A REASSESSMENT OF THE ABSOLUTE CHRONOLOGY OF THE EGYPTIAN NEW KINGDOM AND ITS 'BROTHERLY' COUNTRIES

by Rita Gautschy[1]

1. Introduction

Egyptian chronology of the second millennium BC is essential not only for Egypt, but also for the Levant, Syria, Mesopotamia and the Aegean. The local chronologies of the different regions are interwoven by documented synchronisms and archaeological finds. At first sight the various chronologies seem to agree reasonably well after about 1400 BC. On closer inspection, however, it becomes clear that many arguments concerning open questions of Assyrian, Hittite and Babylonian chronology in this period are bound to the absolute dating of Ramesses II whose ascension to power is customarily dated to 1279 BC, based on a single lunar date. Thus, when using Assyrian or Babylonian chronology as a benchmark for possible chronological scenarios in Egypt, one has to be aware that prior to 1133 BC some questions in Assyrian chronology have been solved with respect to the standard Egyptian chronology. The danger of circular arguments is self-evident, although often neglected. Egyptian chronology of the 2nd millennium BC has been the topic of a couple of recent investigations, stimulated by the SCIEM 2000 project[2] and by new archaeological evidence. SCHNEIDER (2010) established a timeline for the New Kingdom and the Third Intermediate Period in the context of the SCIEM 2000 project but without taking into account astronomical data.[3] On the other hand, HUBER (2012) based his investigation of the Egyptian chronology of the 2nd millennium BC on available astronomical data.[4] For the period of the Egyptian New Kingdom, he concluded that new and better data are needed to construct a chronology without inconsistencies.[5] The present paper attempts to construct possible chronologies for the Egyptian New Kingdom, taking into account all available astronomical data, the documented direct synchronisms, information from the king lists, and ^{14}C data.

2. Astronomical Data

To derive absolute dates for pharaohs, records of astronomical observations are frequently used. Unfortunately, only a few lunar and Sothic dates are known from Egypt. There are a mere two records of lunar dates where the text explicitly states that the reported day was a first lunar day.[6] Alongside these, a number of lunar dates can be deduced from secondary evidence derived from feast dates.[7] This does not mean *a priori* that they are less reliable, however. In particular, dates referring to the Theban feast-of-the-valley can be useful for chronological purposes. According to the Medinet Habu Calendar (135), the feast began on lunar day 1 in II Shemu.[8] On that day the cult statue of Amun crossed the Nile, went to the temple of Djeser-akhet, toured Deir-el-Bahri in a procession, and spent the night in the funerary temple, either of the ruling king, or of an earlier king

[1] University of Basel. This work was supported by grants R-134/10 and R-122/11 of the cogito foundation.

[2] *The Synchronization of Civilizations in the Eastern Mediterranean in the 2nd millennium BC*, special research programme of the Austrian Academy of Sciences and the Austrian Science Fund.

[3] SCHNEIDER 2010, 373–404.

[4] HUBER 2012, 172–227.

[5] HUBER 2012, 211.

[6] The so-called Piramesses date of Ramesses II (JANSEN 1961, 12 and 33), and the reported date of the battle of Megiddo of Thutmose III (*Urkunden* IV, 657.2).

[7] HUBER 2012 took only the two lunar dates explicitly stating a first lunar day and in addition the so-called Akhmenu foundation date of Thutmose III into account in his investigation.

[8] Due to intercalary lunar months the feast can also start in the first half of the (solar) month III Shemu. Nothing is known about intercalary lunar months in Egypt. But to keep the cultic lunar calendar with the lunar feasts in accordance with the official solar calendar, some kind of intercalation was indispensable.

Ägypten und Levante/Egypt and the Levant 24, 2014, 143–160

pharaoh	date	source and comments
23 Thutmose III	I Shemu 21	Date of the battle of Megiddo; exactly lunar day 1
24 Thutmose III	II Peret 30/ III Peret 1	Akhmenu foundation date
20 Amenhotep II	III Shemu 10 III Shemu 9	Beer brewed for consumption on lunar day 1; lunar day 1 occurred close to III Shemu 9
21 Amenhotep III	III Shemu 1	Feast-of-the-valley date; either lunar day 1 or 2
5 Akhenaten	IIII Peret 13	King took an oath to found Akhetaten
34 Ramesses II	IIII Shemu 24	Day of the feast of Ptah-south-of-his-wall
47 Ramesses II	II Peret 25	Public holiday; lunar day 4 or 5
52 Ramesses II	II Peret 27	Piramesses date; exactly lunar day 1
7 Twosre	II Shemu 28	Feast-of-the-valley date; either lunar day 1 or 2
7 Ramesses III	III Shemu 9	Feast-of-the-valley date; either lunar day 1 or 2
3 Ramesses VI	II Shemu 20	Feast-of-the-valley date; either lunar day 1 or 2
6 Ramesses VII	III Shemu 9	Feast-of-the-valley date; either lunar day 1 or 2
22 Ramesses XI	II Shemu 22	Feast-of-the-valley date; either lunar day 1 or 2

Table 1: Preserved lunar data from the Egyptian New Kingdom.

if the ruling king did not yet have one of his own. In the temple, Amun received offerings on lunar days 1 and 2. Graffiti from the Djeser-akhet temple in Deir-el-Bahri attest to the statue spending the night or receiving offerings in II or III Shemu.[9] The dates on which this occurred should therefore be either first or second lunar days. But it is not always possible to identify the ruling pharaoh unambiguously.

Table 1 summarises all available lunar data. Evidence of two Sothic dates is preserved in records of heliacal risings of the star Sirius: one from year 9 of Amenhotep I (Papyrus Ebers date) and one from the reign of Thutmose III; unfortunately, for the latter, the king's regnal year is lost.[10] The Amenhotep Sothic date, III Shemu 9, dates his 9th regnal year to the period between 1550 and 1537 BC if Memphis was the reference point for the observation, or to between 1532 and 1515 BC if Thebes is assumed as the reference point.

In addition to these Egyptian astronomical data, an allusion to a solar eclipse is preserved in a fragmentary Hittite text of a prayer of Muršili II. Muršili II reports intrigues by his stepmother, the third wife of his father Šuppiluliuma I. Huber (2001), based on the text edition of De Martino (1998), interpreted the text as meaning that when Muršili was marching toward the land of Azzi, the old queen tried to make use of a solar omen to depose him (Col. IV, 24):[11]

> *[When] I was marching [toward the land A]zzi – now the Sun-god made an omen.*

From his Annals we can deduce that this would have happened during the early part of Muršili's campaign to Azzi in his ninth or tenth regnal year.[12] His stepmother insisted that the solar omen did not concern any other person, but only the king himself. The omen is not explicitly described as an eclipse, but eclipses were the only omens we know to have had severe consequences for the reigning king. It has to be stressed, however, that no solar eclipse is mentioned in Muršili's Annals, where he describes the events of his campaign to Azzi. This may suggest that Muršili himself did not see an

[9] Marciniak 1974.

[10] For a recent discussion of the Sothic data see Gautschy 2011b, 125.

[11] Huber 2001, 644 and De Martino 1998, 38–39.

[12] Kümmel 1982, 480–481.

eclipse. It is conceivable that an eclipse was recognised in Hattuša, but not by Muršili on his march.

Based on such a small number of secure astronomical data alone it would be futile to construct a chronological framework. Fortunately, plenty of supplementary information is available and the astronomical data can be used for fine-tuning purposes only.

Egypt	Ḫatti	Babylonia	Assyria	Source
		Karaindaš	Aššur-bēl-nišēšu	Syn-H
		Kurigalzu I	Aššur-nādin-aḫḫe Erība-Adad I	Chr. P Chr. P
Amenhotep III		Kurigalzu I Kadašman-Enlil I Burnaburiaš II		EA 6 EA 1–5 EA 6
	Šuppiluliuma I			EA 41?
Akhenaten	Šuppiluliuma I			EA 41
		Burnaburiaš II		EA 7–11, 14
			Aššur-uballiṭ I	EA 15, 16
		Burnaburiaš II Kara-ḫardaš Nazi-Bugaš Kurigalzu II	Aššur-uballiṭ I	Syn-H Syn-H Syn-H, Chr. P Syn-H, Chr. P
Smenkhkare	Šuppiluliuma I			EA 41?
Horemheb	Muršili II			KUB 19.15 + KBo 50.24
		Kurigalzu II	Enlil-nīrārī	Syn-H
		Nazi-Maruttaš Kadašman-Turgu I	Adad-nīrārī I	Syn-H, Chr. P Chr. P
Ramesses II	Muwatalli Muršili III Hattušili III			Breyer (2010a) CTH 155 CTH 155
	Hattušili III		Adad-nīrārī I?	KBo 1.14
		Kadašman-Turgu I Kadašman-Enlil II		CTH 172 CTH 172
	Tudḫaliya IV		Tukultī-Ninurta I?	CTH 177
		Adad-šuma-uṣur	Tukultī-Ninurta I Aššur-nādin-apli Aššur-nīrārī III Enlil-kudurrī-uṣur Ninurta-apil-Ekur	Chr. P Chr. P Chr. P Syn-H Syn-H
		Meli-Šipak	Ninurta-apil-Ekur	SKL
		Zababa-šuma-iddina Enlil-nādin-aḫi	Aššur-dān I	Syn-H SKL

Table 2: Direct synchronisms documented in Egyptian, Hittite, Babylonian and Assyrian sources. The abbreviations stand for the following sources: EA – El-Amarna tablets (Moran 1992); Syn-H – Synchronistic History (Grayson 1975, 157–170); Chr. P – Chronicle P (Grayson 1975, 170–177); SKL – Synchronistsic King List (Weidner 1926, 66–77); CTH – Catalogue des texts hittites (Laroche 1971); KBo – Keilschrifttexte aus Boghazköi (1916–); and KUB – Keilschrifturkunden aus Boghazköi (1921–1990).

3. Documented Synchronisms and King Lists

For the epoch of the Egyptian New Kingdom no king list with the regnal years of pharaohs is preserved. Nevertheless, thanks to dated wine jars, ostraca, documents and the admittedly partly corrupted information from Manetho, the series of successive kings and their corresponding regnal years can be fairly well established.[13] Assyria provides information in the form of the Assyrian King List, backed by Eponym Lists.[14] The Assyrian King List is accurate to within one year from 1132 BC onwards; prior to 1133 BC the margin of uncertainty is approximately 25 years from the beginning of the reign of Enlil-nāṣir II (1431/1406 BC) onwards. Prior to Enlil-nāṣir II, the reign lengths of two kings are missing in all preserved copies of the King List and the number of missing years is estimated to be somewhere between zero and seventy years.[15] From Babylonia we know the Babylonian King List[16] and a Synchronistic King List.[17] Documented direct synchronisms – mainly from the Amarna period and from the times of Ramesses II – allow information from different regions to be linked and thus to bridge gaps in local chronologies.[18] In the literature, various lists of synchronisms are available; most of them contain not only direct, but also indirect synchronisms.[19] Admittedly it is sometimes a matter of taste whether a documented synchronism is categorised as direct or indirect. A synchronism may be securely categorised as direct if no names are given but the respective kings can both be deduced unambiguously from the reported events in the text. However, more frequently one of the kings can be identified while the name of the other is reconstructed based on standard chronology. I have tried to eliminate such false direct synchronisms in the following investigation. A prominent victim to fall out of my list with direct synchronisms is the synchronism between Muršili III and Adad-nīrārī I, deduced by Hagenbuchner (1989) from CTH 171, a powerful synchronism since Muršili III reigned only for 7 years.[20] However, the text gives no names. Due to the mention of Wašašatta, the text can be connected with Adad-nīrārī I on the Assyrian side. The Hittite partner, though, could be any one of three kings: Muwatalli II, Muršili III or Hattušili III.

Table 2 summarises all the synchronisms which I have categorised as direct, and their sources. The only dubious synchronisms in this table are the three accompanied by a question mark.

4. ^{14}C Data

New ^{14}C data from Egypt provide further important information about the absolute dates of pharaohs.[21] To narrow down the uncertainty of the ^{14}C analysis the authors of the study applied the so-called method of wiggle matching; this means that they used information about the reign lengths and the order of the pharaohs in the modelling of the absolute dates. Such a treatment allows the margin of uncertainty of the ^{14}C determination to be reduced to about 25 years for the Egyptian New Kingdom. However, one has to keep in mind that incorrect assumptions about reign lengths of pharaohs in their modelling (*e. g.* Horemheb) may influence the resulting absolute dates.[22]

5. Lunar Data and Egyptian Reign Lengths

Putting together all the available information allows different possible absolute chronologies to be con-

[13] See von Beckerath 1994, 35–63 for details.

[14] Glassner 1993, 146–151.

[15] For a discussion of various proposed reign lengths for these two kings see Pruzsinszky 2009, 64–67.

[16] Grayson 1975, 171–177.

[17] Weidner 1926, 66–77.

[18] The El-Amarna tablets provide us with the information that Amenhotep III was contemporaneous with the Assyrian king Aššur-nādin-aḫḫe II as well as with the Babylonian rulers Kurigalzu I and Kadašman-Enlil I. The Assyrian king Aššur-uballiṭ I wrote letters to Akhenaten and Tutankhamun. The long-reigning Babylonian king Burnaburiaš II was a contemporary of Amenhotep III, IV and Tutankhamun and of the Ḫatti ruler Šuppiluliuma I. Kadašman-Turgu proposes to Hattušili III that they march together against Ramesses II. Such a plan of a joint action makes most sense before the Egyptian – Hittite peace treaty in year 21 of Ramesses II, although a later occurrence cannot be completely excluded. The Kassite king Adad-šuma-uṣur, who reigned for 30 years, provides a few further important synchronisms: he was a contemporary of the Assyrian kings Tukultī-Ninurta I (last years), Aššur-nādin-apli, Aššur-nīrārī III, Enlil-kudurrī-uṣur and Ninurta-apil-Ekur.

[19] See *e. g.* Pruzsinszky 2009, 35–36 and 38 for a recent compilation.

[20] Hagenbuchner 1989, I 161–162 and II 260–264.

[21] Bronk Ramsey *et al.* 2010, 1554–1557.

[22] See Huber 2012, 208–211 for some notes on the radiocarbon-based data. Since the submission of this paper new ^{14}C-analyses have been published: see the discussion of the radiocarbon data in Aston 2013, 285–287 and 305–306, as well as references therein. I thank David Aston for sending me a copy of his paper prior to publication.

structed. The starting point for each chronological option is the lunar date of year 52 of Ramesses II since it is recorded explicitly that the stated day is a lunar day 1. Nevertheless, one has to be aware that this date may possibly be off by one day in comparison to the calculations.[23] Aston (2013) has recently made an up-to-date compilation of the highest attested regnal year dates of pharaohs.[24] Three kings reigned between Akhenaten and Ramesses II for whom different values of reign lengths are proposed – namely "Smenkhkare", Horemheb and Seti I.[25] The highest dates for these three kings are listed in Table 3. The archaeological evidence strongly argues against more than 14 or 15 years of reign for Horemheb: in the tomb of Horemheb in the valley of the kings more than 200 hieratic jar dockets mentioning his year 13 or 14 have been found, but none with higher dates.[26] Based on the lunar data it is clear that the total number of regnal years of the kings with disputed reign lengths can amount to 28, 42, 53, 67 or 78 years. Adopting 15 years for Horemheb results in a reasonable sum of 28 years for all three kings; adopting 27 years for Horemheb results in 42 years.[27]

pharaoh	secure	doubtful	sources	adopted
Neferneferuaten Smenkhkare	2 1		12 6/9/29/39	3/4 for both together
Seti I	9	11, 15	20/51/55/59	9
Horemheb	14	16, 27, 59	4/5/9	15/27

Table 3: Reign lengths of pharaohs which are secure[28], doubtful[29], given in Manethonian sources[30], and which are adopted in this work.

pharaoh	date	$P1_{27}$	$P2_{27}$	$P3_{27}$	$P4_{27}$	$P1_{15}$	$P2_{15}$	$P3_{15}$	$P4_{15}$
23 Thutmose III	I Shemu 21	0	0	**+1**	0	0	**-1**	**-1**	0
24 Thutmose III	II Peret 30/ III Peret 1	0 +1	0 +1	-1 0	0 +1	-2 -1	-1 0	-2 -1	-2 -1
20 Amenhotep II	III Shemu 10 III Shemu 9	+1 0	+1 0	+1 0	+1 0	0 -1	0 -1	0 -1	0 -1
21 Amenhotep III	III Shemu 1	**+1**	0	**+1**	0	0	0	0	0
5 Akhenaten	IIII Peret 13	**+1**	**+1**	**+1**	**+1**	0	0	0	**+1**
34 Ramesses II	IIII Shemu 24	0	0	0	0	0	0	0	0
47 Ramesses II	II Peret 25	0	0	0	0	0	0	0	0
52 Ramesses II	II Peret 27	**-1**	0	**-1**	**-1**	**-1**	0	**-1**	**-1**
7 Twosre	II Shemu 28	0	0	0	0	0	0	0	0
7 Ramesses III	III Shemu 9	0	0	0	0	0	0	0	0
3 Ramesses VI	II Shemu 20	0	0	0	0	0	0	0	0
6 Ramesses VII	III Shemu 9	0	**-1**	0	0	0	**-1**	0	0
22 Ramesses XI	II Shemu 22	0	0	0	0	0	0	0	0

Table 4: Fits of the lunar data for four possible chronological solutions with a reign length of 27 years for Horemheb (grey shaded; columns 3 to 6) and with 15 years for Horemheb (columns 7 to 10).

[23] On one hand, the lunar crescent can be unobservable due to bad visibility conditions in cases where the calculations predict observability. On the other hand, occasionally the lunar crescent may have been observed thanks to perfect visibility conditions in cases where the calculations predict unobservability.

[24] Aston 2013, 288–291.

[25] The reigns of a lady, Neferneferuaten, and of a male person, Smenkhkare, are counted together and labelled as "Smenkhkare" throughout this work. It is not definitively settled whether Neferneferuaten reigned before or after Smenkhkare.

[26] Van Dijk 2008, 193–200.

[27] 42 years for these three kings is the standard value used in most chronological treatments, see *e.g.* Kitchen 2007, 163–172 or Hornung 2006, 197–217.

[28] See Hornung 2006, 207–211 for the reign lengths of Neferneferuaten, Smenkhkare and Horemheb; and Van Dijk 2011, 325–332 for the reign length of Seti I.

[29] Hornung 2006, 207–211.

[30] Josephus, Eusebius and Africanus; see von Beckerath 1997, 123–128.

A comparison of the historical lunar data with celestial mechanics calculations[31] (Table 4) shows that the astronomical data, like the archaeological evidence, favour a short reign length of 15 years for Horemheb. With respect to lunar data, 39 years for Horemheb would fit comparably well, but a total number of 53 years for the kings with disputed reign lengths can be excluded, based on the documented synchronisms with Assyria. While possible chronological solutions with 27 years for Horemheb (shaded grey in Table 4) result in unexplainable deviations in a positive direction (+1), solutions with 15 years for Horemheb show deviations in a negative direction (–1). Deviations in a negative direction can easily be explained by a missed sighting of a theoretically visible lunar crescent due to unfavourable weather conditions. On the other hand, a deviation in a positive direction means that the lunar crescent was observed although it was theoretically no longer visible. Such a deviation can occasionally occur due to perfect weather conditions and a close miss of the critical value of the sighting criterion on the following day. However, in all the cases here, it was impossible to observe the lunar crescent on the following day. The systematic change of the deviations from –1 to +1 prior to Ramesses II in the chronological options with 27 years for Horemheb also hints at erroneous reign lengths. Nevertheless, since some of the lunar data – and especially those prior to Ramesses II – are less secure, additional evidence is helpful to exclude a reign length of as long as 27 years for Horemheb.

To further test the hypothesis of a short reign length for Horemheb, one can utilise Assyrian chronology and the documented synchronisms. 90 years at most passed between the accession of Aššur-uballiṭ I, who was contemporary with Akhenaten and Thutankhamun, and the death of Adad-nīrārī I, who was a contemporary of the early Ramesses II and the Hittite kings Muršili III and Hattušili III. A corresponding minimum period from Aššur-uballiṭ I to Adad-nīrārī I, fulfilling all the necessary direct synchronisms, results in about 70 years. The reign lengths from Akhenaten to year 20 of Ramesses II add up to 80 years if 15 years are assumed for Horemheb. Adopting 27 years for Horemheb would result in 93 years. Both values fit within the 70 to 90 years documented in Assyria when taking into account that year 20 of Ramesses II is a *terminus ante quem* for the accession of Hattušili III; very likely he came to power a few years earlier. Nevertheless, a short reign length for Horemheb can be accommodated more easily within the given Assyrian time frame. At all events, a reign length of 39 years for Horemheb – which results in comparable matching of the lunar data to the solution with 15 years – can be excluded. Thus, I will consider in the following only chronological solutions with 15 years of reign for Horemheb.

6. Chronological Framework

Within a generous time frame, four different chronological solutions can be proposed; two of them are compatible with the assumption that the Egyptian day began at dawn (P1 and P3 in Table 5), the other two with the assumption that the day began with sunrise (P2 and P4 in Table 5). Since the fit is of comparable quality in each case, the lunar data cannot be used to select the correct chronology. Instead, one can take a look at Hittite chronology.

6.1 Synchronisms with Ḫatti

Unfortunately, the exact reign lengths of the Hittite kings can only be estimated. For a comparison with Hittite chronology, years 5 to 21 of Ramesses II are crucial. Muwatalli II was the antagonist of Ramesses II in the battle of Qadeš. Between the battle of Qadeš in year 5 of Ramesses II and the peace treaty in his year 21, signed with Hattušili III, 16 years are left to accommodate several events in Hittite history: the occurrence of the death of Muwatalli, 7 regnal years for Muršili III, the taking-over of the throne in Ḫatti by Hattušili III, Muršili III's escape to Egypt, Ramesses' refusal to extradite Muršili III, and a change of mind on both sides resulting in the negotiation of the peace treaty.

Muwatalli II is assumed to have reigned between 18 and 23 years (Breyer 2010a, 59). His immediate predecessor was Muršili II who reigned circa 25 to 31 years (Bryce 2005, xv). From his 10th year, the solar omen is preserved which is likely an allusion to a solar eclipse. Counting backwards in time, starting from year 5 of Ramesses II, for the four proposed chronological

[31] http://www.gautschy.ch/~rita/archast/mond/mondeng.html (Gautschy 2011a).

options, and taking into account the uncertainties in the Hittite reign lengths, one obtains the time slots listed in Table 6 for a solar eclipse with a large magnitude, visible in Hattuša.

pharaoh	P1	P2	P3	P4	C14 (2010)	C14 (2013)	years
1 Ahmose	1539	1550	1564	1575			25y 4m
1 Amenhotep I	1514	1525	1539	1550			20y
1 Thutmose I	1494	1505	1519	1530			12y
1 Thutmose II	1482	1493	1507	1518			14y
1 Thutmose III	1468	1479	1493	1504	1498–1474	1502–1470	54y
1 Amenhotep II	1414	1425	1439	1450	1445–1423	1456–1419	25y 10m
1 Thutmose IV	1388	1399	1413	1424			9y 8m
1 Amenhotep III	1378	1389	1403	1414	1408–1386	1423–1386	38y 7m
1 Akhenaten	1339	1350	1364	1375	1370–1348	1385–1348	17y
1 "Smenkhkare"	1322	1333	1347	1358			3y
1 Tutankhamun	1319	1330	1344	1355	1353–1331	1365–1328	10y
1 Ay	1309	1320	1334	1345			4y
1 Horemheb	1305	1316	1330	1341			15y
1 Ramesses I	1290	1301	1315	1326			1y 4m
1 Seti I	1288	1299	1313	1324			9y
1 Ramesses II	1279	1290	1304	1315	1297–1273		66y 2m
1 Merneptah	1213	1224	1238	1249			9y 6m
1 Seti II	1203	1214	1228	1239			5y 10m
1 Siptah	1197	1208	1222	1233			5y 9m
1 Twosre	1192	1203	1217	1228			2y
1 Sethnakhte	1190	1201	1215	1226			3y
1 Ramesses III	1187	1198	1212	1223			31y 2m
1 Ramesses IV	1156	1167	1181	1192			6y 9m
1 Ramesses V	1149	1160	1174	1185			3y 10m
1 Ramesses VI	1145	1156	1170	1181			9y
1 Ramesses VII	1136	1147	1161	1172			7y
1 Ramesses VIII	1129	1140	1154	1165			2y
1 Ramesses IX	1127	1138	1152	1163	1143–1117		18y 3m
1 Ramesses X	1109	1120	1134	1145			3y
1 Ramesses XI	1106	1117	1131	1142			28y
End of NK	1078	1089	1103	1114			

Table 5: Four possible chronological frames of the Egyptian New Kingdom based on the lunar data (all dates are BC). Column 6 gives the C14 data of Bronk Ramsey (2010), column 7 the ^{14}C data of Quiles (2013), column 8 the adopted reign lengths of the pharaohs.

Option	Time-span	Possible solar eclipse identifications		
P1	1319–1299	1308/04/13	1312/06/24	
P2	1330–1310	1312/06/24	1328/10/17	1335/03/13
P3	1344–1324	1328/10/17	1335/03/13	1340/01/08
P4	1355–1335	1335/03/13	1340/01/08	1355/10/27

Table 6: Possible solar eclipse identifications for the four chronological options. All dates are BC.

Six serious candidates for the date of the solar eclipse remain: three of them, 1312 BC, 1328 BC and 1355 BC, are not compatible with the interpretation of the text that Muršili II started campaigning around the time of the eclipse. Nevertheless, they are not yet excluded as possible identifications. For each combination of solar eclipse and chronological option, there exist two fixed points: year 5 of Ramesses II given by the chronological option, and year 9 or 10 of Muršili II given by the solar eclipse option. These fixed points are determined by different kinds of astronomical data and are thus *independent* of each other. Establishing Hittite chronology starting from year 9/10 of Muršili II down to the death of Hattušili III, and comparing it with the chronological options of Egypt shows that for each combination the key synchronisms can be fulfilled.[32] Thus, although an account of a solar eclipse is preserved, the uncertainty in the reign lengths of the Hittite kings makes it impossible to eliminate immediately any of the four proposed chronologies for Egypt based on possible dates of the eclipse.

Recently, a synchronism between year 8 or 9 of Muršili II with year 1 of Horemheb has been derived from a fragmentary Hittite text where a person named Ꜣrma'a is mentioned in connection with events which can be dated to years 7 to 9 of Muršili II.[33] The key question is whether Ꜣrma'a can be equated with Horemheb. Since Horemheb is called Armais, Harmais, Armesis or Armaios in the later Manethonian textual tradition, this seems likely.[34] This would mean that Horemheb was being referred to by his personal name in the text, suggesting that his function must have been that of a viceroy and commander in Asia, *i.e.* before taking the throne. Since an accession to the throne is mentioned in the text, it may be that Ay was the king in Egypt during year 7 of Muršili II while for the following two years, after the mentioned ascension, Horemheb was king. But in the whole text after the passage about the accession to the throne, the person in question is still called Ꜣrma'a; *i.e.* his throne name is not used. Thus it seems possible that the mention of an accession to the throne is a reference to the accession of Ay. In this case, the proposed synchronism of year 8 or 9 of Muršili II with year 1 of Horemheb would have to be changed to a synchronism between year 8 or 9 of Muršili II and year 1 of Ay. Indeed, the remaining traces on the tablet would be compatible with the restoration of the throne name of Ay; nevertheless other restorations are equally possible.[35] Groddek (2007) derived a different synchronism from the same fragmentary Hittite text. He argues that the fact that Horemheb is called by his personal name does not necessarily imply that Horemheb was not pharaoh at that time. He interprets the mentioned change of reign as referring to a change in the Hittite kingdom, namely from Šuppiluliuma I to Arnuwanda II, arguing that the events mentioned in column ii of the text are a reference to events which happened before the ones in column i. Groddek (2007) concludes that year 12 or 13 of Horemheb equals year 10 of Muršili II.[36]

Abandoning none of the interpretations of the text *a priori*, three different hypotheses are to be tested against the possible chronological options based on the astronomical data. Table 7 summaris-

[32] The key points are the following: Muwatalli alive in year 5 Ramesses II, Hattušili III king before year 21 Ramesses II, Hattušili III still alive after year 34 Ramesses II when Ramesses II marries a Hittite princess and exchanges letters with Hattušili III and his wife.

[33] KUB 19.15 + KBo 50.24; Miller 2007, 252–53.

[34] For a different opinion based on philological arguments see Simon 2009, 340–348 and the reply by Devecchi and Miller 2011, 148–151.

[35] Devecchi and Miller 2011, 157.

[36] Groddek 2007, 102.

option	1 Ay	1 Horemheb	8/9 Muršili II	12/13 Horemheb	10 Muršili II
$P1_1$	1309	1305	1310/09	1293/92	1308
$P1_2$	1309	1305	1314/13	1293/92	1312
$P2_1$	1320	1316	1314/13	1304/03	1312
$P2_2$	1320	1316	1330/29	1304/03	1328
$P3_1$	1334	1330	1330/29	1318/17	1328
$P3_2$	1334	1330	1337/36	1318/17	1335
$P3_3$	1334	1330	1342/41	1318/17	1340
$P4_1$	1345	1341	1337/36	1329/28	1335
$P4_2$	1345	1341	1342/41	1329/28	1340
$P4_3$	1345	1341	1357/56	1329/28	1355

Table 7: The possible chronological options based on the Egyptian lunar data and on the Hittite solar eclipse tested against the different proposed synchronisms between Horemheb or Ay and Muršili II. The grey shaded areas designate matches. The last column gives the year of the solar eclipse. All dates are BC.

es the results. Groddek's proposed synchronism is not supported by the astronomical data. The three possible chronologies shaded in grey in Table 7 remain: one low chronology where the synchronism equating year 1 of Ay with year 9 of Muršili II is dated to 1309 BC ($P1_1$), and two high chronologies where the synchronism equating year 1 of Horemheb with year 8 or 9 of Muršili II is dated to 1330 BC or to 1341 BC ($P3_1$ and $P4_2$ respectively).[37] Thus, the synchronism between Muršili II and Ay/Horemheb leads to the exclusion of the chronological option P2 for Egypt with year 1 of Ramesses II in 1290 BC.

After having narrowed down the possibilities, the solar eclipses can be studied in more detail.[38] The exact location of the land of Azzi is unclear, but it is usually thought to be situated in the northeast of Anatolia, somewhere around the Lake Van. For the solar eclipse of 1308 BC ($P1_1$), the maximum magnitude of 0.7 in Hattuša occurred before sunrise. Probably the eclipse would have been recognised only because the Sun was eclipsed at the moment of sunrise. Further to the east, the eclipse would probably not have been noticed because the magnitude at the moment of sunrise was already too small. A date in April also agrees well with the interpretation of the text about Muršili II campaigning in Azzi. In the case of the eclipse of 1340 BC ($P4_2$) it would be barely credible that Muršili would not mention it in his Annals. This eclipse was total or almost total and due to the light change it would have been impossible to miss it even if the weather was bad and the sun itself not observable. However, the real drawback of an identification of this solar eclipse as the one in question is the fact that it is highly unlikely that Muršili II was on a campaign around the beginning of January. One would have to assume, to fit the narrative reconstructed by Huber (2001), that the queen delayed her attempts to depose Muršili until after his departure, months after the eclipse had taken place. For the solar eclipse of 1328 BC ($P3_1$), two problems occur: the maximum magnitude of about 0.75 around noon in Hattuša is the

[37] The absolute dating of Horemheb and Ay is obtained by using the Egyptian lunar data. Years 8, 9 and 10 of Muršili II are determined from the solar eclipse in his 9th or 10th year. The absolute dating of the Egyptian pharaohs and of the Hittite kings in Table 7 is *independent* of the synchronism between Ay or Horemheb and Muršili II. Additionally, the astronomical dating of the two regions is also *independent* of each other with the exception that the Egyptian lunar data for Ramesses II have been used to define generous time slots for the occurrence of the solar eclipse in question.

[38] See http://www.gautschy.ch/~rita/archast/solec/solec.html for maps of the solar eclipses (Gautschy 2012).

lowest limit expected for the detection of an unpredicted solar eclipse.[39] However, it would easily explain why Muršili, campaigning further to the east, did not take notice of the eclipse. The second shortcoming is that it occurred in October, thus very late in the year. In this case Muršili should already have been on his way back from Azzi to Hattuša – if still campaigning at all.

Undoubtedly, the eclipse of 1308 BC fits best the reconstructed circumstances of the text. But since the text is heavily restored I refrain from excluding any chronological option based on the evidence of the solar eclipse alone.

6.2 Synchronisms with Assyria

To select the most probable chronology for Egypt, one can check against Assyrian chronology once again. The reign lengths of the Assyrian kings during the period in question are well preserved. Prior to 1133 BC and from Aššur-nādin-aḫḫe II onwards, only the exact reign lengths of Aššur-nādin-apli (3 or 4 years), Ninurta-apil-Ekur (3 or 13 years), Aššur-dān I (36 or 46 years) and the exact meaning of the Akkadian term *ṭuppišu* can be questioned. *ṭuppišu* is traditionally translated to mean a short reign length of a few months. Taking into account these uncertainties, absolute dates can thus be inferred with an uncertainty of about 22 years. Reckoning from the distances of the Assyrian kings indicates that the reign of Aššur-nādin-aḫḫe II (contemporary with Amenhotep III) started between 1401 BC and 1379 BC, and that of Aššur-uballiṭ I (contemporary with Akhenaten, Smenkhkare and Tutankhamun) between 1364 BC and 1342 BC. Additionally, not every year in the given time spans can be the accession year. A comparison with the absolute dates of Amenhotep III, Akhenaten and Tutankhamun for options P1, P3, and P4 (Table 5) shows that only options $P1_1$ and $P3_1$ seem to be in accordance with the traditional translation of the term *ṭuppišu*. In order to fulfil all direct synchronisms in Table 2, option $P4_2$ would require about 10 years for the two Assyrian kings with *ṭuppišu* reign lengths, which seems unlikely.[40] Thus, adopting a reign length of 15 years for Horemheb eliminates the long chronology with year 1 of Ramesses II in 1315 BC and an equation of the solar eclipse of Muršili II with the one of 1340 BC.

6.3 Daḫamunzu-affair

Before the recently discovered synchronism between Muršili II and Horemheb or Ay, the so-called Daḫamunzu-affair was the main synchronism between the Hittites and Egypt prior to Ramesses II. Thus, all proposed chronologies were based on the identification of the pharaoh in question and on the lunar dates of Thutmose III and Ramesses II.

In the *Deeds of Šuppiluliuma* (DŠ), Muršili II tells us that while his father was in the land of Karkemiš, he received a letter from the Egyptian queen, called by her title *daḫamunzu*, informing him that her husband Bibḫururiya had died recently and, since she had no son, asking Šuppiluliuma to send one of his numerous sons to become her husband. She added that she did not want to make a servant her husband and that she feared *tekri*.[41] Šuppiluliuma was suspicious and sent his chamberlain to Egypt to assess the actual situation. The following spring, the chamberlain returned from Egypt together with an Egyptian messenger, confirming the words of the queen that her husband Nibḫururiya had died and that there was no son. Thereupon, Šuppiluliuma sent his son Zannanza to Egypt. Fragment 31 of the DŠ then recounts that Zannanza had died.[42] Šuppiluliuma accused the Egyptians of having murdered his son and swore revenge.[43] Hereupon the Hittite prince Arnuwanda crossed the Egyptian border and took thousands of prisoners of war. Unfortunately, these prisoners brought a pestilence to Ḫatti: Šuppiluliuma and Arnuwanda later died due to this pestilence.

---

[39] Ginzel 1899, 14 reports that an unpredicted solar eclipse was usually detected by indigenous peoples when a limiting magnitude of 0.75 was reached if the sun was high in the sky, and a limiting magnitude of about 0.50 if the sun was close to the horizon.

[40] For option $P4_2$ the synchronism between Amenhotep III and Burnaburiš is not fulfilled unless at least 10 years are counted for the kings with *ṭuppišu* reign lengths. Also the synchronisms between Hattušili III and Kadašman-Turgu I and Kadašman-Enlil II become very difficult with an accession of Kadašman-Turgu I many years after the peace treaty between Ramesses II and Hattušili III.

[41] Deeds of Šuppiluliuma, fragment 28 (Güterbock 1956, 94–98). The exact meaning of *tekri* is unknown. Small parts of the original letter of the *daḫamunzu* are preserved (Edel 1994, 15).

[42] Deeds of Šuppiluliuma, fragment 31 (Güterbock 1956, 107–108).

[43] van den Hout 1994, 68–70.

The common opinion is that the pharaoh in question was Tutankhamun. Breyer (2010b) strongly argued for such an identification on philological grounds, as did Kitchen (1962) earlier on. The name of the pharaoh in the Hittite text, once denoted as Bibḫururiya and once as Nibḫururiya, seems to match better the throne-name of Tutankhamun (Nb-ḫpr.w-Rʿ) than that of Akhenaten (Nfr-ḫpr.w-Rʿ-wʿ-n-Rʿ) or Smenkhkare (ʿnḫ-ḫpr.w-Rʿ). Additionally, the situation described accords well with the known historical situation after Tutankhamun, which culminated in Ay's ascension of the throne. Recently, Huber (2012, 202) stated that the pharaoh in question could only have been Tutankhamun and he based the identification of the possible solar eclipse of Muršili II in his proposed chronologies on this fact. Only Wilhelm and Boese (1987) opted, many years ago now, for an identification of the pharaoh with Smenkhkare. They pointed out that in Amarna letter 41, where Šuppiluliuma I calls the pharaoh Ḫuriya, the given name can be conclusively interpreted as being a haplography for *a-na a-na-ḫu-u-ri-i–i[a]*, the throne name of Smenkhkare. This interpretation implies that Šuppiluliuma I had become king during the reign of Akhenaten. Miller (2007), adopting the shorter reign length of Horemheb, argued repeatedly for an identification of the deceased pharaoh with Akhenaten.[44] Schneider (2010), following Miller's arguments constructed a chronology for the Egyptian New Kingdom where he accepted the identification with Akhenaten.[45] The chronologies proposed in this investigation are based on the lunar data and on a solar eclipse; thus the pharaoh in question was a result of, not a basic assumption for the construction of the chronology. When checking the remaining two chronological options against the Daḫamunzu-affair it is evident that only Akhenaten ($P1_1$) and, for the earlier option ($P3_1$), Smenkhkare are candidates for the deceased Egyptian pharaoh in question. Akhenaten and his wife Nefertiti certainly had children; six daughters of the couple are known. But they had no male heir. Smenkhkare, on the other hand, had no living children with his wife Meritaten, a daughter of Amenhotep IV and Nefertiti. The exact relationship between Akhenaten, Smenkhkare and Tutankhamun is not known. Genetic tests have shown that the mummy found buried in tomb KV 55 was the father of Tutankhamun and a son of Amenhotep III and queen Tiye.[46] Nonetheless, it is not clear whether the mummy should be identified with Akhenaten or with Smenkhkare; all the facts, except the estimated young age of 19 to 20 years of the mummy, hint at Akhenaten. If Tutankhamun was the son of Akhenaten and a secondary wife, a male heir existed when Akhenaten died. Maybe Tutankhamun was too young and his mother not powerful enough to enable him to become pharaoh after Akhenaten's death. The most likely candidates to be the Daḫamunzu are Meritaten or Nefertiti. A recently found inscription in the quarry from Dayr Abu Hinnis attests that Nefertiti was alive in year 16 of Akhenaten.[47] However, Nefertiti is never mentioned in the Amarna letters while Meritaten's name occurs twice in letters from the Babylonian king. The context of these letters allows to deduce that Meritaten was supposed to have an important position at the Egyptian court. Thus, Meritaten seems to be the prime candidate.

From the description in the DŠ one can deduce that the Egyptian throne was empty for at least half a year, and more probably for a year or even more. With a documented 2-year reign for the lady Neferneferuaten, occurring either between Akhenaten and Smenkhkare or between Smenkhkare and Tutankhamun, it seems obvious that no smooth transition took place, thus leaving open a time slot for a possible temporal placement of the Daḫamunzu-affair before the death of Tutankhamun. It should be stated that the Daḫamunzu-pharaoh must have died around the end of summer, a fact which never fitted the identification with Tutankhamun, whose burial must have taken place in April according to the flowers which were used for his burial.[48] However, the latter argument was put into question by van Dijk (1993), who argues that the flowers probably were deposed in the tomb before sealing it, which may have taken place a few months later than the time of the actual burial of the pharaoh.[49]

[44] Miller 2007, Devecchi and Miller 2011, Cordani 2011.

[45] Schneider 2010, 397–403.

[46] Hawass *et al.* 2010, 638–647.

[47] van der Perre 2012, 197.

[48] Germer 1989, 4–26. If the burial in April followed the usual mummification process of about 70 days, the king would have died in January or February.

[49] van Dijk 1993, 52–56.

6.4 Evidence from the Amarna correspondence and Hittite sources

The cuneiform tablets of the so-called Amarna letters (EA) cast some light on Egyptian relations with Babylonia, Assyria, Mitanni, Amurru, Ḫatti, Syria, Canaan, and Alašiya. For additional hints on which pharaoh is most probably the pharaoh in question in the Daḫamunzu-affair, the letters from Mitanni, Amurru, Tyros and Byblos are particularly helpful. Unfortunately, only few letters from Ḫatti itself are preserved. In EA 41 Šuppiluliuma talks about the pharaoh "Huriya's" recent ascension to the throne and expresses his wish to exchange further presents as Šuppiluliuma did with Huriya's father.[50] EA 42 is less polite, asking the pharaoh whether he wrote to Šuppiluliuma with peace in mind.[51] Either Šuppiluliuma was on good terms with Amenhotep III, congratulated Akhenaten on his ascension and subsequently their relations cooled considerably, or the kings in question were Akhenaten and Smenkhkare, respectively. In Mitanni, at the time of the beginning of the Amarna archive around year 30 of Amenhotep III,[52] Šuwardata was king. But soon Tušratta followed as king; in year 36 of Amenhotep III he wedded a daughter to the Egyptian pharaoh. At some point during the reign of Akhenaten, Tušratta was murdered by his own son. In Amurru, Abdi-Aširta ruled approximately until the end of Amenhotep III's reign. Afterwards, Abdi-Aširta's sons seem to have ruled together for a while until Aziru took the leading position. The pharaoh ordered Aziru to come to Egypt but Aziru repeatedly delayed his departure to Egypt, giving as his excuse Šuppiluliuma's presence in the land of Nuḫašše which constituted a threat to Aziru's territory. Tušratta's death and the presence of Šuppiluliuma in Nuḫašše are mentioned in Hittite texts too.[53] Another important event documented in Egypt as well as in Hittite sources is a raid on Amqu, shortly before the occurrence of the Daḫamunzu-affair.[54] Putting together all these pieces of evidence, I come to the conclusion that very probably Akhenaten is the deceased pharaoh, although Smenkhkare cannot be entirely excluded due to his very short reign length.[55] Cordani (2011) – arriving at the same main conclusion – remarked that an identification of the deceased pharaoh with Smenkhkare would imply a relatively long stay by Aziru in Egypt, which seemed implausible to her.[56]

6.5 Discussion

The chronological options proposed in this work were constructed based on the following data and basic assumptions:

1. Lunar data from the period of the Egyptian New Kingdom
2. Horemheb reigned 15 years, "Smenkhkare" 3 years and Seti I 9 years
3. Occurrence of a solar eclipse in Muršili II's 10th year (*i.e.* the solar omen reported is indeed an eclipse account)
4. Synchronism between Muršili II and Horemheb (*i.e.* ʾArmaʾa can be equated with Horemheb)
5. Direct synchronisms listed in Table 2 of this paper
6. The Assyrian King List

A systematic investigation reduced the original four possible chronological options to two, eliminating both options constructed on the assumption that the Egyptian day began with sunrise. Thus the Egyptian day began with dawn.[57] For both remaining options, $P1_1$ and $P3_1$, the net of documented direct synchronisms between Egypt, Ḫatti, Babylonia and Assyria confines the absolute dates given in Table 8 in such a way that they cannot deviate more than 2 years at most for Assyria, and not more than about 5 years for Babylonia and Ḫatti. Concerning the dates of the Assyrian kings listed in Table 8, one year of reign each was allowed for the two kings with *ṭuppišu* reign lengths, thus providing upper limits. For the Hittite kings, the lowest proposed values of reign lengths for Šuppiluliuma I (25 years), Muršili II (25 years) and Muwatalli (18 years) have been chosen, since oth-

50 Moran 1992, 114.

51 Moran 1992, 115–16.

52 Moran 1992, xxxiv.

53 *e.g.* fragment 27 of the DŠ (Güterbock 1956, 85), Šuppiluliuma-Šattiwaza treaty (Beckman 1996, 38–48).

54 EA 170 (Moran 1992, 257) and fragment 28 of the DŠ (Güterbock 1956, 94).

55 A thorough discussion of the subject would require a separate paper. For recent research about the Aziru correspondence see Cordani 2011.

56 Cordani 2011, 113.

57 This is in accordance with the opinion shared by most Egyptologists, see *e.g.* Krauss 1993. Arguing against this assumption were mainly Luft 1987, 3–11 and Leitz 1995, 72.

erwise the Hittite synchronisms with Egypt and Babylonia cannot be maintained.

The most serious drawback of option $P1_1$ may be the fact that if the deceased pharaoh in the Daḫamunzu-affair is Akhenaten, Šuppiluliuma I would have died only 3 to 4 years afterwards, namely in the year when Smenkhkare died and Tutankhamun ascended the throne. This contradicts the common reconstruction of the various fragments of the DŠ which would require 5 to 6 more years of Šuppiluliuma I. Option $P3_1$ has 8 or 9 more years of Šuppiluliuma I after the death of Akhenaten, which on the other hand seems too long. But if the deceased pharaoh in the Daḫamunzu-affair is Smenkhkare, then option $P3_1$ provides a perfect fit with its 6 years between the death of Smenkhkare and the death of Šuppiluliuma I. While option $P1_1$ accords with a Low Assyrian Chronology (36 years of Aššur-dān I, 3 years of Ninurta-apil-Ekur), option $P3_1$ requires a High Assyrian Chronology (46 years of Aššur-dān I, 13 years of Ninurta-apil-Ekur). In both options, the direct synchronisms summarised in Table 2 are fulfilled. Concerning the match of the lunar dates, option $P1_1$ fits slightly better, but not decisively so. Unfortunately, in both options deviations occur, especially in those cases where the texts state explicitly that the day mentioned is a first lunar day. It should be noted that the supposed Sothic date from the Papyrus Ebers Calendar – III Shemu 9 in year 9 of Amenhotep I[58] – agrees with a place of observation in Memphis for option $P3_1$ while no match can be obtained for option $P1_1$. The Sothic date of Thutmose III from Elephantine is in accordance with years 13 to 26 of Thutmose III for option $P1_1$ and Thebes as reference point, and with years 20 to 33 of Thutmose III for option $P3_1$ and Memphis as reference point. Usually, the list of feasts containing this Sothic date is dated to the later part of Thutmose's reign, thus option $P3_1$ seems preferable. However, the solar eclipse of Muršili II fits better for option $P1_1$ (1308 BC) than for option $P3_1$ (1328 BC). Concerning the ^{14}C data from 2010 (see Table 5), they are in full agreement with option $P3_1$ prior to Ramesses II and deviate not more than 5 to 12 years after Ramesses II. Since the ^{14}C data were modelled assuming a higher reign length for Horemheb, such a deviation is well within the limits of this dating method. For option $P1_1$, the opposite applies: dates prior to Ramesses II deviate by approximately 10 years.

7. Conclusions

Collecting all the pieces of evidence, two possible absolute chronologies of the Egyptian New Kingdom – based on lunar and Sothic data, one solar eclipse, ^{14}C data, known synchronisms, textual and archaeological witnesses – remain: one high chronology with year 1 of Ramesses II in 1304 BC, year 1 of Thutmose III in 1493 BC and the beginning of the New Kingdom around 1565 BC (option $P3_1$) on one hand, and one low chronology with year 1 of Ramesses I in 1279 BC, year 1 of Thutmose III in 1468 BC and the beginning of the New Kingdom around 1540 BC (option $P1_1$) on the other. Both chronological solutions comprise reign lengths of 15 years for Horemheb, 9 years for Seti I and 3 years for both Neferneferuaten and Smenkhkare. These chronologies agree well with Assyrian, Babylonian and Hittite chronologies. Accepting the considerably lower reign length of Horemheb, which is suggested by the archaeological facts from his tomb and supported by the lunar data, means that one has to accept that the pharaoh of the Daḫamunzu-affair is definitely not Tutankhamun. For option $P3_1$ the pharaoh in question would very probably be Smenkhkare. The *daḫamunzu* in the Hittite texts would then be the widow of Smenkhkare, Meritaten, reigning as Neferneferuaten between Smenkhkare and Tutankhamun. In accordance with the interpretation of Wilhelm and Boese (1987), Šuppiluliuma I would have addressed EA 41 to Smenkhkare. For option $P1_1$ the Daḫamunzu-pharaoh would be Akhenaten with the lady Neferneferuaten reigning for a short time between Akhenaten and Smenkhkare. Accepting a reign length of 15 years for Horemheb excludes the high chronology with year 1 of Ramesses I in 1315 BC which has recently been discussed by Huber (2012, 211), since it would require about 10 years of reign for the two kings with *ṭuppišu* reign lengths in the Assyrian King List to avoid destroying the well documented synchronism between Amenhotep III and Burnaburiaš.

Option $P3_1$, with higher dates of Ramesses II and his successors compared to the standard chronology implies that the Third Intermediate Period is extended by 25 years. On the other hand, option

[58] Gautschy 2011b, 125.

year	Egypt	Ḫatti	Babylonia	Assyria	year	Egypt	Ḫatti	Babylonia	Assyria
1539	1 Ahmose				1564	1 Ahmose			
1514	1 Amenhotep I				1539	1 Amenhotep I			
1494	1 Thutmose I				1519	1 Thutmose I			
1482	1 Thutmose II				1507	1 Thutmose II			
1468	1 Thutmose III				1493	1 Thutmose III			
1414	1 Amenhotep II				1439	1 Amenhotep II			
1406			1 Kara-indaš		1433				1 Enlil-nāṣir II
1398				1 Aššur-bēl- nišēšu	1427			1 Kara-indaš	1 Aššur-nīrārī II
1397			1 Kadašman-Harbe I		1420				1 Aššur-bēl- nišēšu
1389			1 Kurigalzu I	1 Aššur-rā'im-nišēšu	1418			1 Kadašman-Harbe I	
1388	1 Thutmose IV				1413	1 Thutmose IV			
1381				1 Aššur-nādin-aḫḫe II	1411				1 Aššur-rā'im-nišēšu
1378	1 Amenhotep III				1410			1 Kurigalzu I	
1371				1 Erība-Adad I	1403	1 Amenhotep III			1 Aššur-nādin-aḫḫe II
1357			1 Kadašman-Enlil I		1393				1 Erība-Adad I
1344				1 Aššur-uballiṭ	1380			1 Kadašman-Enlil I	
1343		1 Šuppiluliuma I	1 Burnaburiaš		1366			1 Burnaburiaš	1 Aššur-uballiṭ
1339	1 Akhenaton				1364	1 Akhenaton			
1322	1 Smenkhkare				1363		1 Šuppiluliuma I		
1319	1 Tutankhamun				1347	1 Smenkhkare			
1318		1 Arnuwanda			1344	1 Tutankhamun			
1317		1 Muršili II	1 Kara-hardaš 1 Nazi-Bugaš		1340			1 Kara-hardaš 1 Nazi-Bugaš	
1316			1 Kurigalzu II		1339			1 Kurigalzu II	
1309	1 Aja				1338		1 Arnuwanda		
1308				1 Enlil-nīrārī	1337		1 Muršili II		
1305	1 Horemheb				1334	1 Aja			
1298				1 Arik-dēn-ili	1330	1 Horemheb			1 Enlil-nīrārī
1291			1 Nazi-Maruttaš		1320				1 Arik-dēn-ili
1290	1 Ramesses I				1315	1 Ramesses I			
1289		1 Muwatalli			1314			1 Nazi-Maruttaš	
1288	1 Seti I				1313	1 Seti I			
1286				1 Adad- nīrārī I	1312		1 Muwatalli		
1279	1 Ramesses II				1308				1 Adad- nīrārī I
1271		1 Muršili III			1304	1 Ramesses II			
1265			1 Kadašman-Turgu I		1294		1 Muršili III		
1264		1 Hattušili III			1288			1 Kadašman-Turgu I	
1254				1 Šalmaneser	1287		1 Hattušili III		
1247			1 Kadašman-Enlil II		1276				1 Šalmaneser
1238		Tudhalia IV	1 Kudur-Enlil		1270			1 Kadašman-Enlil II	

year	Egypt	Ḫatti	Babylonia	Assyria	year	Egypt	Ḫatti	Babylonia	Assyria
1229			1 Šagarakti-Šuriaš		1262		Tudhalia IV		
1224				1 Tukultī-Ninurta I	1261			1 Kudur-Enlil	
1216			1 Kaštiliašu IV		1252			1 Šagarakti-Šuriaš	
1213	1 Merenptah				1246				1 Tukultī-Ninurta I
1210		Arnuwanda III			1239			1 Kaštiliašu IV	
1209			1 Tukultī-Ninurta		1238	1 Merenptah			
1208		Šuppiluliuma II	1 Enlil-nādin-šumi		1235		Arnuwanda III		
1207			1 Kadašman-Harbe II		1233		Šuppiluliuma II		
1206			1 Adad-šuma-iddina		1232			1 Tukultī-Ninurta	
1203	1 Seti II				1231			1 Enlil-nādin-šumi	
1200			1 Adad-šuma-uṣur		1230			1 Kadašman-Harbe II	
1197	1 Siptah				1229			1 Adad-šuma-iddina	
1192	1 Twosre				1228	1 Seti II			
1190	1 Sethnakhte				1223			1 Adad-šuma-uṣur	
1187	1 Ramesses III			1 Aššur-nādin-apli	1222	1 Siptah			
1184				1 Aššur-nīrārī III	1217	1 Twosre			
1178				1 Enlil-kudurrī-uṣur	1215	1 Sethnakhte			
1173				1 Ninurta-apil-Ekur	1212	1 Ramesses III			
1170			1 Meli-Šipak	1 Aššur-dān I	1209				1 Aššur-nādin-apli
1156	1 Ramesses IV				1205				1 Aššur-nīrārī III
1155			1 Marduk-apla-iddina		1199				1 Enlil-kudurrī-uṣur
1149	1 Ramesses V				1194				1 Ninurta-apil-Ekur
1145	1 Ramesses VI				1193			1 Meli-Šipak	
1143			1 Zababa-šuma-iddina		1181	1 Ramesses IV			1 Aššur-dān I
1142			1 Enlil-nādin-aḫi		1178			1 Marduk-apla-iddina	
1136	1 Ramesses VII				1174	1 Ramesses V			
1134				Ninurta-tukultī-Aššur	1170	1 Ramesses VI			
1133				Mutakkil-Nusku	1166			1 Zababa-šuma-iddina	
1132				1 Aššur-rēša-iši I	1165			1 Enlil-nādin-aḫi	
1129	1 Ramesses VIII				1161	1 Ramesses VII			
1127	1 Ramesses IX				1154	1 Ramesses VIII			
1115				1 Tiglath-pileser I	1152	1 Ramesses IX			
1109	1 Ramesses X				1135				Ninurta-tukultī-Aššur
1106	1 Ramesses XI				1134	1 Ramesses X			Mutakkil-Nusku
1078	End of NK				1133				1 Aššur-rēša-iši I
					1131	1 Ramesses XI			
					1115				1 Tiglath-pileser I
					1103	End of NK			

Table 8: Absolute chronologies for Egypt, Ḫatti, Babylonia and Assyria for options $P1_1$ (left) and $P3_1$ (right). All dates are BC.

	$P1_1$	$P3_1$	P_{AG}
Documented synchronisms	+	+	+
Solar eclipse	+	o	+
Sothic dates	–	+	+
Lunar dates	o	o	+
C14 dates	o	o	o
Reconstruction of DŠ	–	+	–
	Lengthening of Second Intermediate Period by approximately 15 years	Lengthening of Third Intermediate Period by 25 years	11 additional years for Amenhotep II and Thutmose IV

Table 9: Pros (+), cons (–), and neutral arguments (o) of the chronological options, as well as the consequences for the preceding and following period.

$P1_1$ with lower dates prior to Horemheb allows about 15 more years for the Second Intermediate Period. It is probably the investigation of these periods which will finally allow the correct choice of New Kingdom Chronology to be made between the two possibilities. For the epoch of the Third Intermediate Period a couple of lunar feast dates are preserved, so research will continue with a thorough investigation of the Third Intermediate Period. A third possibility to accommodate the gained number of years has recently been outlined by Aston (2013).[59] He argues that from a ceramic point of view the length of time occupied by the reigns of Amenhotep II and Thutmose IV should be increased. Adopting his idea, a third composite chronological option P_{AG} can be proposed: a combination of option P2 from Ahmose to Thutmose IV with a total of 11 extra years for Amenhotep II and Thutmose IV, and of option $P1_1$ from Amenhotep III onwards.[60] Such a chronology would keep up the standard chronology with year 1 of Thutmose III in 1479 BC, year 1 of Ramesses II in 1279 BC and a beginning of the New Kingdom in about 1550 BC,[61] but shift the main part of the gained years from Seti I and Horemheb to Amenhotep II and Thutmose IV. The fit of all astronomical data would be perfect with only the lunar date of year 52 of Ramesses II being slightly too early. The Sothic date can be well explained with a reference point of the observation in Thebes and the presumable solar eclipse of Muršili II identified with the one in 1308 BC.

Table 9 summarises the arguments for and against the three options.

Depending on the weight one gives to the various arguments, one will be tempted to opt for the one or the other chronological option as the correct one. To me, the high chronology ($P3_1$) and the composite chronology (P_{AG}) currently seem more promising because the supposed Sothic date of Amenhotep I is not in accordance with any reference point in Egypt for option $P1_1$, while for options $P3_1$ and P_{AG} it fits well with an observation made in the surrounding of Memphis and Thebes, respectively. The second drawback of chronological option $P1_1$ and the main problem of option P_{AG} are that they do not fit the common reconstruction of the *Deeds of Šuppiluliuma*. On the other hand, for option P_{AG} the fit of the lunar data is better than for option $P3_1$.

[59] Aston (2013), 292–302.

[60] In this manner 11 of the 14 years can be accommodated. However, a shift of 14 years would not be in accordance with the lunar data. In contrast to option $P2_{15}$ in Table 4, which was established assuming a beginning of the day with sunrise, for option P_{AG} a beginning of the day with dawn has to be assumed which subsequently leads to a better fit of the lunar data.

[61] Year 1 of Ahmose in 1550 BC, year 1 of Amenhotep I in 1525 BC, year 1 of Thutmose I in 1505 BC, year 1 of Thutmose II in 1493 BC, year 1 of Thutmose III in 1479 BC, year 1 of Amenhotep II in 1425 BC, and tentatively year 1 of Thutmose IV in 1394 BC (corresponds to 5 extra years for Amenhotep II and 6 extra years for Thutmose IV). The year dates of all following kings can be found in Table 8, left side (option $P1_1$).

Bibliography

Aston D.

2013 *Radiocarbon, wine jars and New Kingdom Chronology*, *Ä&L* XXII, 285–311.

Beckman G.

1996 *Hittite diplomatic texts*, Atlanta.

Breyer F.

2010a *Ägypten und Anatolien. Politische, kulturelle und sprachliche Kontakte zwischen dem Niltal und Kleinasien im 2. Jahrtausend v. Chr.*, Wien.

2010b *Egyptological remarks concerning Daḫamunzu*, *Ä&L* XX, 445–451.

Bronk Ramsey Ch., Dee M. W., Rowland J. M., Higham T. F. G., Harris S. A., Brock F., Quiles A., Wild E. M., Marcus E. S. and Shortland A. J.

2010 *Radiocarbon-Based Chronology for Dynastic Egypt*, *Science* 328, 1554–1557.

Bryce T.

2005 *The Kingdom of the Hittites*, Oxford.

Cordani V.

2011 *Aziru's Journey to Egypt and its Chronological Value*, 103–113, in: J. Mynářová (ed.), *Egypt and the Near East – the Crossroads*, Prague.

De Martino S.

1998 *Le accuse di Muršili II alla regina Tawananna second il testo KUB XIV 4*, 19–48, in: S. De Martino and F. Imparati, *Studi e Testi* 1, Florence.

Devecchi E. and Miller J. L.

2011 *Hittite-Egyptian Synchronisms and their Consequences for Ancient Near Eastern Chronology*, 139–176, in: J. Mynářová (ed.), *Egypt and the Near East – the Crossroads*, Prague.

Edel E.

1994 *Die Ägyptisch-hethitische Korrespondenz aus Boghazköy*, Vol. I, Opladen.

Gautschy R.

2011a *Monddaten aus dem Archiv von Illahun: Chronologie des Mittleren Reiches*, *ZÄS* 138, Vol. 1, 1–19.

Online data: http://www.gautschy.ch/~rita/archast/mond/mondeng.html

2011b *Sirius im Alten Ägypten*, *ZÄS* 138, Vol. 2, 116–131.

Online data: http://www.gautschy.ch/~rita/archast/sirius/siriuseng.htm

2012 *Sonnenfinsternisse und ihre chronologische Bedeutung: Ein neuer Sonnenfinsterniskanon für Altertumswissenschaftler*, *Klio* 94, Vol. 1, 7–17.

Online data: http://www.gautschy.ch/~rita/archast/solec/solec.html

Germer R.

1989 *Die Pflanzenmaterialien aus dem Grab des Tutanchamun*, Hildesheim.

Ginzel F. K.

1899 *Spezieller Kanon der Sonnen- und Mondfinsternisse für das Ländergebiet der klassischen Altertumswissenschaften und den Zeitraum von 900 v. Chr. bis 600 n. Chr.*, Berlin.

Glassner J. – J.

1993 *Chroniques Mésopotamiennes*, Paris.

Grayson A. K.

1975 *Assyrian and Babylonian Chronicles*, Locust Valley (N. Y.).

Groddek D.

2007 *Zu den neuen ägyptisch-hethitischen Synchronismen der Nach-Amarna-Zeit*, *GM* 215, 95–107.

Güterbock H.G.

1956 *The Deeds of Suppiluliuma as Told by His Son, Mursili II*, JCS X, 41–68, 75–98, 107–130.

Hagenbuchner A.

1989 *Die Korrespondenz der Hethiter*, Vol. I and II, Heidelberg.

Hawass Z., Gad Y. Z., Ismail S., Khairat R., Fathalla D., Hasan N., Ahmed A., Elleithy H., Ball M., Gaballah F., Wasef S., Fateen M., Amer H., Gostner P., Selim A., Zink A. and Pusch C. M.

2010 *Ancestry and Pathology in King Tutankhamun's Family*, *The Journal of the American Medical Association* 303, 638–647.

Hornung E.

2006 *The New Kingdom*, 197–217, in: E. Hornung, R. Krauss, D. A. Warburton (eds.), *Ancient Egyptian Chronology*, Leiden.

Huber P. J.

2001 *The Solar Omen of Muršili II*, *JAOS* 121, Vol. 4, 640–644.

2012 *The Astronomical Basis of Egyptian Chronology of the Second Millennium BC.*, *JEH* 4, 172–227.

Jansen J. J.

1961 *Two Ancient Egyptian Ship's Logs*, Leiden.

Kitchen K. A.

1962 *Suppiluliuma and the Amarna Pharaohs: a study in relative chronology*, Liverpool.

2007 *Egyptian and Related Chronologies – Look, no Sciences, no Pots!*, 163–172, in: M. Bietak und E. Czerny (eds.), *The Synchronisation of Civilisations in the Eastern Mediterranean in the Second Millennium B. C. III*, Vienna.

Krauss R.

1993 *Was wäre, wenn der altägyptische Kalendertag mit Sonnenaufgang angefangen hätte?*, *BSEG* 17, 63–71.

Kümmel H. M.

1982 *Die Zehnjahr-Annalen des Muršili II*, in: TUAT 1, 471–480.

Laroche E.

1971 *Catalogue des textes hittites*, Paris.

Leitz Ch.

1995 *Altägyptische Sternuhren*, Leuven.

Luft U.

1987 *Der Tagesbeginn in Ägypten: Der Tag begann bei Sonnenaufgang*, *AoF* 14, 3–11.

Marciniak M.

1974 *Les inscriptions hiératiques du temple de Thoutmosis III*, Warsaw.

Miller J. L.

2007 *Amarna Age Chronology and the Identity of Nibḫururiya in the Light of a Newly Reconstructed Hittite Text*, *AoF* 34, 252–293.

Moran W. L.

1992 *The Amarna Letters*, Baltimore.

Pruzsinszky R.

2009 *Mesopotamian Chronology of the 2nd millennium B.C.: An Introduction to the Textual Evidence and Related Chronological Issues*, Vienna.

Quiles A., Aubourg E., Berthier B., Delque-Količ E., Pierrat-Bonnefois G., Dee M. W., Andreu-Lanoë G., Bronk Ramsey C. and Moreau C.

2013 *Bayesian modelling of an absolute chronology for Egypt's 18th Dynasty by astrophysical and radiocarbon methods*, *JAS* 40, 423–432.

Schneider Th.

2010 *Contributions to the Chronology of the New Kingdom and the Third Intermediate Period*, *Ä&L* 20, 373–404.

Simon Z.

2009 *Kann Armā mit Horemheb gleichgesetzt werden?*, *AoF* 36, 340–348.

van den Hout T. P. J.

1994 *Der Falke und das Küken: der neue Pharao und der hethitische Prinz?*, *ZA* 84, 64–70.

van der Perre A.

2012 *Nofretetes [vorerst] letzte dokumentierte Erwähnung*, 195–197, in: F. Seyfried (ed.), *Im Licht von Amarna: 100 Jahre Fund der Nofretete*, Petersberg.

van Dijk J.

1993 *The New Kingdom Necropolis of Memphis: Historical and Iconographical Studies*, PhD thesis University of Groningen.

2008 *New evidence on the length of the reign of Horemheb*, *JARCE* 44, 193–200.

2011 *The Date of the Gebel Barkal Stela of Seti I*, 325–332, in: D. Aston, B. Bader, C. Gallorini, P. Nicholson, S. Buckingham (eds.), *Under the potter's tree*, OLA 204, Leuven.

von Beckerath J.

1994 *Chronologie des ägyptischen Neuen Reiches*, Hildesheim.

1997 *Chronologie des Pharaonischen Ägypten*, Mainz.

Weidner E.

1926 Die *grosse Königsliste aus Assur*, *AfO* 3, 66–77.

Wilhelm G. and Boese J.

1987 *Absolute Chronologie und die hethitische Geschichte des 15. und 14. Jahrhunderts v. Chr.*, 74–117, in: P. Astrom (ed.), *High, Middle or Low?*, Gothenburg.