

## Destruction of Jericho City IV Dated to ~1400 BC by Pumice from Thera, Pottery, Scarabs, and Relative Radiocarbon Dates

The presentation on the pages following was given at the annual meeting of the Near East Archaeological Society at their annual meeting, November 18, 2015, in Atlanta Georgia. In keeping with an audience that included archaeologists currently working in the field, the talk's original title was "Anomalies in Radiocarbon Dating, LB and Earlier, Are Not the Invention of Biblical Archaeologists." The presentation consisted of 16 PowerPoint slides, shown below. Each slide is followed by the lecture notes for the presenter.

*Abstract.* Radiocarbon dating of the Thera eruption has placed the event between 1627 and 1600 BC at the 95% confidence level. The art and pottery motifs at the site of Akrotiri, buried under the tephra, were dated by archaeologists to the Late Minoan 1A, about 150 years later than this 'scientific' date, thus producing a conflict between archaeologists (especially Egyptologists) and those who hold the radiocarbon dates paramount. The presentation focused on a very strong evidence in favor of the archaeologists: the sudden appearance of Thera pumice at Tell el Dab'a stratum C/2, dated by Manfred Bietak to the reigns of Thutmose III and Amenhotep II (roughly 1450 to 1400 BC). Both pharaohs are represented by scarabs in this layer. The same is true of pumice found in the Levant (Tell el-Ajjul, Ashkelon, Tel Na'ami) "only from the Late Bronze Age onwards, whilst all pumice from Middle Bronze Age strata is from other volcanoes" (Bietak 2004). Currently, no one has refuted such statements by respected Egyptologists and Levantine archaeologists. The pumice evidence thus places the Thera eruption about 1450 BC or slightly thereafter. The unadjusted BP (Before Present) radiocarbon date for the LB destruction of Jericho City IV is  $45 \pm 15$  years later than the BP date for Thera. By comparing BP dates instead of the controversial 'adjusted'  $^{14}\text{C}$  dates, the destruction level at Jericho City IV dates to the late 15th or early 14th centuries BC, in agreement with the Late Bronze pottery from the site examined by Bryant Wood and John Garstang, and in conflict with Kathleen Kenyon's much-quoted "Middle Bronze" date of 1580-1550 BC for the destruction.

*Anomalies in Radiocarbon vs. Archaeological Dating, LB and Earlier, Are Not the Invention of Biblical Archaeologists*

Presentation at annual meeting of the  
Near East Archaeological Society,  
November 18, 2015, Atlanta, GA.

Rodger C. Young

=====NOTES=====

The purpose of my talk is not to give a balanced presentation of all sides in the current debate. It is instead to show that there is a problem.

The amount of data connected with this issue is immense, and it all cannot be covered here. However, I do welcome comments from the audience wherever you think that I have left out something of importance.

## Santorini/Thera: Big Explosion, Big Problem



The science is quite exact here, assuming the correctness of the dendrochronology-based calibration curve: the eruption occurred between 1627 and 1600 BC at the 95% confidence level.

(Friedrich et al. 2006), (Bruins et al. 2009)

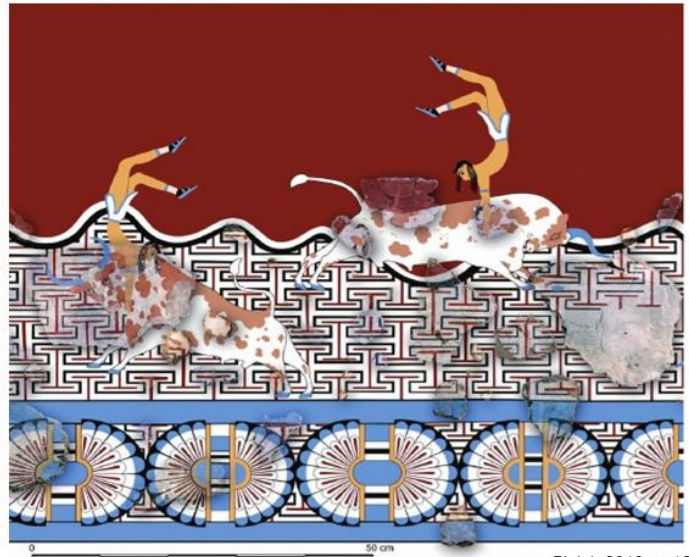
### =====NOTES=====

Some have said that this was the biggest volcanic explosion in historical times. The explosion sent a tsunami across the Mediterranean and deposited a thick layer of tephra on the island itself.

The dates given in the *Science* article are apparently verified by organic material affected by the tsunami and volcanic ash from Thera on top of that at Palaikastro, Crete (Bruins et al. 2009). Red square indicates location of Akrotiri, the town buried under tephra from the eruption.

*Note added after the talk:* The following book was pointed out to me after I had given the presentation: *Israel's Exodus in Transdisciplinary Perspective*, eds. Thomas E. Levy, Thomas Schneider, W. H. C. Propp, and Brad C. Sparks (Springer, 2015). A chapter in this book has a title similar to the summary at the bottom of my slide 8, but even more stronger: "Dating the Theran Eruption: Archaeological Science Versus Nonsense Science," by Malcom H. Wiener, pp. 131-43. Wiener questions the statistical methods for the  $^{14}\text{C}$  date of the Thera Olive branch, and also cites radiocarbon dating of plants near volcanoes on Hawaii and elsewhere that give too early dates. He dates the Thera eruption after 1530 BC, still considerably earlier than the earliest presence of Theran pumice in Tell el-Dab'a stratum C/2 (dated ~1450-1400 by Bietak).

Where would you find this kind of art in the ancient world?



=====NOTES=====

This is a reconstruction, based on samples found in the rubbish heap at Tell el-Dab'a and compared to a similar Minoan frieze (from Crete?).

The discovery of these Minoan friezes that were originally on the walls the 18<sup>th</sup> Dynasty Palace F has been considered one of the most important findings in 20<sup>th</sup> century archaeology. The discovery of Theran pumice in the layer above, C/2, however, is far more important in shedding light on the history and chronology of the ANE in the second millennium BC. This will be discussed shortly.

Austrian Academy of Sciences:  
Excavations at Tell el-Dab'a (ancient Avaris)  
in the Nile Delta, 1966 to present.



Annual meeting of the American Schools of Oriental Research,  
November 2012. Manfred Bietak (on right) was plenary speaker.

=====NOTES=====

Purpose of this slide is to introduce work of the Austrian Academy of Sciences in the Delta of Egypt. If Bietak wasn't an internationally recognized expert in archaeology, he would not have been invited to give the plenary address at this meeting of distinguished researchers in that field. The theme of his talk was the disparity between radiocarbon and archaeological dates in their excavations in Egypt's Delta region (Avaris/Tell el-Daba).

If there was any bias in the radiocarbon dates, you would think that it would be to make the radiocarbon dates agree with the dates assigned by the Austrians to their archaeological findings.

## The 18th Dynasty Palaces at Tell el-Dab'a (Avaris)



Bietak 2010, p. 14

Chapters 8-12 of Exodus require that the land of Goshen was very close to the palace of the pharaoh. Before the Austrian investigators unearthed the foundations of these two palaces, this was used as an argument against a 15th-century Exodus, since the 18th Dynasty capital was known to be at Thebes, 400 miles to the south.

### =====NOTES=====

The Minoan-type fresco described above adorned the wall of one of these palaces, but due to settling of the mud-bricks used in construction, the frescoes did not last long. Their remains had to be pieced together from a dump site by the palaces.

The two palaces were separated by an artificial lake. Their distance apart is 150 cubits by the old Egyptian cubit (so Bietak). This implies that the cubit used by Moses was 20.6 inches instead of the later 18 inches. In particular, it means that Noah's Ark was 515 feet long, not 450 feet.





Bietak 2003, p. 30

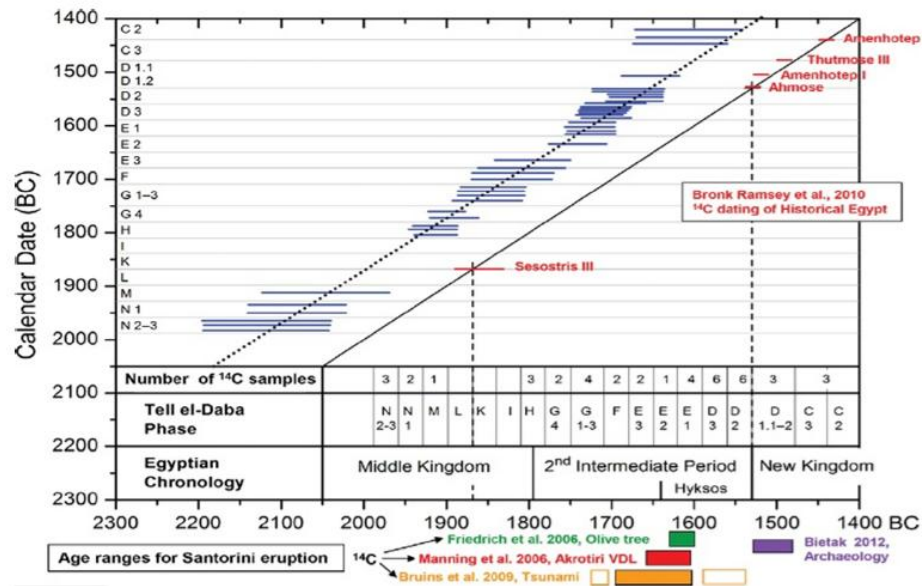
Mural on left is from Akrotiri on Thera, buried in the eruption.  
 On right, in red circles, are fragments from the mural of level C/3 at Tell el-Dab'a that have been superimposed on the Thera mural.  
 The murals were either done by the same artist, or by artisans working from the same original design. But if Thera exploded in ~1613 BC, they would be separated by at least 110 years.



#### =====NOTES=====

I need to explain this, since it is not obvious what is intended at first glance. Bietak has superimposed fragments from the 18<sup>th</sup>-Dynasty palace mural onto the griffin that was part of a mural on Thera. Bietak places the paintings in level C3, ~1480 to 1440 BC (low chronology).

## Offsets: Radiocarbon dating versus archaeological dating



From about 1670 BC to 1400 BC, <sup>14</sup>C dates are ~170 years too early. This is the time-period of the Thera eruption. <sup>14</sup>C dates from about 1670 BC to 2200 BC average ~120 years too early. (Bietak 2014, p. 279)

### NOTES

In this chart, strata C3 and C2 are dated by Bietak and his co-workers at from about 1470 to 1440 and 1440 to 1400 BC based on the stratigraphic record and his (low chronology) dates for the 18<sup>th</sup> Dynasty.

Notice the regularity of these data. The offset is quite consistent; what can explain it? Certainly not a lengthening of the Egyptian chronology! It can be explained by improper tree-ring matching. The calibration curve should be corrected by secure archaeological data like this, not by tree rings—at least for this period in history and this region (also the Levant in 1400 BC and earlier).

15th century offset is about 170 - 200 years, compared to about 120 years for earlier samples. Maybe venting of old carbon from Thera made plants growing in this region in the 15th century have less <sup>14</sup>C.

Bob Porter, memo to me on 9 Nov 2015: "Separate dendrochronologies from America, Germany and UK have been constructed and then carbon dated (typically at 10 year intervals) to produce calibration curves. The International Calibration curve is typically made up of an average of the carbon dates from several regions for each 10 year period (as counted back in the dendrochronologies). Only the UK data (Belfast) has been released (and found wanting); the Germans and Americans refuse to release theirs although they all publish countless articles *about* their dendrochronologies."

Oxford results, on well-provenanced plants from Thebes, are basically in agreement with archaeological dates; actually slightly higher than the 18<sup>th</sup> Dynasty "High Chronology". But Bruins & van der Plicht, "Charcoal Radiocarbon Dates of Tell el-Dab'a (SCIEM 3, 65-77) agree with Bietak that for early levels there, radiocarbon dates are 100 to 200 years earlier than archaeological dates. *Why doesn't someone start with the raw data and refute these results?*



## “Science vs. Archaeology”

This is the way the conflict between radiocarbon results and archaeological results at Tell el Dab’a is often framed. Since “science” reigns supreme in the popular mindset, this phrasing casts suspicion on archaeological claims. A problem with the  $^{14}\text{C}$  “scientific” dates for the previous slide, however, is that not all the tree-ring data that produce the calibration curve have been published, and such as have been published are often in an unsatisfactory form. The scientific method requires that original data, as well as procedures, must be published in a form so that results can be verified.

For Tell el-Dab’a, in contrast, inscriptional and stratigraphic records have been published in numerous scholarly articles and books. The archaeological dates thus derived and shown on the previous slide cannot be moved upward more than two or three decades to conform with the  $^{14}\text{C}$  data. The conflict is therefore between

## “Defective Science vs. Meticulous Archaeology”

### =====NOTES=====

This is like saying “Science vs. the Bible”. It implies a conflict in which one is right and the other is wrong.

I’m not altogether convinced that possible problems with dendrochronology completely explain the disparities. There may be additional complications, such as regional effects.

## Pumice



Chemists can discriminate between pumice that appeared in different volcanic events. Theran pumice appears suddenly and in great quantity in Tell el-Dab'a level C/2, 1450 to 1400 BC (Bietak 2005, p. 15). The same is true at Tell el-'Ajjul and elsewhere in the Levant: Theran pumice appears suddenly in the later 15th century and is nowhere found at an earlier date. (Bietak 2005, p. 17)

The Minoan frescoes at Tell el-Dab'a are from level C/3, a few years earlier than the sudden appearance of pumice from the Thera eruption.

### =====NOTES=====

In *SCIEM 3*, p. 15, Figure 2 puts Theran pumice in level C/2, which the chart on p. 14 puts in range 1440 to 1400 BC. Figure 2 puts "Paintings" in stratum C/3, which is dated from about 1480 to 1440 BC. (Bietak 2005)

p. 17 of *SCIEM 3*: "Also, the massive first appearance of Theran pumice in archaeological contexts (thus far nearly 400 samples) in the Late Bronze Age in the Levant and in the Thutmoside Period in Egypt and not before, would have to be explained as lingering for two centuries on the beaches of Egypt and the Levant before being used, while thus far all pumice found in MB-contexts and in Egypt in the SIP were from other volcanoes."

Column 215 of Bietak, 2004 (*Bibliotheca Orientalis* review of Manning) says Theran pumice was found in large quantities at Tell el-'Ajjul, Ashkelon, Tel Na'ami, "only from the Late Bronze Age onwards, whilst all pumice from Middle Bronze Age strata is from other volcanoes."

## Why not use the BP (Before Present) numbers? To do so, we would need good anchor dates.

Using the BP numbers might, for LB and earlier, avoid the problems introduced by the calibrated dates. If 2 samples from different locations had BP dates that were close together, this would potentially provide a more accurate correlation of dates than pottery analysis. If the archaeological date for one of these samples was secure, this would supply a good date for the other site.

Egyptologists agree that it is impossible to raise the time of Thutmose III and Amenhotep II to the 1623-1601 timeframe required by the scientific results that would date the pumice from Thera to this time. Why not use the 15<sup>th</sup> century BC dates for these pharaohs as the anchor points, and then use their BP values as a basis of comparison?

Then it would no longer be necessary to revise upward by a century or more the dates of Minoan and other cultures so as to match the radiocarbon results, as advocated by Manning and others (Manning 1999). Correlations could once again be made between Egyptian, Minoan, Helladic, and other cultures, using this method to refine cross-cultural dates without requiring radical revision of dates as in the present impasse.

*Bruins and van der Plicht did something like this – next slide.*

=====NOTES=====

Read all of this slide.

## An interesting observation by Bruins and van der Plicht

Could insight be gained by comparing, for samples close in time, BP dates instead of dates that depend on calibrations curves and dendrochronology? Bruins and van der Plicht presented just such a comparison in a note in the British scientific journal *Nature* (Bruins and van der Plicht 1996). Their observation:

$^{14}\text{C}$  date of Thera eruption                       $3,356 \pm 18$  years BP

$^{14}\text{C}$  date of grain from Jericho IV:     $3,311 \pm 13$  years BP

The authors note: "This difference is rather striking, as it could fit the desert period of 40 years separating the Exodus from the destruction of Jericho, mentioned in ancient Hebrew texts." This comes from scholars who are widely cited as 'proving' that the Biblical account of the fall of Jericho is not historical.

What if they had used the archaeological date for the first event and then used the BP difference to calculate the date of the second event?

### =====NOTES=====

No distortions because of problems with dendrochronology and the calibration curves in such an approach. The problem was that they continued to build on the supposition that the 1623-1601 BC date for the Thera eruption was correct, rather than dating this event to the LB period as required by the pumice and reinforced by the LB pottery found in the same layers, both Egypt and the Levant.

## Offset of $^{14}\text{C}$ dates for Jericho

“Further, the fortified Bronze Age city at Tell es-Sultan was not destroyed by *ca.* 1400 BC, as Wood (1990) suggested” (Bruins & van der Plicht, 1995).

Radiocarbon dates for Jericho in the EBI and EBII “are *ca.* 150-300 yr older than conventional archaeological assessments.” (Bruins, 1998)

“Our stratified high-quality  $^{14}\text{C}$  dates from EB Jericho (Trench III) on short-lived material are all without exception significantly older than conventional archaeo-historical time frameworks . . . (Early to Middle EB-I Kenyon, Early EB-II others) is 100–450 years older . . . (Early EB-II Kenyon, Later EB-II others) is 200–500 years older . . . (destructive end EB–II) is 200–300 years older . . . (Early EB–III) is 100-300 years older than conventional archaeo-historical time estimates.” (Bruins & v d P, 2001)

For Jericho & other sites, EB III–EB IV transition, traditionally dated to time of Pepi I, is 200 years earlier than Egyptologists’ dates for Pepi I. (Regev et al. 2012)

### =====NOTES=====

Now let’s look at radiocarbon dates for Jericho. These results will be summarized on the next slide. But read the first sentence from this slide. We need to think about what is said here in relation to what is said on the rest of the slide.

It seems that consistency would demand that if all these earlier radiocarbon dates for Jericho are ‘too early’ for the archaeological dating that was commonly accepted before the  $^{14}\text{C}$  data were published, then these results should also call into question the radiocarbon dating for MB or LB at Jericho City IV. This rather logical conclusion apparently is never considered by the academic community.

The archaeological reasons for the fall of Jericho City IV in the LB period—end of 15th century BC—have been covered extensively in the writings of Bryant Wood. Bryant will present this evidence in his talk following this one.



## Summary of previous slide:

*Comparing <sup>14</sup>C dates to archaeological (Kenyon's) dates for Jericho,*

*C-14 dates are*

EB to Middle EB:	100 to 450 years too old
EBII	200 to 500 years too old
EBII destruction	200 to 300 years too old
Early EBIII	100 to 300 years too old
End of EB III (start of MB)	~200 years too old

Kenyon dated destruction of Jericho City IV to ~1550. Bruins & van der Plicht report and agree with the disparities listed above. They apparently never considered that making a similar adjustment for Jericho City IV (MB Kenyon, LB I Wood) would bring Kenyon's date to a **corrected radiocarbon date of ~1400 BC or slightly later**. This would be consistent with not only the Jericho corrections for EB, but also those necessary for Avaris.

### =====NOTES=====

Prior assumptions will determine whether one accepts the radiocarbon dates of B & vdP 1995 or the adjustments suggested by the present slide. For those of us who believe the Bible and who are acquainted with the many reasons why the archaeological data for Jericho agree with the Bible, as Bryant has shown in his writings, the answer is clear. For others, however, it is important to present good archaeological and scientific arguments showing why Kenyon was wrong.

My professor of OT and Hebrew at Nazarene Theological Seminary, Dr. Harvey Finley, studied under W. F. Albright. He excavated with Albright in the Levant. Dr. Finley said that the head of an Arab work gang told him something about their prior work under the supervision of Kathleen Kenyon. The work-gang boss said that when Kenyon's Arab laborers brought material from their digging that disagreed with her ideas, she refused to consider it.

### Dating the fall of Jericho from pumice and stratigraphy (archaeology) combined with difference in $^{14}\text{C}$ measurements (science)

- Pumice from the LM eruption of Thera appears suddenly Tell el-Dab'a in level C/2 (Bietak 2004, 215).
- Level C/2 has scarabs of Tuthmose III and Amenhotep II (Bietak 2015, c. 322).
- From the start of sole reign of Th III to end of reign of Am II is 1458 to 1400 BC by the low chronology or 1483 to 1425 BC by the high chronology.
- With either of these time-spans, the destruction of Jericho City IV, roughly 45 years later by  $^{14}\text{C}$  measurement, was close to the end of the 15th century BC, not ~1580 BC (Kenyon).
- “[F]rom over 400 samples from archaeological sites not a single particle of Theran pumice has been retrieved from contexts before the New Kingdom/**Late Bronze Age** in the Levant” (Bietak 2015, c. 334).
- By Bietak’s reckoning, the pottery at Jericho must therefore be **LB**, in agreement with Bryant Wood. Kenyon said it was MB.

#### =====NOTES=====

In *On the Reliability of the OT*, Kitchen said that no archaeological remains have been found supporting a 13<sup>th</sup> century fall of Jericho to the Israelites because erosion would have washed away all such evidence. This apparently is still the position of those who support a 13<sup>th</sup>-century Exodus. (But there was no 13th-century Exodus; it occurred in the 15th century.)

## Finally,

The previous slide calculated the date of the destruction level at Jericho City IV by starting with archaeological data. This information was then combined with the two BP dates derived from Jericho and the Thera eruption to calculate that Jericho fell and was burned around 1400 BC.

Can we reverse the process, i.e. start with the Biblical date for Jericho and derive the date for the great Thera volcanic event?

<b>Biblical date for fall of Jericho City IV</b>	<b>Nisan, 1406 BC ± zero</b>
<b>Years back to Thera (Bruins &amp; v d P, 1995)</b>	<b>45 ± 15</b>
<b>Date of Thera eruption</b>	<b>1451 BC ± 15 years</b>

This date for Thera is consistent with well-researched archaeological data from Egypt and the Levant. It does not require a drastic revision of Minoan, Helladic, and other histories in order to accommodate the 17th century date for the eruption derived from dendrochronology-based <sup>14</sup>C calibration curves.

### =====NOTES=====

- 1) Kitchen and others refine all 21<sup>st</sup> and 22<sup>nd</sup> Dynasty regnal dates by reference to 2 Chr 12:2.
- 2) We have here another example where the Bible, used in conjunction with archaeology, refines or corrects a radiocarbon date.
- 3) If Doug Petrovich is correct, as I think he is, that the Exodus was in the 9<sup>th</sup> year of Amenhotep II, then the Biblical date of the Exodus, 1446 BC, is an anchor point for the chronology of the 18<sup>th</sup> Dynasty. It supports a high chronology.

Doug Petrovich's dates for Amenhotep II (reign started in 1455) would likely place the Thera eruption in his reign, based on the figures shown in the slide.

Ask the audience: are there any Egyptian records that name the pharaoh of the Exodus?

Answer: Manetho and Cheremon. As quoted in Josephus, both stated, writing in Greek, that the pharaoh of the Exodus was named Amenophis. Josephus disagreed violently with Manetho and Cheremon on this, but Josephus utterly confused the Hyksos and the Israelites. This confusion did not exist in Manetho and Cheremon. Bietak sometimes uses the name 'Amenophis' when referring to Amenhotep II, as do other Egyptologists.

Conclusion: the conflict over radiocarbon dates in Egypt and the Levant, LB and earlier, is real and is currently not resolved. The conflict is not the invention of someone trying to prove that the Bible is true.

Questions?

Discussion?

Copies of the handout may be downloaded from  
<http://www.rcyoung.org/articles/radiocarbon.pdf>

=====NOTES=====

Four methods of determining date of Jericho City IV destruction.

- 1) Bible (book of Joshua; chronology of Solomon; 1 Kgs 6:1). Date: Nisan (spring) 1406 BC.
- 2) Ceramics (Garstang, Wood). Ceramics are LB1, late 15th century BC. Bietak also said ceramics in level C/2, which was *before* Jericho City IV destruction, were LB, whereas Kenyon said Jericho ceramics were MB; her ceramic reasoning has been effectively refuted by Wood.
- 3) Comparing radiocarbon BP dates: Jericho fell ~45 years after Thera eruption in reign of Th III or Am II. Pumice, ceramic, and Minoan art frescoes in Egypt date eruption to approximately mid 15th century BC. <sup>14</sup>C radiocarbon dates for Jericho grain samples are about 45 years later plus or minus about 15 years—i.e. late 15th century BC or early 14th century.
- 4) Negative evidence: no stratigraphic or artefactual evidence for a 13th century destruction.

[Home](#)[Published articles](#)

## Bibliography

In what follows, *SCIEM* refers to *The Synchronization of Civilisations in the Eastern Mediterranean in the Second Millennium B.C.* Vienna: Verlag der Österreichischen Akademie der Wissenschaften. Vol. 1 was published in 2002, M. Bietak editor. Vol 2: 2003, M. Bietak editor. Vol. 3: Manfred Bietak and Ernst Czerny, eds., 2007.

### BIETAK, MANFRED

- 2003 “Science versus Archaeology: Problems and Consequences of High Aegean Chronology,” in Manfred Bietak, ed., *SCIEM 2*.
- 2004 Review of Sturt W. Manning, *A Test of Time*, (Oxford, 1999), in *Bibliotheca Orientalis* 61:1-2, January-April 2004, 200-222. Available on Bietak’s Academia.edu page.
- 2010 “Minoan presence in the pharaonic naval base of *Peru-nefer*,” in O. Krzyskowska (ed.), *Cretan Offerings: Studies in Honour of Peter Warren*, BSA Studies 18 (London: British School at Athens, 2010) 11–24. The chapter is available on Bietak’s Academia.edu page.
- 2014 “Radiocarbon and the Thera Eruption”, *Antiquity* 88:339 (March 2014), pp. 277-282. Available on Bietak’s Academia.edu page.
- 2015 “Recent Discussions about the Chronology of the Middle and the Late Bronze Ages in the Eastern Mediterranean: Part 1” *Bibliotheca Orientalis* 72:3-4 (2015) 317-335.

### BIETAK, MANFRED, AND HÖFLMAYER, FELIX

- 2005 “Introduction: High and Low Chronology,” *SCIEM* 3, 13-21. Page 2, Figure 2 puts Thera pumice in level C/2, which the chart on p. 14 puts in range 1440 to 1400 BC. Figure 2 puts “Paintings” in stratum C/3, which is dated from about 1480 to 1440 BC. Page 17: “Also, the massive first appearance of Thera pumice in archaeological contexts (thus far nearly 400 samples) in the Late Bronze Age in the Levant and in the Tuthmoside Period in Egypt and not before, would have to be explained as lingering for two centuries on the beaches of Egypt and the Levant before being used, while thus far all pumice found in MB-contexts and in Egypt in the SIP were from other volcanoes.”

### BRUINS, HENDRIK

- 1998 “Early Bronze Jericho: High-Precision <sup>14</sup>C Dates of Short-lived Palaeobotanic Remains,” *Radiocarbon* 40:2 621-28.

### BRUINS, HENDRIK AND VAN DER PLICHT, JOHANNES

- 1995 “Tell Es-Sultan (Jericho): Radiocarbon Results of Short-Lived Cereal and Multiyear Charcoal Samples from the End of the Middle Bronze Age” *Radiocarbon* 37:2 213-20.
- 1996 “The Exodus Enigma” *Nature* 382 (18 July 1996) 213-14.
- 2001 “Radiocarbon Challenges Archaeo-Historical Time Frameworks in the Near East: The Early Bronze Age of Jericho in Relation to Egypt,” *Radiocarbon* 43:3 (2001) 1321-32.

### BRUINS ET AL.

- 2009 Hendrik Bruins, Johannes van der Plicht, J. Alexander MacGillivray, “The Minoan Santorini Eruption and Tsunami Deposits in Palaikastro (Crete): Dating by Geology, Archaeology, 14C, and Egyptian Chronology” *Radiocarbon* 51:2 (2009) 397-411.

### DEE, M. W.

- 2013 “A Radiocarbon-based Chronology for the New Kingdom,” A. J. Shortland and C. Bronk Ramsey, eds., *Radiocarbon and the Chronologies of Ancient Egypt* (Oxford: Oxbow books) 65-75.

### FISCHER, PETER M.

- 2003 “The Preliminary Chronology of Tell el-<sup>c</sup>Ajjul: Results of the Renewed Excavations in 1999 and 2000”, in *SCIEM 2*, 263-94. Pumice from the Minoan Thera eruption appears for the first time, and in great quantity, in level H5 at Tell el-<sup>c</sup>Ajjul. The abundance of Cypriot pottery in this level allows identification as the same time in which pumice first appears at Tell el-Dab’a: Level C/3. Just as in at Tell el-Dab’a, where mature White Slip ware and Chocolate-on-Brown appear first in Level C/3, these same types appear first at Ajjul in level H5. Therefore the pumice together with the pottery date the Thera event to



approximately 1450 BC and no significant amount earlier. Although not mentioned by Fischer, this is important because radiocarbon dates, both raw and calibrated, date the destruction of Jericho City IV from 30 to 60 years after the Thera eruption (Bruins and van der Plicht 1996).

FRIEDRICH ET AL.

2006 Walter L. Friedrich, Bernd Kromer, Michael Friedrich, Jan Heinemeier, Tom Pfeiffer, Sahra Talamo: "Santorini Eruption Radiocarbon Dated to 1627–1600 B.C." *Science* 312 (28 April 2006) 548.

MANNING, STURT W.

1999 *A Test of Time* (Oxford). Seeks to revise upward the dates for Minoan and other cultures to match the radiocarbon data. Extensively criticized by Bietak 2004.

REGEV ET AL.

2012 Johanna Regev, Pierre de Miroschedji, Raphael Greenberg, Eliot Braun, Zvi Greenhut, Elisabetta Boaretto "Chronology of the Early Bronze Age in the Southern Levant: New Analysis for a High Chronology," *Radiocarbon* 54:2 525-66. Available on Johanna Regev's Academia.edu page.

For an example of research that supports an agreement between radiocarbon dates and archaeological dates for the 18th Dynasty—specifically the time of Thutmose III—see (Dee 2013). The following chapter in the book, by Bietak, presents the same chart as shown in Slide 7. Neither author attempts to explain why dates for the 18th Dynasty reported from the Oxford radiocarbon laboratory (Dee and Bronk Ramsey) differ so significantly from 18th Dynasty dates reported from the Vienna radiocarbon laboratory (Bietak and Kutschera).

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