THE ABSOLUTE CHRONOLOGY OF THE EGYPTIAN S.I.P. NEW KINGDOM TRANSITION AND ITS IMPLICATIONS FOR LATE MINOAN CRETE *

Introduction

The absolute dates for the accession of Ahmose I, the first king of the XVIII Egyptian Dynasty, the conquest of Avaris, and the establishment of the New Kingdom in his year 11 (or, less likely, 18-22 [1]) play a key-role in our understanding of the interlinked chronologies of the Late Bronze Age (LBA) not only in Egypt, but also in the entire Eastern Mediterranean, according to the chronological framework built on the basis of the archaeological interrelationships and textual synchronisms.

This key-question has been much disputed since the XIX Century [2] and throughout the entire XX Century, when the absolute date for the beginning of the New Kingdom was fixed between 1580 and 1567 Cal BC [3], and 1575-1550 BC, according to different authors [4]. Also after rejecting Manetho, as a reliable chronological source, several problems have affected the chronology of the beginning of the NK and the end of the S.I.P. They are: 1) the regnal length and coregencies incertitude, and 2) internal biases in the astrochronology, used to shorten the absolute time-ranges for the relevant events through textual information about astronomical observations. The observations involve two different phaenomena: the Heliacal Rising of Sirius, and the last sighting of the last lunar crescent above the Eastern horizon. Correlations of the two events, recorded in the festival calendars, might provide a rather precise date (or, better, a few probable dates) for the moment in which the observations took place. Unfortunately, a long series of possible sources of uncertainty makes astrochronology alone insufficient for absolute dating [5]. Among them the more relevant are: 1) the four-years phases (*tetraeteris*) during which the observation may have taken place, because of the difference between the Egyptian civil year and the lunar calendar;

* I would like to express my gratitude to Prof. P. Biagi (Ca' Foscari University, Venice) and Dr. M.H. Wiener (Institute for Aegean Prehistory, Philadelphia), for their help in the writing of this paper; Prof. F.M. Carinci and Dr. E.M. Ciampini (Ca' Foscari University, Venice); Tommaso Malgherini (Ca' Foscari University, Venice), Dr. D.J. Keenan; Prof. M.W. Bietak (Vienna University, Österreichischen Archäologischen Institutes in Kairo), Prof. W. Kutschera (Institut für Isotopen Forschung und Kernphysik, Vienna Environmental Research Accelerator), Prof. C. Ramsey (Oxford Radiocarbon Accelerator Unity), Prof. S.W. Manning (Cornell University Tree Ring Laboratory, Malcolm and Carolyn Wiener Laboratory for Aegean and Near Eastern Chronologies), Dr. M. Bealby (University of Brimingham, Institute of Archaeology and Antiquity).

[1] Kitchen 2000.

[2] See, for example, W.M.F. Petrie, *Ten Years Digging in Egypt. 1881-1891*, London 1892.

[3] J.H. Breasted, *A History of Egypt. From the Earliest Times to the Persian Conquest*, New York 1948².

[4] A. Gardiner, *Egypt of the Pharaons. An introduction to*, Oxford 1961.

[5] Firneis 2000; M.G. Firneis - M. Rode - Paunzen, Progress-Report on Egyptian Astrochronology, in Bietak 2003, pp. 47-86; G. Brein, Astrochronology and Ancient Egyptian Chronology, in Bietak 2003, pp. 53-56.

2) the problems connected with the observation of lunar crescents, exclusively by visual means, until the Egyptian Late Period;
3) the uncertainty of the latitude at which the observations took place. Moving southwards each single degree would lead to a shift of one day earlier than the actual day of the Heliacal Rising of Sirius at Memphis.

The textual sources do not state the locations where such observations took place. The major possibilities are Memphis, Thebes and Elephantine, involving a total of 6 degrees in latitude[6] Regarding the relevant time-span for this discussion, the main data consist of two lunar observations, made during the reign of Thutmose III (yrs 23 and 24), which fix the possible accession date to 1504 BC, 1479 BC, 1467 BC or even 1454 BC[7], plus the observation of an Heliacal Rising during Amenhotep I year 9, datable between 1506 BC and 1496 BC[8]. All the possible identifications depend on the latitude at which each observation took place.

This has led to three different hypotheses for the absolute chronology of the XVIII Dynasty, otherwise called «High», «Middle» and «Low» (Egyptian) Chronologies[9]. However, the analysis of the astronomical observations with a textual evidence for the regnal lengths and biographical information from the tombs of officers who served under several kings (i.e. the so-called Historical Chronology), and of the two with the chronological datum-line provided by the textually-proved synchronism between the Amarna Court and those of Babylon and Assyria, has yielded evidence for an internally coherent and independent chronological framework, with significant implications for the interrelated chronology of the entire Eastern Mediterranean LBA.

Since the monumental work by Kenneth Kitchen on the chronology of the Third Intermediate Period (T.I.P.) in Egypt[10], several datum-lines have been defined that pinpoint the chronology of the NK on pure textual evidence[11]. Kitchen's reconstruction clearly shows that Tutankhamon died not earlier than 1327 BC, given his correspondence (EA15) with Assur-Uballit I. In turn Amenhotep III died not earlier than 1358 BC, given his correspondence (EA6) with Burnaburiash II[12]. It is important to point out that the radiocarbon dates of Amarna age do confirm an absolute date of ca. 1375 - 1320 Cal BC for this period[13]. An identical time-range is reported also by the radiocarbon data available for the Aegean LM/LH IIIA2, which fully confirms the chronology based on archaeological interrelations.

Thanks to a fixed chronological base in this synchronism, Kitchen[14] moves back to the chronological reconstruction of the XVIII Dynasty by simply adding regnal lengths as follows (*tab. 1*):

The problem

According to his method the absolute date for the accession of Ahmose is 1540 Cal BC, with a rather low possibility for 1550 Cal BC. It is interesting to notice that this

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[6] Firneis 2000.

[7] Krauss 2003.

[8] Krauss 2003.

[9] K.A. Kitchen, *Pharaon Triumphant. The Life and Times of Ramesses II, King of Egypt*, Warminster 1982; K.A. Kitchen, *The Third Intermediate Period in Egypt (1100-650 BC)*, revised edition, Warminster 1996; Kitchen 2000; Kitchen 2007; Krauss 2003.

[10] Kitchen, *Pharaon*… cit. in note 9.

[11] Kitchen 2007.

[12] Kitchen 2000; Kitchen 2007.

[13] H.J. Bruins-J. Van der Plicht, Assorting and Synchronising Archaeological and Geological strata with Radiocarbon: The Southern Levant in Relation to Egypt and Thera, in Bietak 2003, pp. 35-42.

[14] Kitchen 2007, pp. 167-170.

King	*Regnal Length*	*Coregencies*	*Age env. (Cal BC)*
Akhenaton/Amenhotep IV	16	-1 Smenkhkara (?)	1354/1350 - 338/1334
Amenhotep III	38	- (?)*Akhenaton	1392/1388 - 1354/1350
Thutmosis IV	10	- *	1402/1398 - 1392/1388
Amenhotep II	26	+2 Thutmosis III	1428/142 - 1402/1398
Thutmosis III	54	- 2 Amenhotep II - 21 Hatshepsut	1482/1479 - 1428/1424
Hatshepsut	21	Thutmosis III	1482/1479 - 1461/1457
Thutmosis II	3 (*13)	-*	1492/1482 - 1482/1479
Thutmosis I	9 (*12)	-*	1504/1494 - 1492/1482
Amenhotep I	21	-*	1525/1515 - 1504/1494
Ahmose I	25	-*	1550/1540 - 1525/1515

TABLE 1 - HISTORICAL CHRONOLOGY FOR THE EARLY/MID XVIII DYNASTY.

purely textual chronology fits perfectly into the most reliable astrochronological hypotheses [15], which suggest a date of 1479 Cal BC for the accession of Thutmosis III. and a date of 1506 Cal BC for Amenhotep I year 9 [16], and a date of ca. 1550/1540 BC for the accession of Ahmose. This period fits well also in the ceramic seriation made on the basis of specific classes of ceramic yielded by cemetery contexts [17].

In effect if the archaeological interrelationships mentioned below are acceptable, and the traditional chronological network is reliable, the proposed 100/120 Cal yrs shift advocated for the (new) Aegean absolute chronology would reflect on the Egyptian chronology itself. To fit a date of ca. 1630-1600 Cal BC for the LM I A Theran eruption with the archaeological record for the chronological interlinkages, one is forced to insert 100/120 Cal yrs between Amenhotep III and Ahmose (or, maybe, the final S.I.P.), a time-span of 185-200 Cal yrs in total. Such a significant shift is difficult to accept from an archaeological point of view. Moreover, there are definite independent arguments to discard this hypothesis, given that we have the autobiographical inscriptions of officials that served from Ahmose to Thutmosis III, from Thutmosis III to Amenhotep II, and from the latter to Amenhotep III. In other words, the time-span covered by those reigns cannot be shifted backby more than a few years, unless the above kings would have lived to an unbelievably high age. Finally, another argument to discard such a shift in the Egyptian chronology may be found in the textually proved synchronism between Thutmosis IV and the court of Mitanni.

To sum up, there are several convincing arguments that suggest a precise time-span for the beginning and the first part of the XVIII Dynasty, and, in turn, the interlinked Mediterranean chronologies:

1) Regnal lengths for each kingdom, with a total uncertainty of no more than a generation;

[15] FIRNEIS 2000; FIRNEIS-RODE-PAUNZEN, Progress-Report ... cit. in note 5; KRAUSS 2003.

[16] KRAUSS 2003.

[17] See for example D.A. ASTON, New Kingdom Pottery Phases as Revealed Through Well Dated Tomb Contexts, in BIETAK 2003, pp. 207-248.

2) Astronomical observations, which – possibly but not definitely – seem to confirm fairly well the regnal lengths reconstruction;
3) Radiocarbon dating of the Amarna age and interrelated contexts;
4) Textual proof of the synchronism of several kings, mostly (but not exclusively) recorded from the Amarna archive;

As a consequence the only likely time-span for the beginning of Ahmose reign is to be fixed at 1550-1540 Cal BC, and the establishment of the NK at 1539 - 1529 Cal BC (year 11) or 1523-1519 Cal BC (year 18-22).

It seems very likely that a ca. 200/230 Cal years time-span between the late/final S.I.P. and the Amarna age, covers the span from late LM IA to LM/LH III A2 periods in Crete, and the LC IA2-II periods in Cyprus, allowing to suggest a rather flexible, although clear, chronological framework based on the archaeological contexts, with significant chronologically-interrelated imports/exports.

This can be accepted only as long as the «traditional» reconstruction of the chronological interrelationships between archaeological contexts is maintained. In fact, in several of his recent papers [18], Manning has recognised the value of the independent Egyptian chronology, although he has attempted to demonstrate that the traditional interpretation of the archaeological records may be faulty and/or incomplete.

Since the 1980's [19] the synchronism of LM I-II with the XVIII Dynasty in Egypt, and the LBA in the Levant, has been challenged by radiocarbon results obtained from a few Aegean key-sites. In the vast majority they argue that the LM IA-B periods absolute chronology (and, in turn, of the Cypriot LC IA[2]-B) should be shifted back of some 100/120 Cal years [20].

It must be pointed out that during the mid-to late 1990's this hypothesis seemed to be strongly confirmed by other scientific techniques, providing possible information specifically on the date of the mature LM IA Theran eruption in particular. These data included anomalous growth-peaks in the Bristlecone, Belfast and Hohenheim tree-ring sequences for the XVII century Cal BC, and the volcanic activity-related acidity spikes and glass sherds horizons in Greenland ice cores. During the last decade, however, the claims of the independent proxy-data, with regard to the absolute chronology for the Theran eruption, has been discredited [21], and at present radiocarbon dating stands alone as a serious argument in favour of the AHC.

The calibrated pattern of the abundant and high-quality radiocarbon data published during the last decade [22] does seriously challenge the traditional «low» reconstruction of chronological interrelationships, and argues in favour of an «high» chronology. The new datasets rely on high-quality AMS measurements obtained from short-lived materials from a few LM IA-B Aegean contexts, which were stated by the authors to combine satisfactorily at a 95% confidence [23] also

[18] S.W. Manning, *The Thera (Santorini) Volcanic Eruption and the Absolute Chronology of the Aegean Bronze Age, a pdf Companion to: A Test Of Time (1999)*, ...2006; Manning 2007.

[19] B.J. Kemp-R.S. Merillees, *Minoan Pottery in Second Millennium Egypt*, Mainz am Rhein 1980.

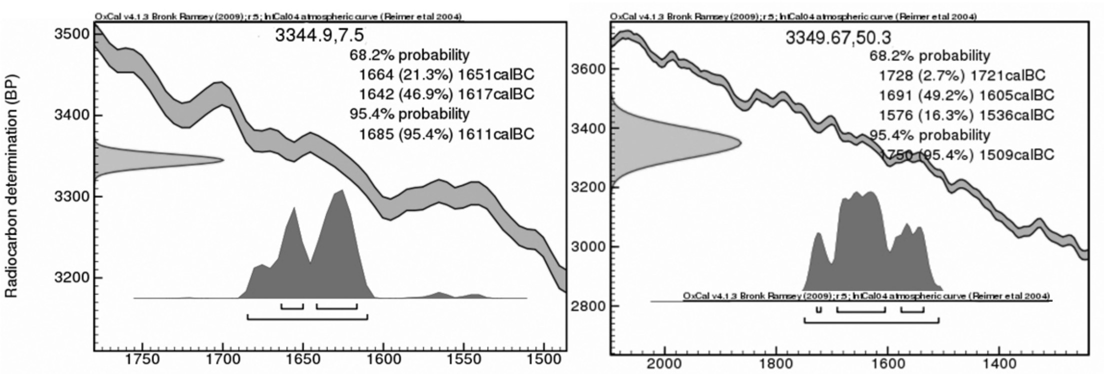
[20] Manning 1999; Manning, *The Thera* ... cit. in note 18; Manning 2007; Manning *et al.* 2001, 2002, 2003; Bronk-Ramsey *et al.* 2004; Friedrich *et al.* 2006.

[21] Wiener 2003; D.J. Keenan, Volcanic ash retrieved from the GRIP ice core is not from Thera, in *Geochemistry Geophysics Geosystems*, 4, n. 11, 2003; N.J.C. Pearce-J.A. Westgate-S.J. Preece-W.J. Eastwood-W.T. Perkins-J.S. Hart, Reinterpretation of Greenland Ice-core Data Recognises the Presence of the Late Olocene Aniakchak Tephra, not the Minoan Tephra (Santorini) at 1645 BC, in Bietak-Czerny 2007, pp. 139-148.

[22] Manning *et al.* 2001, 2002, 2003, 2006; Bronk-Ramsey *et al.* 2004; Friedrich *et al.* 2006.

[23] Although this point has been questioned as

with the previous datasets from Copenhagen, Oxford and Vienna laboratories. This allows the authors [24] to formulate a weighted average (*figs. 1-2*) for the Volcanic Destruction Level (VDL) at Akrotiri, Thera (3344.9 ± 7.5 BP [25]), that in calibrated terms ties the eruption to the 1685 - 1609 Cal BC time-span (at 2 sigma confidence).



The 28 radiocarbon determinations presented by Manning for the Akrotiri VDL[26] favour the Aegean Long Chronology, both in terms of the general pattern of uncalibrated results, and of the Bayesian analysis combining calibrated dates to further reduce uncertainty in the datasets. Moreover, the results obtained by Manning *et al*.[27] were supported [28] by a sequence of radiocarbon measurements from an olive branch said to contain 72 rings observed by x-ray tomography, and further claimed to be year rings, found near Akrotiri, covered by tephra, and published by Friedrich *et al*.[29]. It produced a final date of 3331 ± 10 BP, covering the calibrated time-span 1627 - 1600 Cal BC at 2sigma, following Friedrich's model. In effect the sequenced analysis of different measurements is said to show that the most sensible time-range for the Theran eruption falls between 1663 and 1589 Cal BC at a 95% confidence [30]. This implies a shift of ca. 100/120 Cal yrs in the absolute chronology of LM IA-B periods. A similar shift is suggested also by the ^{14}C data from LM IB contexts at Chania and Myrtos-Pyrgos, although they have proven to be problematic and more difficult to interpret [31].The ^{14}C data pertaining to the LM IB destructions at Chania and Myrtos-Pyrgos, presented also in Manning *et al*. 2006, are not taken in account in the present paper for the sake of simplicity. For a detailed, critical analysis of these results see several recent papers by Malcolm Wiener [32].

However precise, this reconstruction is not entirely free of problems or contradictions. A

relying on subjective and not entirely verifiable assumptions used for narrowing error bands in response to the number of measurements, irrespective of how consistent, inconsistent, or incongruous they are, Wiener, *pers. comm*. 25/11/2009, for which I am most grateful; Wiener forthcoming.

24 Manning *et al.* 2006.

25 Manning *et al.* 2006.

26 Manning *et al.* 2006.

27 Manning *et al.* 2006.

28 The radiocarbon measurements obtained from this olive branch may be questionable for the reasons exposed below in the text and in Wiener 2009; Id. forthcoming.

29 Friedrich *et al.* 2006.

30 Manning *et al.* 2003, 2006; Bronk-Ramsey *et al.* 2004; Manning 2007.

31 Manning 2007.

32 Especially Wiener 2003, Wiener 2007, 2009 and forthcoming.

However precise, this reconstruction is not entirely free of problems or contradictions. A good summary can be found in four papers by M.H. Wiener[33].In particular, if the $^{14}C/^{12}C$ ratio, in each sample,is indeed objective and bias-free, according to the radioactive decay law, all the models applied to transform it into calendar years (also taking in account the possible presence of local offsets reflected in the samples) are rather subjective, because they rely on assumptions often uneasy to verify. In particular, Wiener quotes the following possible sources of uncertainty:

1) seasonal variations reflecting differences in growing season between plants and trees growing in different environments, leading to a different absorption of ^{14}C from the winter «low» and the summer «high», which may also depend on local micro-climatic conditions. Problems may arise from the comparison between measurements obtained from short-lived materials and decadal/bidecadal measurements of trees in the radiocarbon curve, since «the intra-year difference alone in radiocarbon-age measurements between the summer high and winter low is said to vary generally between 8 and 32 radiocarbon years»[34].

2) local variability not picked up in the calibration curve (which is in fact a weighted probability band for the whole northern hemisphere);

3) uncertainty about the nature of the calibration curve because of the relatively small number of measurements on segments of known date, some of which are misleading[35], and from the use of decadal measurements, which would mask to some extent both the inter and the intra-year variability, with years of greater growth being overrepresented;

4) uncertainty about the nature of the algorithms used to connect the sample measurements to the calibration curve, and to combine the different datasets, which employ the number of measurements irrespective of consistency to offer a narrow probability band that could mask small and consistent offsets[36];

5) unknown error components between the different laboratories (the datasets presented in Manning *et al.*, 2006, show a mean difference in inter-laboratory measurements of 11.4 ^{14}C years, but this mean may mask wide swings in both directions[37]);

6) possible contamination of the samples from ^{14}C depleted carbon reservoirs. ^{14}C depleted carbon may derive from events of deep seawater up-welling and degassing, from groundwater reservoirs reached by plant roots, soil concentration/limestone formations, and volcanic venting. Other problems, that may not be recognised in the calibration curve, may arise also from solar activity cycles, as the 11 and 88 yrs sunspot cycles[38].

Regarding the possible contamination from depleted CO2, Wiener[39] quotes Morner and Etiope (2002) stating *«[in the] Tethyan Belt, high CO2 fluxes are related to important crustal formation of [...] carbonate rock [causing] high levels of CO2 concentration in ground and*

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[33] Especially Wiener 2003, Wiener 2007, 2009 and forthcoming.

[34] Wiener forthcoming.

[35] As recognised in Manning 2007.

[36] Wiener 2007, 2009 and forthcoming, with references; A. Michczynski, Influence of C14 Concentration Changes In The Past On Statistical Inference Time Intervals, in *Radiocarbon* 46 (2), 2004, pp. 997-1004; D.J. Keenan, Why Early Historical Radiocarbon Dates Downwind From the Mediterranean Are Too Early, in *Radiocarbon* 44 (1), 2002, pp. 225-237; D.J. Keenan, Radiocarbon Dates from Iron Age Gordion are confounded, in *Ancient West and East* 3, 2004, pp. 100-103; D.J. Keenan, *Anatolian Tree Rings Studies are Untrustworthy*, www.informath.org, 2006.

[37] Wiener, comm. pers. 25/11/2009.

[38] Wiener forthcoming; F.B. Knox-B.J. McFadgen, Radiocarbon/Tree-Ring Calibration, Solar Activity, And Upwelling of Ocean Water, in *Radiocarbon* 46 (2), 2004, pp. 987-995; D. Mauquoy-B. Van Geel-M. Blaauw-A. Speranza-J. Van der Plicht, Changes in solar activity and Holocene climatic shifts derived from 14C wiggle-match dated peat deposits, in *The Holocene* 14 (1), 2004, pp. 45-52.

[39] Wiener forthcoming, p. 13.

groundwater» and he draws the attention on the fact that «*the great earthquake at the at the beginning of the Late Cycladic I period [at Thera], 50 to 100 [Cal] years before the [LC I-LM IA] eruption, released quantities of magma through fissures*» and this statement seems relevant also with regard to the olive branch dated by Friedrich *et al.*[40].

To sum up, Wiener[41] concludes that «*[the] two sigma error bands of ±15 or less 14C years with respect to calibrated dates for the second millennium BC rest on highly optimistic assumptions concerning the accuracy and precision of the calibration curve, the near perfection of the algorithms connecting sample measurements to the calibration curve, the absence of seasonal and climate-induced variation, and the non-existence of 14C deficient carbon from any source in the samples tested [.]*».

In a recent paper[42], Manning has recognised some of this over-optimism, although he has also correctly observed that, while in theory any of these alteration effects is possible, it seems impossible to find a solid and unequivocal argument for the actual presence of one or more of them, claiming that «*at present there seems no even vaguely satisfactory explanation that could plausibly account for such a small and consistent/systematic 'old' age error/contamination for radiocarbon dates for the whole region at this time (and only this time)*»[43]. At this regard, it must be observed (as Wiener does) that while it is at present impossible to demonstrate such error/contamination effects, they would not necessarily need to apply to the «whole region» (as the datasets do not actually cover the whole Aegean region, and those from LM IA Trianda and Miletus are not really unequivocal as those from Akrotiri), and they would not necessarily apply «at this time (and only this time)» given the scarcity of radiocarbon determinations from earlier levels[44].

Wiener also notes that the claim of a «small and consistent/systematic» offset does not correspond to the facts, for the differences in measurements are neither small nor consistent; further, no information has been provided as to how discarded «outliers» were distinguished from included measurements[45].

Moreover, although it is undeniable that the pattern of radiocarbon results, after they are combined by the use of sequenced analysis, suggests a date for the Theran eruption and the LM IA period in the XVII century Cal BC, and that the datasets do combine very well in the AHC scenario with an impressive 95% probability, nevertheless the general pattern of uncombined radiocarbon data does not always seem homogeneous (*tab. 2, figs. 1-2*): this impression is even strengthened when the results are individually calibrated[46].

Out of 28 dates for the Akrotiri VDL published by Manning *et al.*[47], 16 fall between 3350 and 3140 BP, thus allowing to suggest that the eruption may have occurred in the XVI century Cal BC as well as in the (late) XVII (*tab. 2*).

In effect, after individual calibration 25 dates out of 28 suggest that an eruption date as late as the middle of the XVI century Cal BC is entirely possible, and 19 could also speak in favour (with a lower possibility) of a date later than 1530 Cal BC. It can be observed that a difference of only ±20 ^{14}C years is enough to undermine the measurements reliability for an «high» or a «low» date for the Akrotiri VDL within its tighter range. This value is very close to the available precision for a single AMS measurement. In this respect, it may be also noteworthy that the additional information provided by the Bayesian calculation for narrowing incertitude in the

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[40] Friedrich *et al.* 2006.
[41] Wiener forthcoming, pp. 9-10.
[42] Manning 2007.
[43] Manning 2007, p.111.
[44] Wiener 2007, 2009 and forthcoming.
[45] Wiener pers. comm. for which I am most grateful, Wiener 2009, and forthcoming.
[46] T. Fantuzzi, The debate on Aegean High and Low Chronologies: an Overview through *Egypt*, in *RdA* XXXI, 2007, pp. 53-65.
[47] Manning *et al.* 2006.

dataset mean relies heavily on assumptions introduced *a priori* that are rather subjectively determined values and thus dependent on the judgement of the person doing the calculation.

Of course, this does not deny the value of Bayesian sequenced analysis when applied to a consistent dataset, as it is case, where it has provided useful and significant information in the form of possible reconstructive frameworks. Nevertheless it seems enough to cast some doubt on the claimed «objectivity» of the radiocarbon chronology as opposed to the «subjectivity» of the archaeological reconstruction. In fact, given the present impasse,

Lab. Number	*Material*	*Species*	*Uncalibrated radio carbon date BP*	*Calibrated BC date at 1 sigma (68.2%)*	*Calibrated BC date at 2 sigmas (95.4%)*
Akrotiri, VDL (Manning *et al.*, 2006)					
OxA-11817	Carbonised seeds	*Lathyrus* sp.	3348 ± 31	1689 (62.2%) 1608 1570 (.7%) 1561 1546 (1.9%) 1541	1735 (5.2%) 1714 1694 (90.2%) 1531
OxA-11818	Carbonised seeds	*Hordeum* sp.	3367 ± 33	1728 (4.6%) 1721 1691 (63.6%) 1620	1744 (87.8%) 1605 1579 (7.6%) 1536
OxA-11820	Carbonised seeds	*Hordeum* sp.	3400 ± 31	1742 (68.2%) 1666	1862 (0.9%) 1853 1771 (94.5%) 1617
OxA-11869	Carbonised seeds	*Hordeum* sp.	3336 ± 34	1683 (51.5%) 1606 1574 (9.3%) 1558 1551 (7.4%) 1538	1730 (2.1%) 1719 1692 (93.3%) 1525
OxA-12175	Carbonised seeds	*Hordeum* sp.	3318 ± 28	1631 (22.5%) 1601 1593 (45.7%) 1532	1681 (954%) 1524
OxA-1548	Charcoal	*Lathyrus* sp.	3335 ± 60	1687 (41.0%) 1601 1593 (27.2%) 1532	1756 (94.2%) 1492 1478 (1.2%) 1459
OxA-1549	Charcoal	*Lathyrus* sp.	3460 ± 80	1888 (68.2%) 1687	2012 (0.6%) 2000 1978 (92.7%) 1606 1576 (2.1%) 1537
OxA-1550	Charcoal	*Lathyrus* sp.	3395 ± 65	1862 (2.6%) 1851 1772 (65,.%) 1611	1880 (8.0%) 1838 1831 (87.4%) 1529
OxA-1552	Charcoal	*Lathyrus* sp.	3390 ± 65	1861 (1.6%) 1853 1771 (65.5%) 1608 1568 (1.1%) 1563	1879 (7.1%) 1838 1831 (88.3%) 1526
OxA-1553	Charcoal	*Lathyrus* sp.	3340 ± 65	1690 (68.2%) 1530	1866 (1.1%) 1849 1774 (92.7%) 1491 1480 (1.6%) 1456
OxA-1554	Charcoal	*Lathyrus* sp.	3280 ± 65	1632 (65.3%) 1494 1473 (2.9%) 1464	1762 (1.4%) 1718 1692 (94.0%) 1430
OxA-1555	Charcoal	*Lathyrus* sp.	3345 ± 65	1608 (15.8%) 1570 1561 (52.4% 1448	1682 (95.4%) 1411
OxA-1556	Carbonised seeds	*Hordeum* sp.	3415 ± 70	1871 (7.8%) 1846 1812 (2.4%) 1803 1776 (58.1%) 1626	1891 (95.4%) 1530
K-5352	Pulses	-	3310 ± 65	1668 (6.2%) 1516	1741 (95.4%) 1451
K-5353	Pulses	-	3430 ± 90	1879 (11.1%) 1839 1829 (57.1%) 1633	1961 (95.4%) 1513
K-3228	Pulses	-	3340 ± 55	1688 (43.8%) 1603 1589 (24.4%) 1534	1753 (95.4%) 1497
K-4255	Charred twig	*Tamarix* sp.	3380 ± 60	1750 (64.8%) 1608 1570 (2.3%) 1561 1546 (1.1%) 1541	1877 (4.2%) 1842 1822 (2.6%) 1797 1781 (88.1%) 1521
VERA-6795	Peas	*Pisum sativum*	3360 ± 60	1739 (11.7%) 1707 1697 (43.5%) 1606 1576 (13.0%) 1536	1871 (2.1%) 1846 1811 (0.5%) 1804 1776 (92.8%) 1500

(*continua*)

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VERA-5519	Grains	-	3490 ± 80	1915 (63.0%) 1735 1714 (5.2%) 1694	2027 (95.4%) 1621
VERA-6795	Grains	-	3140 ± 70	1498 (57.7%) 1371 1346 (10.5%) 1316	1606 (2.1%) 1573 1559 (0.5%) 1550 1539 (91.6%) 1257 1230 (1.3%) 1216
Akrotiri, mature LM I A (samples divided between Oxfordand Wien - Manning *et al*., 2006, Bronk Ramsey *et al*., 2004)					
OxA-12170	Carbonised seeds	*Lathyrus* sp.	3336 ± 28	1682 (56.4%) 1607 1572 (7.1%) 1560 1548 (4.7%) 1540	1690 (95.4%) 1528
VERA-2757	Carbonised seeds	*Labhyrus* sp.	3315 ± 31	1627 (20.6%) 1600 1594 (7.6%) 1532	1682 (95.4%) 1520
-repetition	Carbonised seeds	*Labhyrus* sp.	3390 ± 32	1738 (28.8%) 1708 1697 (30.7%) 1661 1654 (11.7%) 1638	1770 (95.4%) 1609
OxA-12171	Carbonised seeds	*Hordeum* sp.	3372 ± 28	1727 (4.2%) 1721 1691 (64.0%) 1627	1745 (93.9%) 1608 1570 (1.0%) 1561 1546 (0.5%) 1541
VERA-2758	Carbonised seeds	*Hordeum* sp.	3339 ± 28	1684 (60.4%) 1608 1570 (5.1%) 1561 1546 (2.7%) 1541	1691 (95.4%) 1528
-repetition	Carbonised seeds	*Hordeum* sp.	3322 ± 32	1658 (1.3%) 1655 1636 (25.2%) 1602 1592 (41.6%) 1532	1687 (95.4%) 1522
OxA-12172	Carbonised seeds	*Hordeum* sp.	3321 ± 32	1636 (25.2%) 601 1593 (43.1%) 1532	1686 (95.4%) 1521
VERA-2756	Carbonised seeds	*Hordeum*	3317 ± 28	1623 (21.2%) 1605 1581 (47.0%) 1536	1664 (2.7%) 1652 1641 (92.7%) 1526
OxA-10312	Charcoal	*Tamaris* sp.	3293 ± 27	1608 (68.2%) 1530	1632 (95.4%) 1501
VERA-2748	Charcoal	*Tamaris* sp.	3319 ± 28	1631 (23.1%) 1602 1592 (45.1%) 1532	1681 (95.4%) 1525
OxA-10313	Charcoal	*Tamaris* sp.	3353 ± 27	1681 (68.2%) 1616	1736 (6.1%) 1712 1695 (76.1%) 163 1589 (13.1%) 1534
VERA-2749	Charcoal	*Tamaris* sp.	3335 ± 33	1682 (51.1%) 1606 1574 9.5%) 1558 1551 (7.6%) 1538	1728 (1.3%) 1720 1691 (94.1%) 1525
OxA-10314	Charcoal	*Olea europaea*	3330 ± 27	1663 (8.3%) 1651 1641 (31.9%) 1605 1577 (28.1%) 1536	1686 (95.4) 1525
VERA-2750	Charcoal	*Olea europaea*	3325 ± 28	1658 (1.8%) 1655 1637 (27.4%) 1604 158 (39.0%) 1534	1685 (95.4%) 1527
OxA-10315	Charcoal	*Olea europaea*	3449 ± 39	1874 (16.3%) 1844 1815 (7.0%) 1800 1778 (29.9%) 1730 1719 (15.0%) 1692	1885 (95.4%) 1667
VERA-2743	Charcoal	*Olea europaea*	3413 ± 28	1750 (68.2%) 1682	1866 (2.8%) 1849 1774 (92.6% 1629
OxA-10316	Charcoal	*Olea europaea*	3342 ± 38	1687 (53.8%) 1606 1574 (8.0%) 1558 1551 (6.4%) 1538	1737 (5.7%) 1712 1695 (89.7%) 1525
VERA-2744	Charcoal	*Olea europaea*	3427 ± 31	1771 (68.2%) 1686	1877 (10.0%) 1841 1822 (4.4%) 1797 1781 (81.0%) 1635
OxA-1317	Charcoal	*Olea europaea*	3440 ± 35	1868 (10.7%) 1848 1775 (57.5%) 1690	1881 (95.4%) 1666

(*continua*)

(*continuazione*)

VERA-2745	Charcoal	*Olea europaea*	3386 ± 28	1737 (20.3%) 1712 1695 (47.9%) 1636	1747 (95.4%) 1617
OxA-10318	Charcoal	*Olea europaea*	3355 ± 40	1732 (5,6%) 1718 1693 (57,4%) 1608 1570 (3,4%) 1561 1546 (1,8%) 1541	1740 (95.4%) 1530
VERA-2746	Charcoal	*Olea europaea* *Olea europaea*	3471 ± 28 3424 ± 38 3386 ± 30	1877 (25.3%) 1842 1821 (15.8%) 1797 1781 (27.1%) 1745	1884 (91.1%) 1737 1712 (4.3%) 1695
OxA-10319	Charcoal			1864 (5.2%) 1850 1773 (63.0%) 1682	1877 (10.8%) 1841 1826 (6.0%) 1796 1783 (78.6%) 1629
VERA-2747	Charcoal			1737 (20.3%) 1712 1695 (47.9%) 1636	1753 (95.4) 1611
Akrotiri, VDL (Friedrich *et al*., 2006)					
Hd-23599/24426	Charcoalized twig - ring 1-13	*Olea europaea*	3383 ± 11	1731 (14.1%) 1719 1692 (42.9%) 1663 1651 (11.3%) 1641	1738 (23.9%) 1710 1695 (71.5%) 1631
Hd-23587	Charcoalized twig - ring 14-37	*Olea europaea*	3372 ± 12	1688 (43.9%) 1660 1654 (24.3) 1638	1731 (6.1%) 1718 1692 (89.3%) 1625
Hd-23589	Charcoalized twig - ring 38-59	*Olea europaea*	3349 ± 12	1666 (68.2%) 1620	1689 (95.4%) 1609
Hd-23588/24402	Charcoalized twig - ring 60-72	*Olea europaea*	3331 ± 10	1659 (3.5%) 1655 1638 (53.2%) 1608 1570 (75%) 1561 1547 (4.0%) 1541	1677 (67.2%) 1603 1588 (28.2%) 1531

Table 2 - Radiocarbon dates for the Theran eruption mentioned in the text, individually calibrated (after Fantuzzi 2007), against IntCal 04 calibration curve (Reimer *et al*. 2004) according to OxCal 4.1 (Bronk-Ramsey 2009).

all of the possible chronological reconstructions (both the «high» and the «low») do undeniably bear some degree of subjectivity, and this cannot safely be dismissed.

The second very important argument in favour of the AHC lies in the mentioned sequence reported by Friedrich *et al*.[48]. These measurements where taken from a 72 ring olive branch. They all fall in the right dendrochronological order, with older rings yielding older dates. The outer ring yielded a date of 3331±10 BP, which falls into the oscillating portion of the calibration curve, although it has been calibrated to 1613±13 BC after combining it with the measurements from earlier rings, which fall outside of the oscillating portion. However precise this date can be, the first problem lies in the impossibility to determine whether the branch was dead or alive at the time of the eruption. While the tree itself was probably alive (as the excavators found traces of leaves), the branch in question might have died several decades before the eruption since we know that olives can bear dead branches for up to 100 years[49]. Wiener notices that the radiocarbon date of 1613±13 Cal BC proposed for the last ring of the branch[50] fits perfectly into the absolute date of the seismic destruction event at the beginning of LC I[51], that might have caused the death of the branch[52].

[48] Friedrich *et al.* 2006.

[49] Wiener 2007, 2009 and forthcoming; Blitzer, quoted in Wiener forthcoming.

[50] Friedrich *et al.* 2006.

[51] Wiener forthcoming.

[52] This argument is however full of implications, as the contemporaneity between the radiocarbon dates obtained from the seeds sampled and those from the olive branch needs explanation, if one considers the branch to have died long before the eruption (Ramsey, pers. comm. for which I am most grateful).

Another element of uncertainty consists in the volcanism of the island itself: apart from a possible contamination from volcanic venting (a possibility that was denied by Friedrich, but that cannot be completely discarded), the tree might very easily have picked up ^{14}C depleted carbon through the roots, as it is very abundant on the soils and groundwater of Thera.

Moreover, it is important to point out that the radiocarbon dates from Tell el Dab'a, so far unpublished, provide another argument against an independent shift of the Aegean and Cypriot absolute chronologies. They seem to show an «old age» alteration effect, comparable to that hypothesised for the radiocarbon dates from Thera, which leads the measurements for Thutmosis III's age, in particular, to be comparable to the interval proposed for the Theran eruption, 150-180 Cal yrs older than the historical date [53]. These dates question the Egyptian absolute chronology itself, and this confirms the impression of an unfillable gap between the historical/archaeological chronology and the radiocarbon one for the wider Eastern Mediterranean region, although other dates for queen Hatshepsut yr 7 foundation deposit (also unpublished [54]) have produced results in close agreement with the historical chronology [55]. The publication of those datasets (which is forthcoming [56]) is highly welcome, as a thorough comparison between this «shifted» sequence and those from the Aegean is not possible without knowing uncalibrated results and error bands plus all the contextual information about the measurements. Such a comparison will undoubtedly bring new elements about the presence of an error/alteration in the historical chronology or in the radiocarbon measurements for the XV-XIV centuries Uncal BP. Once again, the presence of alteration effects cannot be so far demonstrated concretely, although it cannot be ruled out in the absence of an unequivocal proof, and is to be kept in consideration, if one is looking for «objectivity» (as far as it is possible).

To sum up, there is still too much uncertainty about the radiocarbon evidence to consider it a conclusive proof without the support of any archaeological record. Of course uncertainty affects the archaeological contexts used for chronological interrelationships. Finding the reason for the discrepancy between archaeological and radiocarbon chronologies is very difficult at the present moment. It seems the case that a conclusive solution to the problem of the Aegean LBA I-II absolute chronology is not possible so far, and we need additional evidence on both sides.

Even though it is undeniable that some uncertainty very often occurs in the archaeological contexts, and that the traditional chronology is not «fixed and immutable», there is not enough convincing evidence to justify an unilateral independent shift of the Aegean and Cypriot chronologies of some 100/120 Cal yrs. The archaeological record is very widely and systematically arguing in favour of a chronology rather lower than that

[53] H.J. Bruins, Charcoal Radiocarbon Dates of Tell el Dab'a, in Bietak-Czerny 2007, pp. 65-78; Bietak-Höflmayer 2007, pp. 13-24.

[54] Consisting in 10 measurements giving results wholly consistent with the «traditional» historical chronology, see Wiener forthcoming.

[55] Bietak, pers. comm., 28/08/09 for which I am most grateful.

[56] W. Kutschera-M. Bietak-C. Bronk Ramsey-M. Dee-R. Golser-T. Higham-K. Kopetzki-P. Stadler-P. Steier-U. Tanheiser-F. Weninger-E.M. Wild, Radiocarbon dating at Tell el-Daba and its relation to the archaeological and historical chronology of Egypt in the Second Millennium B.C., forthcoming.

proposed by Manning *et al.*[57] and Friedrich *et al.*[58], while opposite arguments may be found only in a very few and rather doubtful contexts[59].

On the other hand, it is also undeniable that the absence of an unequivocal and conclusive argument to finally discard this hypothetical shift is noteworthy. Thus it seems clear that more new evidence is needed before an acceptable conclusive solution on the chronological debate can be found, and that at least some – if minor – changes in the traditional interrelated «low» chronologies are plausible, from the archaeological elements that follow.

The archaeological record for interrelated chronologies

The chronology of the end of the S.I.P. and the beginning of the XVIII Dynasty in Egypt is unfortunately not very well linked to that of Minoan Crete. This might reflect the period of reorganisation and expansion of the Egyptian trade and influence during/after the fall of the Hyksos power and trading network, that took place during this time-span[60]. However, some fairly good dating evidence can be found, which link the chronology of Egypt and LM Crete both directly (through the presence of datable artefacts of Egyptian origin in Crete and *vice versa*) and indirectly, through the Cypriot tomb assemblages and ceramic sequences. We can state that the S.I.P. in Egypt was somewhat contemporary with MM III in Crete, as it is arguable by a few findings including the serpentine lid bearing the cartouche of Khyan, found at Knossos in a context attributed by Evans to MM III. Similarly, with regard to MC III in Cyprus we can fix a chronological beacon around 1620 - 1600 Cal BC, when Egyptian Tell el Yahudieh (TY) ware, produced at Tell el Dab'a or in the neighbouring centres, is exported to the island, which supports the MC III - S.I.P. correlation[61]. Even if some doubts can be cast on the context of the Egyptian imports to Crete (the context of the Khyan lid may, for example, be also attributed, although less likely, to LM IA), this latter connection, based on the presence of imported TY ware, seems hardly discardable without questioning the Egyptian chronology itself. The archaeological elements that link the first part of the XVIII Dynasty to the Mediterranean framework are more abundant thanks to a long series of interpretative elements, that are insufficient on their own to prove or dismantle the Aegean High Chronology (AHC) hypotheses, but that fit well with other pivotal arguments for the traditional interrelated chronology (as the PWS - WS I sequence), and are very less likely – if at all – interpretable in the AHC scenario.

This is the case for the findings from Akrotiri, where the chronology suggested by the reworked Egyptian alabastron Akr*1800, datable between the S.I.P. - N.K. transition and the early XVIII Dynasty[62], is confirmed by the presence of the famous a WS I cup, from

[57] Manning *et al.* 2001, 2003, 2006; Bronk-Ramsey *et al.* 2004.

[58] Friedrich *et al.* 2006.

[59] Wiener 2003, 2007, 2009 and forthcoming; contra Manning 1999, 2007; Manning 2005, pp. 97-114; Manning *et al.* 2001, 2002, 2003; G. Cadogan - E. Herscher - P. Russel - S.W. Manning, Maroni-Vournes: a Long White Slip sequence and its Chronology, in Karageorghis 2001, pp. 75-88.

[60] M.W. Bietak, The Tuthmoside stronghold of Perunefer, in *Egyptian Archaeology* 26, 2005, pp.13-17.

[61] Bietak 2004; Eriksson 2001, 2003.

[62] Bietak 2004, pp. 200-222; P.M. Warren, Crete and Egypt: The Transmission of Relationships, in A. Karetsou ed., *ΚΡΗΤΗ ΑΙΓΥΠΤΟΣ: Πολιτιστικοί δεσ-μοί τριών χιλιετιών*, Αθήναι 2000, pp. 24-28; Warren 2006.

Gorceix's excavations. Together with these, many other elements can be found in a few Aegean and Cypriot LB I contexts to support the rough synchronism between (mature) LM IA and the early XVIII Dynasty:

1) A reworked Egyptian alabastron and an egyptianising jar, both likely datable to the early XVIII Dynasty, have been found in uncontaminated LH I contexts in the Shaft Graves at Mycenae [63];
2) The Aegean materials from the Cypriot tomb assemblages allow us to postulate a synchronism between the LC IA2 period and LM IA. Furthermore there are several arguments which correlate LC IA2 with the Egyptian chronology, and especially to the Thutmosisde era, among which are an Ahmose-inscribed vessel that has been found in a probable LC I A context at Palaepaphos-Teratsoudhia tomb 104, the Egyptian *Mechak* razors of probable (but not certain) Thutmosisde age found in LC IA2-IB tombs, and, of course, the famous PWS - WS I and PBR-BR export sequences.
3) The pumice ejected by the Theran eruption nowhere appears before the XVIII Dynasty or the LBA in the Levant, when in turn it becomes very widely documented. Unfortunately this event cannot be used as an unequivocal argument, as Theran pumice was in use for many centuries [64]. Nevertheless, it is important to point out that it always appears after 1530 Cal BC.
4) By far the most important argument, the Cypriot PWS-WS I, PBR-BR I, and its related ceramic sequences, closely comparable both in Cyprus and Tell el Dab'a, Ashkelon, Lachish and Tell el Ajjul, allow us to formulate an acceptable chronological network between Egypt, the Levant, Cyprus and (by LC IA2) the Aegean during the entire XVI-XV centuries.

PWS, typical of NW Cyprus LC IA1, always makes its appearance in Egypt and the Levant around the end of the S.I.P.-MBA (Tell el Dab'a phase D/2). Almost no direct link (apart from the above-mentioned imported vessels) between the Aegean and Egypt is known at this early phase, although there is very good evidence for the later Thutmoside era, when the subsequent WS I and BR I wares are found in closely datable contexts at Tell el Dab'a (phase C/3) and in the Levant, and also in Cypriot LC IA2 tomb assemblages together with LM IA wares [65]. WS I and BR I never make their appearance out of Cyprus before the beginning of the NK/LBA, except for a doubtful context from Tell el Ajjul [66]. After ca. 1530 Cal BC they are often attested from reliable stratigraphic sequences [67], which almost systematically recall the same development already known from (NW) Cyprus. This suggests that a significant delay between their first production and (hypothetical) later export is unlikely. Both WS I and BR I make their appearance at Tell el Dab'a not earlier

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[63] Warren 2006.

[64] Wiener 2003, 2007.

[65] Eriksson 2001, 2003.

[66] Bergoffen 2001.

[67] Bergoffen 2001, 2003; M.W. Bietak-I. Hein, The context of White Slip Wares in the Stratigraphy of Tell el Dab'a and some conclusions on Aegean Chronology, in Karageorghis 2001, pp. 171-194; P. Åström, The Relative and Absolute Chronology of the Proto White Slip Ware, in Karageorghis 2001, pp. 49-50; M.W. Bietak, Science versus Archaeology: Problems and Consequences of High Aegean Chronology, in Bietak 2003, pp. 23-34; P.M. Fischer, The Preliminary Chronology of Tell el Ajjul: Results of the Renewed Excavations in 1999-2000, in Bietak 2003, pp. 263-294; Eriksson 2001, 2003; Bietak 2004; M.H. Wiener, The White Slip I of Tell el Dab'a and Thera: Critical Challenge for the Aegean Long Chronology, in Karageorghis 2001, pp.195-244, Wiener 2003, 2007.

Period (Crete)	*Cal BC age 48*	*Egyptian correlations*	*Period (Cyprus)*	*Cal BC age1*	*Egyptian correlations*
MM III	? - 1620/1600	*Post* Khyan	MC III	? - 1600	Ty ware in Cyprus
LM I A	1620/1600 - 1520/1500		LC I A 1	1620/1600 - 1550	PWS in Tell el Dab'a D/2
		*Ahmose? *Thutmosisde age?	LC I A 2	1550 - 1500	PWS - WS I transition in Tell el Dab'a - 'Ezbet Helmi (?)
LM I B	1520/1500 - 1440/1425				
		Thutmosis III	LM I B	1500 - 1440/1425	WS I in Tell el Dab'a - 'Ezbet Helmi C/3
LM II	1440/1425 - 1440	Late Thutmosis III/ Amenhotep II	LC II	1400 - 1425 - *Post* 1375	WS II in Tell el Dab'a - 'Ezbet Helmi C/2
LM III A 1	1440/1375	Amenhotep III			
LM III A 2	Post 1375	Amarna age			

TABLE 3 - THE «RAISED LOW» CHRONOLOGY SCENARIO.

than phase C/3, well into the XVIII Dynasty, and most likely during the reigns of Hatshepsut and Thutmosis III; they are known also from closely comparable phases in Lachish, Ashkelon and Tell el Ajjul. The following LC IB imports, in the form of typical WS II and BR II, start to appear in Egypt and the Levant before the death of Thutmosis III (Tell el Dab'a phase C/3), in a period which can be linked with LM IB in Crete through a few imported items from Egyptian contexts of this age. They are: 1) the Minoan/Helladic alabastron JdE 47772 and cup JdE 47773 found in tomb NE1 at Saqqara together with LC I ware, 2) the assemblages of Medinet al Gurob tomb 245 (with its LH II A alabastron JdE 47079) and of Sidmant, cemetery A, tomb 137 (with a LM IB alabastron), all dated, although not beyond any doubt, to the reign of Thutmosis III[68]. The position of LC I A2 in this picture is indeed not very clear, as we shall see later. Furthermore there is also evidence to suppose that the LM II/LH IIB periods began before the end of the reign of Thutmosis III, as a LH IIB jar (now in the Ashmolean Museum) is reported to have been found in Coffin 9 in the tomb of Maket, dated to the reign of this King. This archaeological reconstruction may be closed, after a gap in the documentation for the reign of Thutmosis IV, with the fairly solid correlation between Amenhotep III and the Aegean LM/LH III A1 period, which is supported by the Egyptian imports of this date from Sellopoulo Tomb 4, from Isopata Royal Tomb, and Mycenae. The relationship between the Amarna age and LM/LH III A2, which is confirmed also by the large amount of LH III A2 ware found in Egypt and by the radiocarbon dates, is unquestioned. All these archaeological elements have been put together by Warren in the *Timelines* volumes[69], and may be synthesised as follows (*tab. 3*).

Heirloom effect/Regional barriers

The only possibility for accepting the AHC without questioning the Egyptian chronology, would be a complete revision of the chronology of Late Cypriot I A1 - B inter-

[68] ASTON, New Kingdom... cit. in note 17; WARREN 2006.

[69] E. CZERNY - I. HEIN - H. HUNGER - D. MELMAN - A. SCHWAB eds., *Timelines: Studies in Honour of Manfred Bietak (Orientalia Lovaniensia Analecta* 149), I - III, Leuven - Paris - Dudley 2006.

nal sequences, and the chronological value of the exported PWS-WS I and PBR-BR I sequences, on the base of an hypothetical regional delay affecting in particular the adoption of PWS and WS wares in the Eastern Cypriot assemblages [70]. Manning [71] correctly observed that the Cypriot imports sequence from Tell el Dab'a is somehow problematic: in particular there is a possible gap in the Cypriot assemblages from phases D/1-C/3 of this site (ca. 1530-1480 Cal BC), that may in turn correspond to the period of its reorganisation as an international port after the end of the S.I.P and the Hyksos rule. This gap is marked by the absence of overlapping between different ceramic classes, the most relevant of which are PWS and WS I wares, which overlap during the whole LC IA2 - early LC IB periods in Cyprus, but coexist in Tell el Dab'a for only a very short period. WS II and BR II make their appearance at Tell el Dab'a by the end of the reign of Thutmosis III (phase C/2), and, following the traditional reconstruction, this would shorten the chronology of LC IA2-IB as seen from Tell el Dab'a to some 50-80 calendar years, a figure which seems too low. As a result, it is conceivable that a significant part of at least LC IA2 is underrepresented within the Tell el Dab'a sequence, that the Cypriot assemblages of phases D/1 - C/3 may reflect actual different trading partners within Cyprus, and that the chronology of LC IA2 may possibly be shifted back by a significant time span: to what chronological extent?

The Cypriot tomb contexts which yielded TY pottery seem to offer a fairly solid datum line for linking the LC IA1 period to a period not earlier than phases D/3-D/2 (env. 1600-1530 BC), but possibly also to phase E/1. This fact definitely allows a shift of some kind within the internal Cypriot development, but this uncertainty cannot move much further beyond the last decades of the XVII century, because of the TY evidence from MC III contexts, as for instance Apera tomb IA, that have produced TY specimens datable to Tell el Dab'a phases E/3 and E/2. The presence of other Cypriot wares typical of LC IA1 in Tell el Dab'a phase D/2 (as the Black and White Hand Made), together with the PWS evidence, gives the impression that LC IA1 can be linked to the advanced/final S.I.P phases (D/3 - D/2), and is not very likely to be much earlier. The WP III/IV evidence seems to confirm this pattern also, as it is never found together with PWS (a coexistence that would be typical of Eastern Cypriot LC IA contexts), and seems even residual in phase D/3. This, instead of advocating an higher LC IA1 chronology, seems rather to confirm the link between the LC IA periods and Tell el Dab'a phases D/3 - C/3. It seems also to allow for the presence of regional barriers between Eastern and North-Western Cyprus, but only *after* ca.1600 Cal BC (allowing possible delay-effects). Manning [72] tries to by-pass this problem by postulating the presence of regional barriers and different trading partners between NW Cyprus (where PWS and WS were produced first) and Eastern Cyprus (where WS ware was adopted only at a later stage). The Cypriot assemblages from Tell el Dab'a would originate from the latter (and this would account for their delayed arrival in Egypt), while the WS I specimen from Thera would be a NW one, arriving there more than a century prior to the Egyptian specimens.

These hypotheses, if not impossible to discard in the absence of a conclusive argument, are quite unlikely from an archaeological point of view, because they are challenged by two main questions:

[70] MANNING 1999, 2005, 2007; CADOGAN-HERSCHER-RUSSEL-MANNING, Maroni-Vournes … cit. in note 61; MANNING *et al*. 2002, 2003.

[71] MANNING 2007.

[72] MANNING 1999, 2005, 2007.

(1) The absence of any evidence for a delay up to 100/120 Cal yrs in the adoption of LC IA ceramic tradition between Western and Eastern Cyprus. Even if it is undeniable that some uncertainty often affects the contexts used for chronological interrelations, so far there are not enough convincing elements to suggest that LC IA period begins earlier than 1625 Cal BC, and the contexts of TY ware in Cyprus, and of Cypriot imports in Egypt and the Levant, do strongly argue for a later date. The presence of regional barriers in LC IA Cyprus is possible but, according to the available archaeological data, they do not seem likely to allow for a very long delay, as that required by the hypothetical presence of early LC IA2 WS I on Thera *before* 1600 Cal BC[73].

(2) The absence of any evidence for the statement that Tell el Dab'a and (at least) part of the Levant had exchanges only with Eastern Cyprus. This may be the case for later imports, but the Cypriot assemblages from Tell el Dab'a phases D/3 and D/2 do not show less affinities with Western Cyprus (and especially Toumba tou Skourou) than with Eastern Cyprus[74]. This suggestion seems confirmed by the presence of TY ware in NW Cyprus, the typological affinity between the PWS specimens from Tell el Dab'a and the production from Toumba tou Skourou, and the absence of WP III/IV overlapping with PWS (a coexistence typical of Eastern Cyprus) in the Tell el Dab'a sequence.

Moreover, at Toumba tou Skourou PWS was found in association with both WS I and LM IA wares, but never with TY ware. In this regard we may recall also the presence of BWHM Cypriot ceramics from Tell el Dab'a layer D/2. PWS ware does in fact appear in contexts without WS I at Pendayia, Akhera and Toumba tou Skourou (where even transitional PWS-WS I is recognisable), and together with PBR at Stephania. Thus it can be considered a NW Cypriot invention, which makes its appearance only in later Eastern Cypriot contexts. In this light, the presence of PWS without WS I in Tell el Dab'a phase D/2 might offer another suggestion in favour of a connection between this site and (also) NW Cyprus in the late/final S.I.P.

To sum up, if at present there is a gap in the Cypriot sequence at Tell el Dab'a, it seems likely to correspond to the LC IA2 period in Cyprus, and in turn, to the reorganisation of the site as an international port after the conquest of Avaris and the establishment of the NK. The beginning of LC IA2 may well be shifted back to 1575 or even 1600 Cal BC, although this cannot allow for a date of the Minoan Eruption *before* 1600 Cal BC, and there seems to be not a single good reason to push the beginning of the preceding LC I A1 to a date earlier than 1630 Cal BC, while there seem to be reasonable evidence for a start date slightly later, even in NW Cyprus.

As a result, it seems unlikely, albeit not impossible, that WS I reached Thera prior to ca. 1580/1570 Cal BC, even allowing sensible regional delays in Cyprus. This impression fits very well with the (raised) low chronology, given the occurrence of LM I B materials

[73] R.S. Merillees, Some Cypriot White Slip Pottery from the Aegean, in Karageorghis 2001, pp. 89-100. It has to be noted, however, that the North Western Cypriot origin of the WS I specimen from Thera is questioned by many scholars (Wiener *pers. comm.* 25/11/2009), and the same can be said for its being *early* LC I A 2 (see Wiener, The White Slip… cit. in note 69; Wiener forthcoming).

[74] Eriksson 2001, 2003.

<table>
<tr><th>Historical Date (Cal BC)</th><th>Phases in Tell el Dab'a</th><th colspan="9">Selected Cypriot wares from Tell el Dab'a</th><th>Archaeological/historical Cypriot Chronology</th></tr>
<tr><td>1700</td><td rowspan="3">F</td><td rowspan="12">WP III/IV</td><td rowspan="9"></td><td rowspan="15"></td><td rowspan="15"></td><td rowspan="23"></td><td rowspan="23"></td><td rowspan="23"></td><td rowspan="26"></td><td rowspan="26"></td><td rowspan="13">MC III</td></tr>
<tr><td>1690</td></tr>
<tr><td>1680</td></tr>
<tr><td>1670</td><td rowspan="3">E/3</td></tr>
<tr><td>1660</td></tr>
<tr><td>1650</td></tr>
<tr><td>1640</td><td rowspan="3">E/2</td></tr>
<tr><td>1630</td></tr>
<tr><td>1620</td></tr>
<tr><td>1610</td><td rowspan="3">E/1</td><td rowspan="14">WP V</td></tr>
<tr><td>1600</td></tr>
<tr><td>1590</td></tr>
<tr><td>1580</td><td rowspan="3">D/3</td><td rowspan="3">Residual?</td></tr>
<tr><td>1570</td><td rowspan="9">LC I A 1/2</td></tr>
<tr><td>1560</td></tr>
<tr><td>1550</td><td rowspan="3">D/2</td><td rowspan="15"></td><td rowspan="8">BWHM</td><td rowspan="8">PWS</td></tr>
<tr><td>1540</td></tr>
<tr><td>1530</td></tr>
<tr><td>1520</td><td rowspan="3">D/1.2</td></tr>
<tr><td>1510</td></tr>
<tr><td>1500</td></tr>
<tr><td>1490</td><td rowspan="2">D/1.1</td></tr>
<tr><td>1480</td><td rowspan="7">LC I B</td></tr>
<tr><td>1470</td><td rowspan="3">C/3</td><td rowspan="7"></td><td rowspan="7"></td><td rowspan="7"></td><td rowspan="7">WS I</td><td rowspan="7">BR I</td><td rowspan="7">RLWM</td></tr>
<tr><td>1460</td></tr>
<tr><td>1450</td></tr>
<tr><td>1440</td><td rowspan="4">C/2</td><td rowspan="4">WS II</td><td rowspan="4">BR II</td></tr>
<tr><td>1430</td></tr>
<tr><td>1420</td></tr>
<tr><td>1410</td><td>LC II</td></tr>
</table>

TABLE 4 - CHRONOLOGY OF THE CYPRIOT CERAMIC ASSEMBLAGES FROM TELL EL DAB'A (AFTER BIETAK - HÖFLMAYER 2007).

in Thutmosis III contexts, XVIII Dynasty materials in LM I A-B contexts in Crete [75] and in LC I A 1-2 contexts in Cyprus.

Manning [76] does certainly deserve the credit of having demonstrated that more new evidence is necessary, also from an archaeological point of view, to achieve a conclusive opinion on the interlinked chronologies, and of stimulating the collection of a new amount of data, from all the different points of view, and in particular it seems relevant to note that:

(1) At least part of the LM I A period in Crete is certainly contemporary with the late S.I.P.;
(2) At least part of the LC I A2 period in Cyprus is possibly contemporary with the late S.I.P., the transition between the preceding LC I A1 and LC I A2 being not very well attested in the Cypriot assemblages at Tell el Dab'a phases D/2 - D/1 (*tab. 4*).

Notwithstanding this fact, there is no good evidence to maintain that the shift requited by the AHC maybe an acceptable solution. Smaller shifts have been entirely accepted/suggested also by non-supporters of the long chronology [77], with modest adjustments of the traditional interrelated chronologies.

Allowance of a shift of some 120 Cal yrs on the Minoan, Helladic, Cycladic and NW Cypriot chronologies is based only on indirect evidence (i.e. uncertainty about imported contexts and heirloom effects), while one would expect to find a good direct evidence

[75] J. PHILLIPS, *Aegyptiaca on the island of Crete in Their Chronological Context: A Critical Review* (2 Voll.), Wien 2008.

[76] MANNING 1999, 2005, 2007; MANNING *et al.* 2001, 2002, 2003, 2006; BRONK-RAMSEY *et al.* 2004.

[77] WARREN 2006; V. KARAGEORGHIS, *Cipro. Crocevia del Mediterraneo orientale 1600-500 a.C.*, Milano 2002.

allowing us to formulate a different, but detailed and coherent chronological framework. The few WS I specimens found in contexts possibly earlier than 1530 Cal BC (including the one from Thera) do not offer a solid chronological beacon: using them as a «fossil guide» to postulate a different chronological hypothesis bears something of a circular argument given that they are: (1) very few in number and looking rather sporadic, and (2) all coming from doubtful contexts only possibly datable to the XVII century BC[78]. Using these contexts to date the imports to a period prior to 1530 Cal BC bears also all the subjectivity involved in using all the other imported contexts to formulate an absolute chronology, although with the significant difference that these latter are more abundant, regular and well interlinked in the archaeological record, so as to allow the formulation of a concrete interpretative framework. Apart from the PWS-WS I and its related ceramic sequences, which would need to be repeated continuously, including formative and transitional-style phases, for some 120-140 Cal yrs to allow a date for the Theran eruption around 1630/1600 BC the chronological argument based on Egyptian interrelationships rests on many other independent elements, among which are the TY ware and XVIII Dynasty objects in Cypriot contexts, the Egyptian objects of XVIII Dynasty date found at Akrotiri and Mycenae, the LM IA rhyta vase shapes reproduced in Egypt during the XVIII Dynasty, and never found in Hyksos contexts[79], and the depiction of LM IA items in the Theban tombs. While it is possible for an individual object to be an heirloom even much older than the assemblage where it was recovered, and while very often archaeological contextual interpretation bears *in se* some degree of uncertainty, large number of imported objects – including several highly-valued items – are really unlikely to arrive with regularity after some 80-100 Cal yrs of delay[80]. It is clear, from all the above-mentioned elements, that the absolute chronology of the Aegean LBAI-II can hardly be independently shifted back by such a long time-span (as that requested by Manning and Friedrich) without shifting to some extent also the Egyptian chronology for the late S.I.P.-Early XVIII Dynasty. The close relationship between Cypriot LC I wares and Egypt, the interconnections between LC IA2 and LM IA and the presence of Egyptian artefacts in both LM/LH I Greece and Thera do combine very well, clearly showing that the real pattern of archaeological data does strongly argue in favour of a «low» (or «raised-low») chronology, just as the pattern of (combined) radiocarbon data can argue in favour of the AHC (*tab. 5*).

Conclusions

It is undeniable that some uncertainty often affects the reconstruction of the archaeological contexts used for the interrelated chronology, and that this chronology(ies) is definitely not fixed and immutable. Nonetheless it relies on an extensive stratigraphic and contextual evidence, given by a large number of interrelated contexts, regularly attested. So far they have produced a *corpus* (or better several independent *corpora*) of dating elements,

[78] Wiener 2003, 2009 and forthcoming; Bietak 2004; D.A. Aston, Kom Rabi'a, 'Ezbet Helmi and Saqqara NK 3507. A Study in Cross Dating, in Bietak-Czerny 2007, pp. 135-162.

[79] R. Koehl, Minoan Rhyta in Egypt, in Karetsou ed., *ΚΡΗΤΗ ΑΙΓΥΠΤΟΣ* cit. in note 62, pp. 94-100.

[80] Wiener, The White Slip… cit. in note 69; Wiener 2003, 2007, 2009 and forthcoming.

TABLE 5 - COMPARISON BETWEEN THE ARCHAEOLOGICAL-BASED AND RADIOCARBON-BASED CHRONOLOGIES FOR CRETE AND CYPRUS AND THE EGYPTIAN HISTORICAL CHRONOLOGY.

while, at the opposite, there seems to be not enough convincing evidence in the archaeological record to justify an independent shift of the Aegean and Cypriot absolute chronologies of some 100/120 Cal yrs, except for a few sporadic elements. On the other hand, the absence of an unequivocal and conclusive argument to finally discard any possibility for this shift is noteworthy, and the debate will undoubtedly go on for a long time.

Some – though minor – changes in the interrelated «low» chronology are indeed possible, and the presence of regional barriers between Eastern and North-Western Cyprus, reflected in the gap corresponding to LC IA2 in the Tell el Dab'a assemblages, seems equally possible; nevertheless there is no good evidence to conclude that these «barriers» might have covered a period longer than a century, as would be required by the presence of WS I at Thera prior to 1600 Cal BC, while at the former site (and in the rest of Egypt and the Levant) it arrives only after 1530 Cal BC. The assertion that the Tell el Dab'a Cypriot assemblages reflect only an eastern Cypriot situation seems also not based on enough evidence to give allowance for such a shift given, in particular, the presence of NW Cyprus-Egypt interconnections in the course and around the close of the XVII century Cal BC.

The available data for the ^{14}C datings for the 3400-3300 Uncal BP period in Egypt and the Aegean would be so far clear enough to justify a drastic change in the interrelated chronologies from an unilateral point of view only if a concrete archaeological base for this change can be found, but this seems not the case at the moment.

The high quality of the measurements, and the overall good agreement after Bayesian sequenced analysis[81], together with the presence of possibly-related similar results in the Tell el Dab'a radiocarbon chronology, does once again highlight the fact that a conclusive explanation for the offset between the radiocarbon-based «high» chronology and the historical/archaeological «low» or «raised low» one is difficult to find both in the ^{14}C calibration methodology, and the extensive stratigraphic and contextual archaeological evidence[82], and that more new evidence is necessary to draw a conclusive opinion on the question.

New important elements are expected to come from (1) the collection of new sets of ^{14}C data from the preceding MM III in Crete and MC III archaeological contexts in Cyprus, (2) The comparison between the Tell el Dab'a radiocarbon sequence and the Aegean radiocarbon sequences, (3) the (re)analysis of the archaeological contexts that may yield significant and widely attested elements for chronological interrelations. Finally, volcanic glass sherds and acidity spikes horizons in the Arctic cores do remain question-marked, as they may offer several, and rather precisely dated, possible candidates for the Theran eruption in the XVII, XVI and XV centuries Cal BC, although the possibility for a precise identification of one of them with the Minoan eruption on a microchemical base is highly questioned. A candidate that would fit into the «Low» chronology has been identified by Malcolm Wiener[83] in an horizon dated to 1526/1524 Cal BC, but no reliable connection between this or any of the other volcanic horizons and the Theran eruption is available at the moment[84]. Until a conclusive element will be found to unequivocally link the LM I-II

[81] Claimed by the authors of Manning *et al.* 2003, 2006, but not accepted by everyone; Wiener forthcoming.

[82] Kutschera, pers. comm. 28/08/09.

[83] Wiener 2006.

[84] Wiener 2003, 2006, 2007, 2009 and forthcoming; J.A. Southon, A Radiocarbon Perspective on Greenland Ice-Core Chronologies: Can We Use Ice Cores for C14 Calibration, in *Radiocarbon* 46 (3), 2004, pp. 1239-1259; B.H. Clausen-C.U. Hammer-C.S. Hvidberg-D. Dahl-Jensen-J.P. Steffensen, A comparison of the volcanic records over the past 4000 years

and LC I-II periods to a precise calibrated time-span within a plausible archaeological scenario, the debate on the absolute chronology of the Late Bronze Age in the Aegean must be considered an open question. However, in absence of an equally plausible archaeological scenario for the AHC, given all the mentioned unknowns about radiocarbon dating for the questioned time-span, and/or until another independent chronological test will be available for confirming one of the chronological hypothesis, conservativeness seems necessary in chronological reconstructions, as an archaeological framework for the whole Eastern Mediterranean (early) Late Bronze Age cannot be based on undefined archaeological elements.

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from the Greenland Ice Core Project and Dye 3 Greenland ice cores, in *Journal of Geophysical Research* 102, No.C12, 1997, pp. 707-723; C.U. HAMMER, What can Greenland Ice Core data say about the Thera Eruption in the II Millennium B.C., in BIETAK 2000, pp. 35-38; C.U. HAMMER-G. KURAT-P. HOPPE-W. GRUM-H.B. CLAUSEN, Thera Eruption Date: 1645 BC Confirmed by New Ice Core Data, in BIETAK ZIELINSKY-P.A. MAYEVSKI-L.D. MEEKER-S. WHITLOW-M.S. TWICKLER-M. MORRISON-D.A. MEESE-A.J. GOW-L.B. ALLEY, Record of Volcanism since 7000 BC from the GISP2 Greenland Ice Core and Implications for the Volcano-Climate System, in *Science* 264, 1994, pp. 948-952.

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ABSTRACT

THE ABSOLUTE CHRONOLOGY OF THE EGYPTIAN S.I.P. NEW KINGDOM TRANSITION AND ITS IMPLICATIONS FOR LATE MINOAN CRETE

The textual/archaeological based absolute chronology for the end of the Second Intermediate Period, and the first part of the Egyptian XVIII Dynasty, has been much refined in several studies over the last two decades, and offers a good chronological datum-line which reflects significantly on the absolute chronology of LM I-II Crete, through both direct and indirect archaeological arguments. This painstakingly built chronological framework has however been challenged by radiocarbon results collected in the last thirty years from a few key-sites in the Aegean. Thorough reanalysis of the archaeological contexts that have yielded reasonable proof to build a chronological framework for the Eastern Mediterranean Middle – to – Late Bronze Age shows that, if on the one hand this possibility is not definitely discardable, its acceptance is nonetheless questionable, since it can be based only on indirect archaeological evidence. On the other hand, the new radiocarbon chronology recently proposed for the Theran Eruption seems to rely on optimistic assumptions which lead to interpretative models that are not surely discardable in the absence of an unequivocal proof, but that are nonetheless not convincing enough to overcome the actual «traditional» interpretation of interrelated chronologies, at least until new unequivocal and widely attested archaeological elements could be found to support this completely different scenario also from an archaeological point of view.