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General conclusions

In: Klontza-Jaklová, Věra. *What's wrong? : hard science and humanities – tackling the question of the absolute chronology of the Santorini eruption*. First publishing Brno: Filozofická fakulta, Masarykova univerzita, 2016, pp. 64-67

ISBN 978-80-210-8472-8

Stable URL (handle): <https://hdl.handle.net/11222.digilib/136837>

Access Date: 19. 02. 2024

Version: 20220831

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3. GENERAL CONCLUSIONS

As shown above, the absolute chronology of the mid 2nd millennium BC is uncertain and represents one of the most complex problems of prehistory. The main question can possibly be simplified as: ‘Does the problem lie in radiocarbon methods or in Aegean prehistory and Egyptology?’³¹ The problem cannot be solved statistically: A higher probability cannot be directly interpreted as indicating a correct answer. It seems today that the majority tends to use the high chronology (= deeper dates) for the Santorini catastrophe, trusting the new radiocarbon dates obtained from a large number of Bronze Age sites, including those outside the Eastern Mediterranean. On the other hand it is impossible completely to exclude the arguments of classical archaeological methods and Egyptian absolute chronology reconstructed from historical sources. But what we really need is to be sure that the chronologies we use are correct and that means we need scientifically proven data. When saying “scientific” I refer to both physical and social sciences equally. As social scientists, we need to find methodologies and the type of finds and contexts which will allow us to test our interpretations and will produce results closer to the historical reality.

The actual questions can be defined as follows:

1. Did the Santorini eruption happen during the SIP or during the early Eighteenth Dynasty? In other words: Is the LM IA phase contemporary with the SIP or with early Dynasty XVIII?
2. Is it possible that Egyptian absolute chronology can have a larger deviation than has been assumed and, if so, when precisely does it begin to deviate?
3. If the Egyptian chronology is correct, why does the radiocarbon dating method provide incorrect dates?

Today there are basically two chronological charts (Table 7):

High chronology:

LM IA	Dynasty XIII - SIP
LM IB	Late SIP - early Dynasty XVIII
LM II - IIIA: 1	Tuthmose III. - Amenophis III.
End of LM IIIA:1	Amenophis III.

Low chronology:

MM III	Dynasty XIII - SIP
LM IA	Late SIP - early Dynasty XVIII
LM IB - LM II	Tuthmose III.
LM III A:1	Amenophis III.

With absolute dates for Crete:

High	CRETE	Low
1750	MM III	1700
1700		1600
1600 (eventually 1628)	LM IA	1500
1490	LM IB	1430
1430	LM II	1390
1390	LM IIIA1	1370/60
1300	LM IIIB2	1300

Table 7

High and Low synchronisms of Cretan and Egyptian relative chronologies.

Maybe the main problem is not when the event happened but where the mistake is; where lies the crossroads from which we took the wrong path. It is abundantly clear that an interdisciplinary and multidisciplinary approach is extremely important. Nevertheless, although physical science and the social sciences are in closer contact on the “Santorini issue” than ever, this relationship still requires a lot of work (Knappett 2011, 48).

After the analysis I have presented above, I am convinced that there are archaeologists who ought to revise their methodologies. We should reconsider the typological scales and entire system of parallels which have often been used automatically and mechanically. What has been dubbed “a common sense method” now seems to be giving rise to more and more special pleas and doubts appearing in the literature (i.e. Knappett 2010, 161, 213; Jung 2012; Cline 2014, 114). Although our relative typological scales are very precise we may well be failing in our understanding of how to use them in an actual historical process and it is fascinating how much work has been done on ty-

pologies and how little we understand their dynamics (Knappett 2011, 161). It seems that they don't "behave" in time and space as we expect (Knappett 2011, 213; Trnka and Lorencová 2016). A similar opinion was expressed more than 20 years ago by P. Warren: 'Absolute dating of these ceramic periods from artefactual evidence is far less precise than we would like.' (Warren 1994, 492) among others, e.g. Makkay (1996, 220), Muhly (2003, 17–23).

M. Wiener (2009b, 279) comments on the shapes of Aegean Bronze Age vessels: "Can each of these have been copied by Egyptian artists 50–75 years after they were superseded in the Aegean?" He implies that it is impossible, that it is too long a time lapse and thus that imports-exports represent quite precise points in time. But in archaeology, as in other disciplines, we cannot simply guess or estimate what seems to be plausible and what not. There are many examples today of major shifts of styles and fashions in time and space. We know that pottery made in Aegean in 12th – 13th century AD was copied by central European potters centuries later (in 16th century; Klonta-Jaklova, *in preparation*). Archaeologists divide the material into so-called chronologically sensitive types of artifacts and wares used for a long time. Changes in shapes and decorations have their logic but this logic is not universal, it is not valid for each type in each time and space. Some of them have incredible duration: e.g. trickle-decoration on Cretan Bronze Age pithoi, TY Ware in the Near East, transport amphorae from the Hellenistic period to the Middle Byzantine period and even later. The balance of benefit (not only in the economic meaning) must be very stable in those cases. But some other shapes and decorations can appear and disappear much more quickly and probably carry more sensitive symbolisms (Knappett 2011, 160). The point is: do we always understand which wares belong to the first and which to the second group?

As J. A. McGillivray (2009, 155) says: "for more than two centuries archaeologists have refined the Bronze Age Mediterranean historical framework by observing the relative order of superimposed levels on a series of sites. Next, they established inter-site relationships based on common cultural characteristics – primarily on ceramics, art and architecture. Nothing has changed. This is still how we verify our relative chronology." But maybe we should no longer do so without at least questioning its validity and applicability to the problem we address. Even this system, which looks so solid and with which we are all so comfortable, is not necessarily accurate and may not work linearly.

Today it is impossible to approach the problem as isolated and cut out from its context. Natural sciences and archaeological methods must look together for a united solution (French and Shelton 2009, 196–197). We must make every effort to understand the metho-

dologies and limits of each discipline. Also we must be critical of our own methods and results; we must be strict with ourselves. What we are studying are people – individuals and societies –and people are not passive, they act, so the principles of human thinking are as important as the relative amounts of isotopes in their bones or the regularities of climate changes.

Going back to the Santorini issue, it is, firstly, essential to revise the earlier finds, since many mistakes are automatically transferred from publication to publication (Manning 1988, 24). However, it makes no sense just to keep discussing those same early finds so, as Manning (1999, 44) suggests, new finds and fresh stratigraphic evidence must be sought. The same stratigraphic sequences, from Tell el-Dab^a (e.g. Bietak 2013a), Tell el-Maskhuta (Redmount 1995), Tel Kabri (Niemeier 1990.), Alalakh (Woodley 1955; Niemeier 1991; 1996), Tell el-Ajjul (Fisher 2009), are repeated again and again, including serious doubts about them (Krauss and Warburton 2009). It seems that it may be important to include more northern regions in the game, such as the Balkans or central Europe. One of the most important regions seems to be Macedonia with tells, such as Kastanas (e.g. Jung 2002) or Dikili Tash (Koukouli-Chryssanthaki et al. 2008) and others.

Not only do we need new contexts and finds, we also need new methodologies. It seems that the way we currently work with parallels, imports and influences doesn't give always correct dates (Makkay 1996, 219–220) and connections and relationships, which mirror these, were more complex than we expect. Finds from rich graves are particularly problematic, as discussed above (Manning 1988, 24). Some years ago we were still using their ceramic styles as chronological and stylistic markers but it seems that the way past societies viewed this material, as producers and as users, is very different from the way we view it.

It is also notable, and far from logical, that the radiocarbon dates which we have obtained for prehistoric periods, are accepted without any doubts and yet for later periods, if they don't match with our assumptions, we tend to reject them as mistaken (Makkay 1996, 220; Guidi et al. 1996, 279). It is also true that the selection of only those opinions and results which fit a particular theory is commonplace (Manning et al. 2009b, 299).

Today it seems that the archaeological and historical scales are slightly shorter than radiocarbon based chronologies (e. g. for the Aegean: MacGillivray 2009, 156; for the Hittite Empire: Bryce 1998; Müller-Karpe 2003). The flow of time is one of the most important factors in history. Its understanding has immediate importance for contemporary societies and for predictions of the future. In the past, the correct chronological framework gives us the opportunity to study causal questions, both general and particular (Wiener

3. General Conclusions

2003, 363). We cannot accept an approach which just rejects radiocarbon dates out of hand, nor can we take the opposite one and simply ignore archaeological methods or literary sources.

We might wonder that, in the case of dating the Santorini eruption and the problems of Late Bronze Age Mediterranean chronology, we can mobilize archaeological and literary sources, a quite dense network of regional interrelations, numerous dates obtained by scientists and still the issue remains such an open question.

This is not a fight, it is not a trial, nor is it a gamble; it is simply science. This means that we will know when we get to the correct answer because the method will give a result which we will be able to verify. However, for the present it is essential to remind ourselves that “Everything in archaeology is always momentary, fluid and flexible” (Hodder 1997) and that “archaeology is a continuously evolving field with new data and new analyses requiring the rethinking of old concepts” (Cline 2014, 118).

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- 1 Cornell University: Tree Rings, Kings, and Old World Archaeology and Environment. (Manning and Bruce (eds.) 2009); Copenhagen: Time's Up! Dating the Minoan eruption of Santorini. (Heinemeier and Friedrich (eds.) 2009); Halle: “1600–Cultural change in the shadow of the Thera Eruption?” (Meller et al. (eds.) 2013).
 - 2 In Greek: Saint Prophet
 - 3 In Greek: Big Hill
 - 4 In Greek: Small Prophet Elijah
 - 5 In Greek: Red Hill
 - 6 In Greek: White Island
 - 7 In Greek: Old burned (land)
 - 8 In Greek: New/Young burned (land)
 - 9 ‘Franks’ in Byzantine literary sources are the Catholic western Europeans.
 - 10 F. McCoy has expressed the opinion that the conditions for the eruption might have been established with the strong earthquakes during the MM period. A tectonic earthquake may have opened cracks as conduits for magma ascent from the melts deep in the crust at the subduction zone. About a century between these earthquakes and the eruption would be adequate for magma ascent of a viscous silica-rich melt to the surface. (2009, 89)
 - 11 The time between intrusion and onset of the 1925–1928 eruption on Nea Kameni lasted 15–75 days (McCoy 2009, 79).
 - 12 “Tremor can be the final signal of an impending eruption, even for viscous magmas such as the rhyodacites of the LBA magma. They are an announcement that magma is in transit to the surface, and can continue throughout the eruption. Magma ascent rates for explosive eruptions can be of the order of 1–3 metres per second, or only a few centimeters per second. For LBA Santorini, Sigurdsson et al. (1990) estimate a magma chamber 8–15 kilometers from the surface. Thus, once tremor started, the Bronze Age inhabitants may have had only hours before a vent opened and the precursor eruption started (assuming the more rapid ascent rate.” (McCoy 2009, 80)
 - 13 “Tsunamis are not single waves, but sets, or packets, of perhaps five or eight waves within which one or two are larger and potentially damaging to coastal areas.” (McCoy 2009, 86)
 - 14 It the past estimates of erupted material were much smaller (e.g. Sullivan 1990, 114–119)
 - 15 We must balance probabilities and choose the most likely. (A. C. Doyle, 1892: The Adventures of Sherlock Holmes)
 - 16 P. Betancourt now concedes that the low (or lower) chronology is possible as well.
 - 17 Project 1: „Co-ordination and Publication Office“, Project 2: „Data Management, Electronic Communication and Quantitative Methods“, Project 3: „Datum Lines by First Appearances“, Project 4: „Thera Ashes“, Project 5: „Chronological Data in Mesopotamia“, Project 6: „Astrochronology“, Project 7: „Dendrochronology“, Project 8: „Radiocarbon (¹⁴C) Dating“, Project 9: „Egypt“, Project 10-11: „Israel/Palestine & Jordan“, Project 12: „Cyprus“, Project 13: „The Minoan Deposit Project“, Project 14: „The End of Mycenaean Culture Project“, Project 15: „Stratigraphic Project Aigina (EH III-LH I)“, Project 19: „Stratigraphie comparée“ (<http://www.oaaw.ac.at/sciem2000/index.html>)
 - 18 It is not automatically possible; local anomalies of microclimate or short time variations must be taken into account (Moody 2000, 52 Grove and Rackham 2003, 27–29)
 - 19 Laboratory of Tuscon University
 - 20 Baillie has only observed a similar extreme (shrinking of tree rings) 9-times in a 6000 year record.
 - 21 J.A. MacGillivray (2009, 159) mentions that it corresponds with an acidity peak in a core obtained by the DYE3 station in Greenland absolutely dated to 1525±4 years but does not cite the original source.
 - 22 “I have explored the Thera quarries too, searching in vain for bits of pine or juniper, but when Friedrich’s group did at last find a piece of wood, the Greek version of Murphy’s law decreed that it had to be an olive tree.” (Kuniholm 2014, 289).

- 23 Today other sources of S compounds include industrial pollution and nuclear explosions. These events are also traceable in glacier stratigraphy
- 24 VEI = the scale has 8 steps which are defined by the height of the column of tephra hurled up and the loudness of the eruption.
- 25 Recently written also as: Tell el-Daba or Tell el-Dab'a (Kutschera et al. 2012, 407) or Tell el-Dabca (Bietak et al. 2009).
- 26 But can the possibility that it was kept as an heirloom for a long time after its production and exported to Crete be excluded?
- 27 High Chronology: 1848–1806` Middle Chronology: 1792 – 1750; Low Chronology: 1728–1686.
- 28 With some exceptions, such as the Tell el-Dab'a layers containing fragments of painted plaster.
- 29 If the Manning et al. 2016 revision is correct and is accepted, the Middle-, or Low-Middle Scale will be valid for the region. However, this shift of Mesopotamian chronology doesn't support the very Low chronology of Tell el-Dab'a.
- 30 See history of research in Maguire 1990, 22 – 33.
- 31 Kutschera et al. (2012, 407) pose the same question.