td>
</tr>
</tbody>
</table>

\(^{21}\) Borchardt [1935, 37, n. 2] suspected that \(mspr\) originated from \(spr\), ‘rib’, since the new crescent is shaped like a rib; see also [Parker 1950, 71, n. 42].
Table 6. New proposal for the sequence and numeration of lunar days. Differences from Parker’s numeration are in square brackets.

Now mspr is accompanied by mspr 2-nw, creating the mspr-sequence; smdt is symmetrically surrounded by two sj3w, in which it is easy to recognize the pre- and post- full moon phases; the interval between quarters is also normalized. If we recalculate Table 5, assuming 3bd = LD 1, then w3gj falls on LD 17 (16.85); psd(n)tjw – on LD 30 (29.91); and smdt/mddj-nt – on LD 15 (14.96), as indicated by its name.

As for the lunar month in which the movable w3gj was celebrated, data from the Illahun archive show that this feast took place...

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22 In both a 29-day month (conjunction ≈ midday of prt Mn; psd(n)tjw is skipped) and a 30-day month (conjunction ≈ end of prt Mn; psd(n)tjw is not skipped), the first quarter falls on LD 7 ([29.25/29.83] * 1/4 = [7.31/7.46]), and the last quarter – on LD 22 ([29.25/29.83] * 3/4 = [21.94/22.37]), counting from the conjunction.
Approximately 60 days after the emergence of Sopdet (Table 7), that is, in the second (not in the first or third) lunar month after the heliacal rising.

<table>
<thead>
<tr>
<th>Source</th>
<th>King / Year</th>
<th>Movable w3gj date</th>
<th>prt Spdt date&lt;sup&gt;24&lt;/sup&gt;</th>
<th>prt Spdt / w3gj interval, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>pBerlin 10165</td>
<td>[Senusret III] / 12</td>
<td>II šmw 22</td>
<td>IIII prt 18 – IIII prt 26</td>
<td>56–64</td>
</tr>
<tr>
<td>pBerlin 10016</td>
<td>[Senusret III] / 18</td>
<td>II šmw 17</td>
<td>IIII prt 19 – IIII prt 28</td>
<td>49–58</td>
</tr>
<tr>
<td>pBerlin 10007</td>
<td>[?] / 1</td>
<td>II šmw (–)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pBerlin 10419</td>
<td>[Amenemhat III] / 38</td>
<td>III šmw (–)</td>
<td>IIII prt 29 – I šmw 8</td>
<td>≥ 53</td>
</tr>
</tbody>
</table>

Table 7. Movable w3gj dates from the Illahun archive. The prt Spdt dates (Memphis; arc. vis. 9°; 1460 y.) are given as ranges due to different estimates of reign dates. The interval between the lunar w3gj and prt Spdt averages 60 days.

Summarizing the above, the following conclusions can be drawn:
– it is necessary to return to the earlier views<sup>25</sup> that the original lunar month began with 3bd;

<sup>23</sup> Some authors assume deviations from the second month to justify the conventional chronology of the Old Kingdom. For example, Luft [1994, 42], Depuydt [2000, 183–184], Gautschy et al. [2017, 80] suggest the first lunar month after prt Spdt based on the supposed correspondence between the civil and movable w3gj dates: Month 1 [I 3ḥt] Day 18 = LM 1 LD 18. However, the rule for calculating the moveable w3gj for the Middle and Old Kingdoms should be the same due to the seasonal nature of the feast.


– $psd(n) tjw$ was an unnumbered intercalary day and headed the lunar month due to the fact that intercalary days were regarded by the Egyptians as $hrjw$ days, ‘which are upon/higher [time unit]’;

– the movable $w^3gyj$ in the Middle Kingdom and earlier took place on ‘day of the moon’, $j^h = LD 17$, in the second lunar month after the heliacal rising of Sirius;

– the list of lunar days was corrupted sometime after the Middle Kingdom: $mspr 2-nw$, presumably as a result of the omission, was moved down to the position in which it appears in the lists of the Ptolemaic temples$^{26}$.

REFERENCES


Borchardt L. (1935), *Die Mittel zur zeitlichen Festlegung von Punkten der ägyptischen Geschichte und ihre Anwendung*, Quellen und Forschungen zur Zeitbestimmung ägyptischen Geschichte, 2, Selbstverlag, Kairo.


$^{26}$ Parker’s list is based on Brugsch’s [1883, 45–48] compilation, which includes data from: (e) – “Pronoas des Tempels von Dendera”, (e’) – “Pronoas von Edfu”, (e’’) – “nördlichen Osiris Tempels auf dem Dache des grossen Tempels von Dendera”, (e’’’) – “gelegentliche Varianten aus dem alt en (A), neuen (N) und Ptolemäer Reiche (P)”.

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O’Mara P. (1984b), “Some Indirect Sothic and Lunar Dates from the Late Middle Kingdom in Egypt”, Studies in the Structural
Movable w3gj and Numeration of Lunar Days in Ancient Egypt


Стародавні єгиптяни відзначали свято $w3gj$, невід’ємну частину культу Осіріса. Дані з архіву Іллахун свідчать про те, що існувало два його різновиди: фіксоване свято, яке припадало на конкретну цивільну дату, і рухоме, пов’язане з певною фазою Місяця. Існує розбіжність щодо доби та місяця, в які відбувалося рухоме свято. Агрегація місячних дат Іллахуна в “мережу дат” вказує на те, що розбіжність пов’язана як з особливостями наборів даних попередніх досліджень, так і з неправильною нумерацією місячних діб у списку Паркера, яка була стандартом понад 70 років. Аналіз списків місячних діб періоду Птолемеїв також виявляє помилкову позицію однієї з діб; при правильному її положенні покращується симетрія фаз відносно фази повного Місяця. На підставі виправленої нумерації місячних діб зроблено висновок, що рухомий $w3gj$ в оригінальному списку припадав на 17-у добу другого місяця після появи Сопдет (геліакічного сходу Сіріуса за сучасними термінами). Потрібні подальші дослідження, щоб перевірити вплив запропонованої корекції на хронологію Середнього царства.

Ключові слова: рухоме свято $w3gj$, $w3gj$ дати, нумерація місячних діб, Місяць, фази, Сіріус, геліакальний схід

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