

DISCUSSIONS
IN
EGYPTOLOGY

38

1997

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EDITORIAL NOTE

1. Length of Articles

Bearing in mind the increasing number of articles now being submitted to us, we shall have to be more rigorous in the future about limiting their length, in order to continue our policy of prompt publication. Since we abandoned the six-page limit on the articles we publish, some of these have been very long and therefore not really suitable for a publication such as ours. It is not our intention to compete with the larger periodicals in our field.

We must therefore ask contributors to edit their own articles to an absolute maximum of twelve pages, ideally less.

It will still be possible, nevertheless, to make exceptions by special arrangement

2. Summaries for the *Annual Egyptological Bibliography*

Many articles are being received without summaries. In order to comply with the request of the *AEB*, which is in the interests of us all, we shall henceforth not accept any article arriving without a summary of a maximum of six or seven lines, placed at the beginning of the article, under the title.

3. New Subscriptions

In order to ensure the continued existence of *DE* in the years to come, we would ask you at all times to encourage as many new subscriptions as possible. *DE* is an open forum with short intervals between numbers. It therefore fulfils a real need for discussion in Egyptology, including reviews of recently-published books. Until now, we have had no financial support from any institute or society.

Alessandra Nibbi
May, 1997

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DISCUSSIONS IN EGYPTOLOGY: GUIDELINES

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- f) Our numbers are now filling early so that articles are often held over until the next number.

CAN THE GIZEH PYRAMIDS BE DATED ASTRONOMICALLY?

IV. Some Lunar Dates from the 4th and 5th Dynasties.

Patrick F. O'Mara

Earlier articles in this series were concerned with establishing some logical foundations for an astronomical chronology of the OK. Two hypothetical conclusions were deduced that might fix a pragmatic point from which to launch a detailed reign-by-reign astronomical analysis of the 4th and 5th Dynasties: (1) The hb·sd of III šmw 27 in sp 18+ of Pepi I fell on 15 March 2432 of Egyptian year 2433/32 B.C.; (2) the distance from this jubilee to the "historiographical" death of Djoser, generally agreed by the consensus to be of 350 ±15 years,¹ can be refined to around 344 years (i.e., 86 Sothic quadriennia).

Yet we must hesitate to ascribe such precise absolute values to the dates we are considering here. Astronomically determined dates may also be treated as being merely relative. For the Old Kingdom we surely have the three alternatives of a low placement (Parker and the current consensus),² a high placement (Wheeler, Hayes, and the present author),³ and a middle placement (Spalen, Brovarski).⁴ For those wishing to experiment with a lower placement, my dates may be lowered along the 25-year lunar lines; a further lowering by 14 years adjusts sunrise-day to dawn-day (e.g., -139±25 years = Parker low placement zone).

¹ Part III of the present series - DE 35 (1996), fn 7.

² Based on the hypothesis of a short First Intermediate Period with Calendar Year 1 in the mid-2nd Dynasty (Ny·Neter) - Pepi I hb·sd sp 18+: ca 2294 B.C., dawn-day (Parker: 2292).

³ Based upon a long Intermediate Period, with OY 1 under Djoser: Pepi I sp 18+: ca 2419 or 2433 B.C. (Egyptian sunrise-day).

⁴ DE 35 (1996) fn. 11. Ca 2344 or 2369 B.C. (dawn-day).

BLOCKING OUT THE OLD KINGDOM REIGNS

What line of inquiry might give us a working list of kings and reigns accounting for around 344 years? Our materials are Manetho, pTurin, the Palermo Stone, and the highest known sp counts. These sources often disagree, but we have three sharp tools with which to cut through the web of contradictions:

(1) X : X+1. Elsewhere,⁵ I have argued that despite many disagreements in our present texts of Manetho and pTurin with respect to OK regnal years, there had been close agreement between their respective sources, an agreement reflecting a consistent and explainable discrepancy of 1 year and expressible as an $x:x+1$ relationship; e.g., Sahura: Tur, 12; Man, 13.⁶ I argue that the $x+1$ form is erroneous in that it is derived from a NK misinterpretation of the end-of-reign moon spaces in earlier annals stones. We have then two guiding formulae: "Tur + 1 = Man" OR "Man - 1 = Tur".

(2) Damaged Years. Where the discrepancy is greater than 1, the high regnal figure may reflect damage in an earlier list that has been made good by borrowing from the lifetime column, this latter an artificial figure, as revealed by a root of 7 or 11 and by its frequent derivation from the x -form: e.g., Userkaf: Tur, 7 \rightarrow Man, 28 (7 x 4); Niuserre: Tur, 11 \rightarrow Man, 44; Djedkare; Tur, 28 (4 x 7) \rightarrow Man, 44 (4 x 11), etc.

(3) Exclusion of ephemeral names: Hardadef and Baufre (neither is shown with a cartouche earlier than the MK); Thamphthis (not a shred of contemporary evidence); Shepseskare (faux Shepseskaf; Manetho's form "Seberche-

⁵ DE 7 (1987) 37-49: 43ff, with Table 1; GM 158 (1997), in press.

⁶ Moreover, it would appear that Manetho himself used at least 2 sources in places, one of x years, the other of $x + 1$ years; e.g., Sefhuris, 29; Soris, 29; Cheneres, 30 (forms of Snefru).

res, 7 years" shows that the name had acquired a rote R^h, whose addition had provoked the dropping of F either for grammatical or phonological reasons).⁷

Table 1, below, embodies the three points just treated.

Table 1. Blocking Out Dynasties III-VI

III:	36 (Tur: 6, 6, 24; Pal: bloc of 36)
IV:	106 Snefru: 29, Khufu: 22, Radjedef: 8, Khafre: 25, Menkaure: 16, Shepseskaf: 6
V:	138 Usrkf: 7, Sahura: 12, Nfrkare: 19, Ranfrf: 21, Niusrre: 11, Mnkauhor: 8, Djedkare: 28, Unas: 32
VI:	64 Teti: 29, Pepi I (to sp 18+): 35

344

(4) Census years and regnal years. We cannot know with certainty whether sp 1 was also regnal year 1 or whether it might have been regnal year 2. Any answer depends upon whether the census count was personal and numbered with respect to the accession year of the king or whether it was periodic and bureaucratic. Gardiner held that it was personal and began invariably in the second year of each reign.⁸ This would mean that approximately half the time the state had to forego a year's revenue because of the new king's accession,⁹ a generous willingness to surrender income unmatched by any other government on 5 continents over 5,000 years of history.

The dated materials used in Part I have placed sp 1 of Pepi II in 2404 B.C., of Pepi I in 2468 B.C., and of Unas in 2528 B.C. These three cases by themselves prove

⁷ The only contemporary evidence is a single seal (P. Kaplony, Rollsiegel des alten Reiches, II, Pl 81, #6); an alleged link with a King "Sekhemkhou" (#5) is contradicted by #3 and #1. The same remarks apply to "Userkare", a misplaced faux Userkaf.

⁸ Alan Gardiner, JEA, 30 (1945) 11-28.

⁹ When the previous king's last year had been year m·ht sp.

nothing, but we shall see that every case that is determinable will place the census in the even-numbered Julian years.¹⁰ All indeterminable cases are compatible.

Starting from the experimental date Unas: 2529 B.C., derived as regnal year 1 (DE 34, 81f) and using our minimal bare-bones list of kings, we may attempt to pursue the trail of presumed lunar dates leading back to the Pyramid Age.

REIGN BY REIGN ANALYSIS OF THE 4TH AND 5TH DYNASTIES

The identification of lunar dates and their assignment to reigns in the 4th and 5th Dynasties must by the very nature of the evidence be fraught with uncertainty and controversy, rather like the 12th Dynasty, where assignment of materials among the Sesostrids II and III and Amenemhet III has been sharply contested. For the OK, the proper assignment of evidence to reign depends greatly upon expert archaeological judgment that often must remain imprecise.

The attribution of lunar nature to two or more dates from the same reign that converge upon a common sp 1 is fairly conclusive. Single dates, however, may on occasion be merely fortuitous (I would estimate not less than 25% of the time). Nor can we tell which of our dates are fortuitous and which are authentic. In this respect we are rather in the position of the modern particle physicist who cannot locate the individual electron but deals with a statistical "swarm" of electrons. We too must rely upon the overall structure — the Gestalt — of our astronomical sightings.

Djedkare. The raw data regarding the length of reign of this king are as follows: Turin assigns 28 years; a sp 16 is known (year 31 or 32, possibly within a core-

¹⁰ E.g., the sequence Snefru, Khufu, Radjedef, Appendix, below.

gency),¹¹ and Manetho assigns 44 years, presumably a fictional construct (Tur: 7 x 4 → Man: 11 x 4).

This pharaoh is known to have a hb·sd reference.¹² Its year and date are unknown, but he recorded in sp 9 a victory in the Sinai to "establish his universal dominion."¹³ Might this have been another occasion of the border wars we have found to be associated with the 36-year periodic jubilee,¹⁴ an occasion for which was due in Julian 2541/40 B.C. (2433/32 + (3 x 36)? If we set 2541 as the year of both jubilee and Sinai campaign, then sp 1 would lie at 2557. If this is treated as being also regnal year 1, then an accession of Unas in 2529 B.C. would accommodate exactly the 28-year reign noted by the Turin Canon for Djedkare.

But this is too neat. Moreover, it violates what appears to be an emerging rule that the biennial census fell in even-numbered Julian years. For if the 36-year jubilee would fall in sp 18+ of Pepi I, then a jubilee of Djedkare ought to fall in an odd-year, either 8+ or 9+. Are we to reject the datum as incompatible with the rule, or does the datum in fact disprove the rule?

Despite the discrepancy, it is not unreasonable to suppose that, since jubilee day (the 240th day, at II šmw 30) lies so deep within the last season of the year, an expedition despatched at the jubilee might not have

¹¹ Letter to Senedjemib, Urk., I, 60-63.

¹² Urk., I, 57; Erik Hornung and Elizabeth Staehelin, Studien zum Sedfest (Basel, 1964) 23.

¹³ Louvre jar inscription, Urk., I, 56.

¹⁴ Kees stresses jubilee representations of bows and arrows and of the subjugation of all enemies as signs of divine renewal of royal power, originating possibly in Narmer's victory over the Delta (Bonnet, Reallexikon der altaegyptischen Religion, I, 158-160; and part II of the present series - DE 34 (1996) 67-82:67f. par. 2, and p. 72).

been able to penetrate the Sinai and find a suitable opponent until early in the following year. Jubilee year 2541 would presumably be sp 8+, not 9, with sp 1 falling in 2556 B.C. A first regnal year at 2557 B.C. corroborates the 28 years assigned by the Turin Canon and deduced from his known Sinai victory of sp 9.

Corroborative evidence may be found in a jar inscription from Mastaba S 679/705 associated with the Ruwer II complex. Although the complex itself is best attributable to Unas, a seal inscription of Djedkare has been found in the burial chamber, justifying a search for others. An unidentified jar inscription is dated to III prt 4 of sp 5+. ¹⁵ When tested for Unas in the year 2519 B.C. there is a 2-day error. Now, a 2-day error in lunar calculations means that the correct assignment is at a distance of 3 years (or 28, or 53); that is to say, it ought to be exactly right for Djedkare if he had the 28-year reign attributed to him by Turin. Indeed, if shifted by 25 + 3 years to 21 November 2547 B.C., the date of our jar inscription would yield an acceptable result. ¹⁶ This inscription would fix the first

¹⁵ Hermann Junker, Giza (Vienna, 1947) VIII, 31, Fig. 8; Pl. vi.

¹⁶ III prt 4 was 21 Nov 2547 B.C.; conj and psd: 23 Nov, 11:02 (Index: 137), Egyp sunrise-day: 22 Nov (1-day error).

I am indebted to Prof. Lee W. Casperson of Portland State University for his great kindness in refining and correcting my astronomical calculations. Using computer generated data, adjusted for errors in the earlier Neugebauer/Schoch tables (v. his articles in JNES: 45 (1986) 139-150 and 47 (1988) 181-184), he has calculated psdntiw for Memphis with an assumed Old Crescent visibility factor comparable to that of Jerusalem. A visibility index figure of 100-250 indicates Old Crescent sufficiency. Prof. Casperson's involvement is technical. He is not responsible for nor does he necessarily endorse views that may be controversial, such as the definition of the Egyptian day and whether Sirius was observational or schematic.

census count of Djedkare at 2556 B.C. A first regnal year at 2557 corroborates the 28 years assigned by Turin and deduced from his known Sinai victory of sp 9.

Materials for this reign from the funerary temple of Neferirikare at Abusir are totally frustrating.¹⁷ I find the many dates to be unutilizable even when applied experimentally to other reigns of the late 5th and 6th Dynasties, and I question most emphatically the assignment of such high census counts as 21 and 28 to this reign of Djedkare.

Menkauhor and Niuserre. The Turin Canon assigns these two pharaohs reigns of 8 and 11 years respectively. Manetho confirms these figures with his 9 ($x + 1$) and 44 (4×11 - fictional lifetime). Their coronations would fall in 2565 and 2576 B.C. I have found no utilizable materials attributable to Menkauhor, but the date 2576 for Niuserre finds support in a single lunar dating.

A fragment from the tomb of Shesemnefer, G5080, erected during the reign of Niuserre, is dated to "II prt 10 (?)" of sp 2.¹⁸ Considered as śmdt and with day 1 at I prt "26"(?) (21 Oct 2574 B.C.), conj and psd fell on 23 Oct, 15:32 (Index: 166) (Egyp sunrise-day: 22 Oct, 1-day error). Emended as suggested by "10 (?)" to either II prt "11" or "12", the datum would be corroborative.

The date 2576 B.C. for Niuserre is striking. We have seen that an extrapolation of the 36-year periodic jubilee

¹⁷ Collected by Paule Posener-Krieger, Les archives funéraires de Néferirikaré Kakai (Paris, 1976) and analyzed by her and others (Anthony Spalinger, "Dated Texts of the Old Kingdom," SAK, 21 (1994) 275-319: 299f, 301, 303).

¹⁸ William S Smith, "Inscriptional Evidence for the History of the Fourth Dynasty," JNES 11 (1952) 113-128: 120, 127. Smith assigned the piece to Shepseskaf, Spalinger to Niuserre (op cit), 292).

line back from the hb.sd of Pepi I in 2433/32 leads to the year 2577/76 B.C. and the conjecture that the cycle was inaugurated in that year because of its bi-centennial rationality with CY 1 ("2777" B.C.).¹⁹ Is this the hb.sd pictured in his sun temple at Abu Gurob,²⁰ although he reigned only 11 years, his predecessor Raneferef only ca 21? We may have, then, another change-of-reign cum unrecorded coregency, that of Raneferef/Niuserre. Jubilee day - which would also have served as his coronation day - would in principle have fallen toward the end of Raneferef's final sole year of reign on II šmw 21 (15 March 2576), 240 days after Sirius. Niuserre's first fully credited year, if we may assume the Teti/Pepi I pattern,²¹ would have begun on I 3ht 1 (29 May) 2576 B.C. The Palermo Stone - in all probability a product of Niuserre's reign for the purpose of linking his accession to the long line of his predecessors²² - would also seem to be datable to the bi-centenary of the calendar, or thereabouts.

Raneferef. Turin assigns this king "x + 1" years, to be emended no doubt to 21 years (cf. Manetho's "20", reflecting perhaps the loss of two digits).²³ A 21-year reign would place his accession in 2597 B.C.; his first census count ought to have been, therefore, 2596 B.C. on the principle of the even-numbered Julian sp years.

I know of no dated inscription bearing the name Raneferef. There is, however, a complete date from a block that almost certainly comes from his reign. In a corner

¹⁹ Part II of present series - DE 34 (1996) 65-82" 80f, 79

²⁰ Hornung/Staehelin, Sedfest, 22.

²¹ Cf. jubilee coregency of Teti/Pepi I (DE 34 (1996) 68.

²² The author's The Palermo Stone and the Archaic Kings of Egypt (La Canada, 1979) 109; 107, fig 40.

²³ Seemingly confirmed by the Palermo verso, with 5th Dynasty reigns of 7-8, 12, 19, 21-22 years (op. cit. fn. 21 supra, 107, fig. 41).

adjacent to the pyramid temple of his predecessor Neferirikare there has been found an inscription of Prince Sheps-ptah, son-in-law of Neferirikare (and therefore of the generation following that pharaoh). The dating is III 3ht 24 (24 Aug 2593 B.C.) of the year after the second count,^{23a} with conj and pꜣd on 24 Aug, 18:00 (Index: 189), Egyp sunrise-day: 23 Aug, a 1-day error. Sp 1 should lie therefore at 2596 B.C. and is compatible with a first regnal year at 2597. Once again, the census count lies in the even-numbered year.

Neferirikare. Turin's notation here is lost. Might we deduce a 19-year reign from Manetho's report of 20 years ("Manetho minus 1 = Turin")? A reconstruction of the Palermo Stone based upon a rational use of the cubit rule shows a 19-year reign for this king, but the demonstration is too complex to be given here and is in any case uncertain.²⁴ Such a 19-year reign would, nonetheless, place both sp 1 and regnal 1 at 2616 B.C.

The date IV 3ht 12 of sp 4 was found by Borchardt while working in the tomb area of the immediate predecessor, Sahura.²⁵ If assigned experimentally to Neferirikare as Full Moon (16 Sept 2610 B.C., with pꜣdntiw on 2 Sept, III 3ht 29), we find that conj and pꜣd fell on 2 Sept, 10:47 (Index: 153), Egyp sunrise-day: 1 Sept, an acceptable 1-day error. Sp 1 would lie at 2616 B.C., as expected.

Sahura is assigned 13 years by Manetho ($x + 1$?), 12 years by the Turin Canon, and 12 by the Palermo Stone (verso: Row III: 8 years; Row IV: 4 years). Both sp 1 and regnal 1 ought to fall in 2628 B.C.

^{23a} Ludwig Borchardt, Das Grabdenkmal des Koenigs Ne-user-re^c (Leipzig, 1907) 145.

²⁴ Y. fn. 22, above.

²⁵ Borchardt, Das Grabdenkmal des Koenigs S'a3hu-re^c, I, 89.

Userkaf. Turin records a reign of 7 years, Manetho 28 (i.e., 7 x 4 - fictional lifetime years). Regnal year 1 ought to lie at 2635 B.C., with sp 1 therefore at 2634.

Queen Meresankh, a niece of Chephren, died on I šmw 21 in the year of the first census of an unknown king, a random date. Her burial on II prt 18 of the following year, sp 1+,²⁶ would have been selected rationally. Inasmuch as she was embarking for the Elysian Fields among the circumpolar stars, her departure would have been given astronomical significance. As Chephren's niece, she was one generation (20-40 years) removed from that pharaoh; her dating is compatible with the reigns of Mycerinus, Shepseskaf, Userkaf, or Sahura, a range of ca 40 years.

II prt 18 was 26 November in 2633 B.C. If treated as lunar Full Moon (šmdt) with psđ on II prt 4 (12 Nov), conj and psd had fallen on 14 Nov, 11:37 (Index: 145), Egypt sunrise-day: 13 Nov (II prt 5) a 1-day error.²⁷

Shepseskaf. Manetho records a reign of 7 years, and the rational Vernier reconstruction of the Palermo Stone has a reign of 6 or 7 years. The Turin Canon, however, notes only 4 years, followed immediately by a corrupt and unidentifiable reign of 2 years. It would seem clear that Turin has borrowed 2 years from the reign of Shepseskaf in order to flesh out the faux intruder, while maintaining the correct column total from an earlier edition. The formula "Manetho minus 1 = Turin" also suggests a reign of 6 years. His accession, then, should lie at 2641 B.C. and sp 1 at 2640, if the census was uninter-

²⁶ Urk., I, 157.

²⁷ Acceptability of a 1-day error of observation is strengthened by the calculable sequence of two 30-day months (psđ: 18 Jul, 17 Aug, 16 Sept). An obscured horizon in Sept and Nov would have led to the erroneous deduction of a 29-day month in Nov, with psđ on the 13th (Egypt sunrise-day: 12th).

ruptedly biennial and impersonal.

Marks on the wall of the rock-cut tomb G 7803 C bear 3 examples of the date III p_{rt} 27 from sp 2 of an unknown king.²⁸ Smith could only guess at a broad 5th or 6th Dynasty placement, yet virtually all his other materials from this area belong to the 4th or early 5th Dynasties. In any case, III p_{rt} 27 (6 Jan 2637 of 2638/37) was conj and p_{sd} on 8 Jan, 15:54 (Egyp 7 Jan, an acceptable 1-day error).²⁹

Because of a chronological fluke it is theoretically possible to assign to Shepseskaf 4 additional datings from Helwan and Gebelein, datings nonetheless that are better left for the reign of Radjedef. Accessions of the two kings are exactly 25 census counts (50 years) apart: Radjedef, 4 (8 years); Khafre, 13 (25 years); Mycerinus, 8 (16 years). Since two from the Helwan/Gebelein batch are from counts 4+ and 3+ — impossible to reconcile with Shepseskaf — it seems preferable to treat them all under the reign of Radjedef, below. Even our date III p_{rt} 27 from sp 2 of G 7803 C may be better assigned to Radjedef, for it is exact when placed in 2688/87 B.C.

Mycerinus. Giza mastaba VII, one in a row of nine almost identical tombs on the south side of the great pyramid of Cheops, has been attributed to Mycerinus because several dressing stones bear inscriptions of work crews borrowing the pharaoh's name ("Great is the Horus Khakhe," "How drunk is Mycerinus"). The most important of these bears the date II p_{rt} 22 of sp 2 but lacks a positive identification of the reigning sovereign.³⁰ This

²⁸ Smith, op cit, 120, 129.

²⁹ Acceptable because of a sequence of two 30-day months in Nov and Dec. Any obscuring of Jan Old Crescent would have led to the (erroneous) presumption of a 29-day month.

³⁰ Junker, Giza, I, 69-81; especially 78 (#10), 75 (Fig 35, #9).

was 6 Dec in 2654 B.C. Conj and p_{sd}: 6 Dec, 10:22 (Index: 129); Egyp: 5 Dec, a 1-day error. This would place Mycerinus' sp 1 at 2656 B.C., and we presume that his accession in regnal 1 lies at 2657 B.C., corresponding to a reign of 16 years (Palermo Stone; Manetho's Soyphis (Khakhe), 16 years; Turin Canon: 18 (?) years). Chephren. The absence of a credible date for this king occasions another gap. A date from sp 8 of an unidentified reign found in a block from the important tomb of Hemunu would fit in here quite well, but perhaps merely fortuitously. Both tomb and dating are better ascribed to Cheops. (see below).

Both Manetho ("Ratoises, 25 years")³¹ and the Palermo Stone assign this reign 25 years, suggesting 2682 B.C. for both sp 1 and regnal 1.

Radjedef. The Turin Canon assigns a reign of 8 years and Manetho 9 ("Thamphthis", the x + 1 form).³² Both sp 1 and regnal 1 ought to lie at 2690 B.C. Four inscriptions out of Helwan and Gebelein all agree in this assignment.

Two ostraka retrieved by Saad's excavations at Helwan are dated to II šmw 3 of sp 4+ and IV 3ht 5 of sp 1.³³ They are believed to be identification labels from mummies shipped from Upper Egypt for burial at Helwan. The high date 4+ would appear to exclude the reign of Shepseskaf at 2632 B.C.. When assigned to Radjedef, II šmw 3 (24 Mar 2682) was conj and p_{sd} on 25 Mar, 20:36 (Index: 145), Egyp sunrise-day: 24 Mar (II šmw 3), some three months before the formal accession of Chephren (I 3ht 1,

31 

32 See text for fn 7, above; DE 7 (1987) 37-49: 43f, with fn. 15.

33 Zaki Saad, Royal Excavations at Saqqara and Helwan, (1941-1945) 106f.

25 June 2682 B.C.).

A crucial piece from sp 1 is dated to IV 3ht 5 (29 Sept 2690 B.C.).³⁴ Treated as smdt, it gives an exact astronomical result: conj and psd: 16 Sept, 13:44 (Index: 162); Egyp sunrise-day: 15 Sept (III 3ht 21). The piece shows, however, the cartouche of Chephren, and this can be held to mark a reign ante quem non. Yet this need not be a decisive factor. The cartouche need not have been a constituent part of the date — it would have been unusual if it had been — but may have been added at the removal of the bodies by later royal command.

Two papyri fragments from Gebelein assignable only vaguely within the broad 4th Dynasty fit the reign of Radjedef,³⁵ in that they too converge to place sp 1 at 2690 B.C. From sp 3+ we have III prt 26 (16 Jan 2684 B.C.), with conj and psd on 17 Jan, 10:45 (Index: 98), Egyp sunrise-day: 16 Jan, a 1-day error.³⁶

Further indecisive support from Gebelein is provided by the incomplete date ? 3ht 20 of sp 2+. This is exact under the assumption of a sunrise-day if emended to "I" or "II" 3ht 20 (15 Jul, 14 Aug 2687 B.C.); conj and psd 16 Jul, 19:17 (Index: 154), Egyp 15 Jul; 15 Aug, 8:29 (Index: 128), Egyp 14 Aug. "III" 3ht 20: 1-day error.

Cheops. The Turin Canon assigns 23 years. The Palermo Stone and Manetho both appear to assign 22 years ("Bi-

³⁴ Idem.

³⁵ Spalinger, op cit, 290f.

³⁶ The index figure 98 is technically ambiguous. Because of the high 271 index for the preceding month, I assume an improved visibility factor and take psdntiw to have lain on the 17th. Assignment of this piece to Shepseskaf in 2634 B.C. would require a coregency with Userkaf, unlikely after only a six-year reign.

cheris"),³⁷ suggesting 2712 B.C. for sp 1. But two items from the tomb of Hemiunu, characterized by both Junker and Baer as belonging with "almost certainty" to the reign of Cheops, converge on the year 2714 B.C., requiring a reign of 24 years.

We have a block from sp 8 dated to III šmw 20³⁸ (14 May 2699 of 2700/2699 B.C.). Treated as šmdt with psđ at III šmw 6 (30 Apr), we find that conj and psđ fell on 1 May, 19:51 (Index: 169), Egyp sunrise-day 30 Apr. Sp 1 would lie at 2714 B.C.

A block from sp 10 dated to IV prt 23 or 24³⁹ (15 or 16 Feb 2695 B.C.) was conj and psđ on 17 Feb, 5:01 (Index: 106). The higher date, IV prt 24 is exact under the sunrise day assumption. Sp 1 again is 2714 B.C.

A building block in the tomb of Akhtyhetep and his wife Princess Merytyetes (Giza 7650) is dated to II šmw 10 of the year of count 12.⁴⁰ Most authorities (Reisner Smith, Junker, Baer) have assigned the tomb to the reign of Khafre on somewhat vague grounds. There is no inherent reason why any particular block might not have been taken from the debris of an earlier reign. In any case, the recorded date corresponds to 2 April 2691 B.C. and was conj and psđ on 3 April, 20:49 (Index: 122 (sunrise-day: 3 April - II šmw 10 - exact). Sp 1 = 2714/13 B.C.

With three dates from different census years all converging upon 2714 B.C. as sp 1, there can be but little question that they are lunar in nature. And all can be assigned to Cheops with considerable confidence. His



³⁷ From šmw·šwfw (𓆎 𓆑) to B3·šwfw·Rē (𓆎 𓆑 or 𓆑 𓆎), with routine faux addition of Rē. Gardiner: Egyptian Grammar, 528: W9; 501: R7 and/or W10* et sq.

³⁸ Junker, Giza, I, 161 (#10) and 159 (Fig. 24, #10).

³⁹ Ibid., 161 (#12).

⁴⁰ Smith, op. cit., 127f, #11; and 119, Fig. 7.

last year would have been the year following his 12th census count, with a reign of 24 or 25 years.

The Reign of Snefru. Charles Maystre assembled long ago from the pyramids at Meydum and Dahshur some half dozen complete dates from census counts 15-17 and reasonably attributable to Snefru.⁴¹ But I have shown by calculation that two of the dates from sp 16 — I 3ht 13 and IV 3ht 14 — lie in the reigns of Pepi II and Teti respectively.⁴² We now have several more dates from the Snefru pyramid area.⁴³ Two of these broaden the list of kings active in this area to include Pepi I, who is known from an inscription of sp 21 to have made repairs specifically upon the pyramids of Snefru. These are Pos-Kr, A13 -- I prt 20 of sp 17 -  and Pos-Kr, A3 -- II šmw 12 of sp 16.  A13 A3

These mesh perfectly with the previously cited date I prt 23 from sp 21 of Pepi I (11 Sept 2428 B.C.) to fix sp 1 at 2468 B.C.⁴⁴ (This again on the hypothesis that when two dates from different years agree on a common sp 1 they are probably both lunar in nature.)

By great good fortune two of the newly examined dates

⁴¹ Charles Maystre, "Les dates des pyramides de Snefru," BIFAO 35, (1935) 89-98.

⁴² My article in GM, 136 (1993)65f. Recalculation has shown that the graffito of IV 3ht 14 belongs to Pepi I, not to Teti. Treated as šmdt, the date (6 Aug 2438 B.C.) would be pđd on III 3ht 30 (23 Jul); conj and pđd 23 Jul, 19:02 (Egyp: 22 Jul, 1-day error).

⁴³ Paule Posener-Krieger in Ali el-Khouli et al, Meidum (1991), Sect. B, "Graffiti on the revetment blocks of the pyramid", 17-21 (P. 7-9).

⁴⁴ Sp 17: I prt 20 (10 Sept 2436) as šmdt (pđd: I prt 6 (27 Aug); conj 29 Aug, 5:21 (Index: 87, insuff), pđd: 28 Aug (Egyp sunrise-day, 27 Aug). Sp 16: II šmw 12 (31 Jan 2437) as šmdt (pd: I šmw 28 (17 Jan); conj and pđd: 17 Jan, 6:43 (Index: 109) (sunrise-day: 16 Jan, 1-day error). For sp 21: DE 34 (1996) 80.

can be assigned specifically to the reign of Snefru if we accept experimentally two assumptions: (1) his highest count was the 17th. We have only one complete date higher than this, that of IV šmw 7 of sp 18+ (Pos-Kr, A28); this is less than a week after the sed jubilee of Pepi I (III šmw 27) and about the time he was launching a (no doubt ceremonial) war against the Bedouins.⁴⁵ Repair of Snefru's pyramid was part of the feverish activity of renewal and victory commemorated in the hb·sd; i.e., the date from sp 18+ belongs to Pepi I and not to Snefru.⁴⁶ (2) The census was uninterruotedly biennial. The juxtaposition of sp 7 and 8 in the Palermo Stone recto (VI, 2, 3) has been shown to be a scribal error — a historiographical glitch, not a historical aberration.⁴⁷

On the basis of these assumptions, the first census count of Snefru would lie at 2748 B.C., giving him a reign of ca 34 years, in sharp contrast to assignments of 24 and 29 years respectively by Turin and Manetho. These latter figures should be regarded as fictional,⁴⁸ perhaps even symbolic (cf. Turin's calendrical sequence of reigns of 6, 6, 24, and 24 years. Is Manetho's 29 years - also his figure for Djoser/Tosorthros - lunar?)

Astronomical confirmation is furnished by the date from sp 15 of II prt 14 (14 Dec 2720 B.C.);⁴⁹ this was

⁴⁵ See fn 14, above, and relevant text.

⁴⁶ An incomplete Meidum date from sp 23 (Pos-Kr, A42), as well as Stadelmann's two dates from sp 24 (Spalinger, op cit, 282f, # 16 and 17), are best assigned to Pepi I, who is known to have made repairs upon the tomb of Snefru in sp 21.

⁴⁷ GM 136 (1993) 57-70: 66ff. Beyond this, the large box #1 had no room. It holds four tightly packed columns even without the census due that year. Boxes 2 and 3 hold only three loosely drawn columns even with their census counts.

⁴⁸ Or 65 (1996) 197-208: 205.

⁴⁹ Stadelmann at the Red Pyramid, (Spalinger, op cit, 282, #5).

conj on 16 Dec, 6:39 (Index: 91, insuff), psd: 15 Dec (sunrise-day: 14 Dec, exact). Sp 1 would lie at 2748 B.C., as anticipated.

The date from Meidum of sp 17, III prt C_rky (30) was 28 Jan 2715 B.C. of 2716/15.⁵⁰ Conj and psd were on 29 Jan, 20:23 (Index: 143) (sunrise-day: 28 Jan - exact). Here again, sp 1 lies at 2748 B.C. The two dates are probably lunar. The two assumptions required for a 34-year reign (sp 17) are validated to the year.

The Fourth Dynasty in the Carlsberg Calendar. This 25-year schematic lunar calendar from the Ptolemaic period is a useful tool for astronomical chronology. While no artificial schema can accurately capture the vagaries of the moon, we are confident that this remarkable late calendar does so in many cases and is seldom more than 1 day in error. Parker, Baer and others have used it as a finder. It may also serve to demonstrate the overall structural validity of a series of astronomically determined dates for those disinclined to follow blindly the path of mathematical calculation. The overall Gestalt or webbing of a string of dates may well complement the calculation of discrete individual items, which often may be untrustworthy for a number of reasons.

In Table 2 I have telescoped the 68 years of the first three reigns upon an extrapolated Carlsberg Calendar. Shown are the Carlsberg years, the relative dynasty years, the census counts, together with psdntiw dates for the contiguous reigns of Snefru, Khufu, and Radjedef. The close fit of the data proves nothing, but it does demonstrate the tangible promise inherent in the new field of Old Kingdom astronomical chronology opened up here, and it invites further exploration by others

⁵⁰ Found by Petrie at Meidum (Spalinger, op cit, 282, #15).

beyond the uncertain and groping labors undertaken here.

Table 2. The 25-Year Cycle of pCarlsberg 9.

(adapted from Parker, Calendars, 15)

sp	dyn yrs	Cbg yrs	HHT				PRT				šMW				Psdntiw dates
			I	II	III	IIII	I	II	III	IIII	I	II	III	IIII	
			1	1	30			29	28			27	26		
.....															
<u>Snefru</u>			18	27	26			25	24			23	22		
15	30	<u>19</u>	18	15			(14)	13			12	11	II prt	<u>14</u>	
		20	6	5			4	3			2	1			
		21	25	24			23	22			21	20			
		22	14	13			12	11			10	9			
17	34	<u>23</u>	3	2			1	(30)	30		29	28	III prt	<u>30</u>	
<u>Khufu</u>		24	22	21			20	19			18	17			
(sp 1	36)	(25	12	11			10	9			8	7)	-----	
.....															
		13	21	20			19	18			17	16	šmdt III šmw	20	
8	50	<u>14</u>	10	9			8	7			6	(6)	5	pšd III šmw <u>6</u>	
		15	30	29			28	27			26	25			
		16	19	18			17	16			15	14			
		17	8	7			6	5			4	3			
10	54	<u>18</u>	27	26			25	(24)	23		22	21	IV prt	22/23	
		19	16	15			14	13			12	11			
		20	6	5			4	3			2	1			
		21	25	24			23	22			21	20			
12	58	<u>22</u>	14	13			12	11			(10)	9	II smw	<u>10</u>	
<u>Radjedef</u>		23	3	2			1	30			29	28	šmdt IV 3ht	5	
1	60	<u>24</u>	22	(21)	21		20	19			18	17	pšd III 3ht	<u>21</u>	
		25	12	11			10	9			8	7			
.....															
(sp 2)		(1	1	30			29	28			27	26)		
2+	63	<u>2</u> (20	20	19			18	17			16	15	I 3ht	<u>20</u>	
		3	9	8			7	6			5	4			
3+	65	<u>4</u>	28	27			26	(25)	25		24	23	III prt	<u>26</u>	
		5	18	17			16	15			14	13			
4+	67	<u>6</u>	7	6			5	4			(3)	2	II šmw	<u>3</u>	
		7	26	25			24	23			22	21			

Dating the Giza Pyramids. There are no contemporary materials that describe or date the arduous construction of the pyramids. All we have hoped to do here is to date the commencement of the first credited year of the successor king. Presumably, his predecessor had died and his pyramid had been formally sealed some time during the previous Egyptian year; e.g., for Cheops, year 88 of

the calendrical cycle. But the Egyptian year stretched across two Julian years; moreover, there is the chance that there may have been an undetectable coregency. The dating $X \pm 1$ provides a range of $2\frac{1}{2}$ years while making allowance for death early in the Egyptian year and/or a short coregency of up to $1\frac{1}{2}$ years.

On this basis we propose the following dates for the sealing of the great pyramids of Giza: Cheops, 2690 ± 1 B.C.; Chephren, 2657 ± 1 B.C.; Mycerinus: 2641 ± 1 B.C.

APPENDIX: Final Synthesis

This is best sketched by means of a chronological listing of the reigns from Snefru to Pepi II, showing accession years and all census years for which data have been used. I have dubbed this the "Palermo Chronology" because virtually all the underlying hypotheses have been derived from this 5th Dynasty annals stone of King Niuserre (v. the author's Palermo Stone and the Archaic Kings of Egypt (La Canada, 1979) and "Resolving the Palermo Stone as a Rational Structure," DE 7 (1987) 37ff). The reader is reminded that, if detached from any connection with a periodic Sed/Min festival, these dates may be shifted relativistically along the 25 (14)-year lines to reflect a middle or low placement.

SUMMARY OF THE DATA

The Palermo Chronology of Dynasties IV-VI *

Snefru	2748-2714	34	M: 29, 30; T: 24; P: 29
sp 15	2720/19		
sp 17	2716/15		
Cheops	2714-2690	24	M: 22, 3x22; T: 23; P: 22
sp 8	2700/99		
sp 10	2696/2695		
sp 12	2692/2691		

Radjedef	2690-2682	8	M: 9; T: 8; P: 8
sp 1	2690/89		
sp 2+	2687/86		
sp 3+	2685/84		
sp 4+	2683/82		
Chephren	2682-2657	25	M; 25; P: 25
Mycerinus	2657-2641	16	M: 16, 17; T: 18?; P: 16
sp 2	2654/53		
Shepseskaf	2641-2635	6	M: 7; T: 4+2; P: 6-7?
sp 2 (?)	2638/37		
Userkaf	2635-2628	7	M: 4x7; T: 7; P: 7-8?
sp 1+	2633/32		
Sahura	2628-2616	12	M: 13; T: 12; P: 12
Neferirikare	2616-2597	19	M: 20; T: lost; P: 19
sp 4	2610/09		
Raneferef	2597-2576	21	M: 20 (+2?); T: 21; P: 21
sp 2+	2593/92		
Niuserre	2576-2565	11	M: 4x11; T: 11
sp 2	2574/73		
Menkauhor	2565-2557	8	M: 9; T: 8
Djedkare	2557-2429	28	M: 4x11; T: 28; sp 16
sp 5+	2547/46		
(sp 8+	2541/40 - hb.sd ?)		(Inferred)
sp 9	2540/39		War (dating inferred)
Unas	2529-2497	32	M: 33; T: 30 (+2?)
sp 11	2508/07		
sp 14+	2501/00		
Teti	2497-2468	29	M: 30; T: lost
(sp 16	2466/65)		(inferred attribution)
Pepi I	2468-2416	52	M:53; T: useless
(sp 16	2438/37		(inferred attribution)
(sp 17	2436/35		(inferred attribution)
sp 18+	2433/32 hb.sd		
sp 21	2428/27		
Merenre	2416-2405	11	sp: 5+; M: 7; T: 14
Pepi II	2405-.....
sp 2	2402/01		
(sp 16	2374/73		(inferred attribution)
sp 22+	2361/60		Min festival. Hb.sd ?
sp 31+	2343/42		