

Epilogue

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Among archaeologists, there are thus effectively two different views concerning the date of the Minoan eruption of Santorini. One view holds that the archaeological material is compatible with the ^{14}C dates, and the other that the archaeological material is not, and demonstrates that the ^{14}C dates for the second millennium are not reliable. This situation differs fundamentally from that aimed at by the natural scientists, and “scientifically” oriented archaeologists, where it is assumed that a persuasive date allows one to begin to reconstruct events. Both those opposed to the proposed date and those potentially open to accepting it view the issue as a chronological one in which one can use typological methods as a means of arguing. On the most superficial level, it should be clear that is impossible that the various parties can be discussing the same question and the same material with the same attitude and yet draw very different conclusions.

Thus this workshop has demonstrated that, in reality, it is not a chronological debate but rather a methodological debate. The issue is just what building blocks one selects in order to build an argument. Those aligned with the traditional younger dates tend to assume that the archaeological evidence can be interpreted as favouring a more recent date than that projected by the methods of the natural sciences. The natural scientists are inclined to view their own results as definitive and to recommend that the archaeologists revise their dates. There are obviously some problems when realising that neither side really understands the methodology and goals of the other. For the archaeologists it is obvious that this is a chronological issue in which all of the available tools are deployed, whereas the natural scientists seem persuaded that the chronology must bend to accommodate their own results.

Given the tendency for the natural science dates to concentrate in the same range, this leads to a degree of confidence that renders discussion difficult when the dates proposed by some archaeologists are radically different.

This alone demonstrates the necessity of dialogue, for without discussion it will be impossible to understand one another, let alone to agree. On the other hand, however, it demonstrates that there is a fundamental problem. And it must be admitted that that problem is fundamentally archaeological.

The chronology of the Bronze Age

The debate about the dating of the Minoan eruption of Santorini can only be understood in the context of the unresolved issues of chronological methodology as used in the Bronze Age. At the beginning of the 20th century AD, archaeological dating methods were rudimentary, to say the least. Because of its continuous sequence of rulers, and the apparent utility of the Sothic dates, Egypt served as a kind of reference point for all other regions. By the middle of the 20th century, astronomical observations in Mesopotamia supplemented the lists of kings as an alternative framework.¹

Thus, since the Second World War, Bronze Age Mediterranean archaeologists have had two astronomically based chronological frameworks with which to build. And, in general, in building chronologies, archaeologists have generally simply tended to adopt these historical chronologies and fit their stratigraphy and ^{14}C dates into those. In

¹ Landsberger 1954.

the course of the 20th century, archaeological excavations in Egypt, Greece, the Gulf, Iran, Iraq, Israel, Jordan, Lebanon, Syria, and Turkey produced individual stratigraphic sequences which could not only be aligned vertically internally, but also linked to each other through objects found in different excavations and regions. This was the basis of Schaeffer's *Stratigraphie Comparée*, and conceptually the method has not really changed since.²

Obviously, however, the dates extrapolated for the objects discovered in the various excavations both in Egypt and Mesopotamia and in the surrounding regions were based upon the proposed dates produced by Egyptologists and Assyriologists – and adopted by the archaeologists. Furthermore, it has not necessarily been appreciated that the quality of excavation has improved in recent decades, and thus that earlier parallels are not necessarily as reliable as more recently excavated parallels. By the same token, it has not necessarily been appreciated that not all archaeological levels have been dated in the same fashion, *i.e.*, based upon an objective analysis of objects found in or on living floors. Furthermore, as noted here in this volume, there are significant disputes about the absolute dates proposed for the Egyptian and Mesopotamia kings. By the end of the 20th century, the differences for the first half of the second millennium amounted to a couple of decades in Egypt,³ but in Mesopotamia they amounted to a more than a century.⁴

Yet Mesopotamia has virtually no relevance for the Aegean, and thus the reliance on Egypt. In fact, however, the links between Egypt and the Levant should have an impact on the understanding of Mesopotamian chronology. Yet this has not been appreciated – neither in Mesopotamia nor in the Aegean. In general, there are several reasons for this. One being that Mesopotamian chronology is not a central issue for Assyriologists: their material moves in blocks and it is irrelevant for their historical work whether the chronology they employ is accurate or not. Another is that Levantine archaeology is generally separated from Mesopotamian archaeology, and thus the Levantine material is aligned with Egypt and the inland Syrian material aligned with Mesopotamia, and the “Middle Chronology”. Yet the reality is that the Levantine material dated via Egypt

virtually demands that one of the lower Mesopotamian chronologies be used,⁵ but this is usually disregarded as Mesopotamian systems are assumed to be philological and not archaeological. However, the stratigraphic links in the Levant – based upon archaeological material and the Egyptian dates – suggest that a lower chronology is the only viable approach. The particular case of Hazor is highly significant here, as the walled city can be directly linked to Hammurabi of Babylon (via Mari), and thus to the Mesopotamian chronology. And the correlations exclude the Mesopotamian “Middle Chronology”, which is in any case excluded by the lack of a suitable solar eclipse related to the birth of Šamši-Adad.⁶ In the case of Hazor, the chronological argument is based on the entire city itself and the characteristic sherds associated with that walled city of the Middle Bronze Age, and not merely a few stray import sherds.⁷ Fortunately, even the broad span of the 1 σ - range of the ¹⁴C dates from Kinet Höyük for Middle Bronze material in 17th century Anatolia is close enough to reinforce a chronological argument in favour of one of the lower Mesopotamia chronologies.⁸

Thus scholars working in the Aegean are largely unaware of the archaeological aspects of Mesopotamian chronology, and adopt the conventional “Middle Chronology” without realizing that the very Levantine archaeological material they use – based on Egyptian dates – virtually prohibits the possibility that the Mesopotamian “Middle Chronology” is correct. In this fashion, incompatible chronologies are systematically incorporated into

² Schaeffer 1948.

³ Spalinger in Redford 2001, I: 267.

⁴ Hunger this volume.

⁵ Ben-Tor 2004; Gates 2000.

⁶ For the archaeology, *cf.* Ben-Tor 2004; for the eclipse, *cf.* Warburton 2002.

⁷ Incidentally, the 18th century ¹⁴C dates for the beams in the Late Bronze palace (Ben-Tor, pers. comm.) would fit reasonably well with a palace which must have existed before Hammurabi's destruction of Mari – if one assumes that the beams survived intact from the Middle Bronze to the Late Bronze.

⁸ Gates 2000, 88–9. I remark that the samples from this site provide additional examples of what appear to be reliable ¹⁴C dates from the second millennium BC.

a single system – with the result that considerable latitude is generally assumed in chronological questions. The idea that change – and exchange – took place quickly is largely neglected, since the limits are so vague.

Hitherto, this has not been a serious problem since there was no means of checking the chronologies. Egyptian chronology is constantly being refined as the kinglists and regnal years are supplemented by prosopographical information, giving hints of limits. In any case, fitting radiocarbon dates into this system was generally irrelevant since ^{14}C dates either appeared to be too broad to be useful or too inaccurate to be taken seriously. A radiocarbon date informing us that Akhenaten reigned in the middle of the 14th century with a 68.2% probability⁹ does not really aid if we know that anyway.¹⁰ Admittedly, most philologists and archaeologists (including the editor) would agree that the radiocarbon dates for the third millennium Egypt are off by a century or more.¹¹ By contrast, the historical dates proposed for the Egyptian kings of the second millennium BC (which could change by decades at most depending upon the ultimate outcome of the astronomical debates) seem to correspond quite well to the control samples that Bronk Ramsey, Marcus and Kutschera (and colleagues) have verified with ^{14}C .¹² This is a peculiar problem since the calibration curve leaves no basis for distinguishing between the second and the third millennia: it is based on samples of trees and should be more or less consistent back at least as far as the continuous series of dendrochronologically dated tree rings.

However, the second millennium is the matter at hand, and here the dating methods are not far apart: the radiocarbon dates for Akhenaten in the 14th century are so close as (a) to be dismissed by the current writer (*supra*) as irrelevant – and (b) to be used by MacGillivray to argue that some of them may reflect Horemhab rather than Akhenaten. In the same fashion, although less decisive, the dates from Kinet Höyük support an argument which coincides well with both the Egyptian historical chronology and the Mesopotamian lower chronologies, based upon interlocking finds of Levantine Middle Bronze Age archaeological material.

Yet the Minoan eruption of Santorini is quite different. Here there is a case of broad and intense disagreement, as it seems that somehow the archaeological, historical and natural science methods lead to a divide rather than a unifying tendency. Thus I contend that this is a methodological issue.

Methods

The methods of dating in historical archaeology consist of stratigraphy, typology, kinglists, astronomical events, and synchronization by bringing different methods into play. In principal, the philological sources for regnal years provide a context for

⁹ Manning, in Hornung *et al.* 2006, 337.

¹⁰ Krauss & Warburton, this volume.

¹¹ Cf. Dreyer 1998, 18. One need only compare Cheops with 95.4% probability for 2880–2580 BC, radiocarbon (Manning in Hornung *et al.* 2006, 342), with our date of 2509–2483⁺²⁵ (Hornung *et al.* 2006, 491). There is hardly even room for overlap. Thus, in the opinion of the editor, radiocarbon calibration for the third millennium still requires a great deal of correction. Philologists and archaeologists working in Egypt would argue that refinements in radiocarbon dating can only be improved by taking historically reliable dates seriously, and using these to control the radiocarbon dates. By contrast, Lord Renfrew (in Hardy & Renfrew 1990) proposes that the radiocarbon dates should be used to date the Egyptian kings. To the philologist, it would appear that the calibration is the problem; for the radiocarbon specialist, there is no difference between the second and third millennia. Yet, this philologist would maintain that many radiocarbon dates in the second millennium seem to be at least potentially acceptable to most scholars when compared with the written sources. However, there is a discrepancy for the third, where few philologists would follow the proposed dates. Obviously, there is a need for a roundtable discussion on this, as two completely different methodologies are involved.

¹² Marcus *et al.* n.d., Kutschera (pers. comm.). In fact, the accuracy of the dates for the entire second millennium, from Late Helladic and Amarna (as presented here by Manning, and Manning in Hornung *et al.* 2006) through Hatshepsut (Marcus *et al.* n.d.) and Illahun (Kutschera pers. comm.), actually suggests to me that the radiocarbon date for Heqanakhte placing the papyrus itself more into the third millennium BC (Kutschera pers. comm.) might oblige us to change the view presented by Allen (2002b) and force us to return to a Dyn. XI date for Heqanakhte. This position has recently received some – completely independent – philological reinforcement from Gestermann 2008, 14–5 who could not possibly have known about the radiocarbon date.

linking astronomical events with those regnal years. Unfortunately, philological arguments usually run in circles and avoid archaeological evidence.¹³

The standard method of dating in archaeology is to assign certain types of material to specific units, which are identified culturally and temporally. In this case, the types are assigned to Late Minoan IA, IB, and II; Late Helladic I and II; Late Cypriot I and II; Dyn. XV, early Dyn. XVIII, mid-Dyn. XVIII and late Dyn. XVIII; as well as the Levantine Middle and Late Bronze Ages. Each of these units is associated with distinctive styles in particular regions and assigned particular dates. Where a stratigraphic sequence can be established, the relative sequence of the typologically identified forms can be established, based on the stratigraphy. These can in turn be compared with the sequences in other regions.

However, this process is not without difficulties. In this volume Wiener states that it is difficult to imagine that a Cypriot White Slip I bowl could have arrived on Thera before 1613 BC, yet in this same volume, Merrillees states that he views this as just barely possible. In the same fashion, Wiener suggests that given the Cypriot imports, the stratigraphy of Tell el-^cAjjul would not support the 1613 date either, and yet in this volume the excavator of Tell el-^cAjjul, Fischer, suggests that the stratigraphy of Tell el-^cAjjul would in fact be compatible with the proposed ¹⁴C date. Furthermore, that same excavator also remarks that the scarcity of White Slip wares at Tell el-Dab^a is rather striking, especially in contrast to their abundance at neighbouring Tell el-^cAjjul which is roughly contemporary.

In principal, the relative dates for the various styles can be established via stratigraphical sequences in the various regions, but the only means of establishing absolute dates for the various typological styles is based upon synchronizing the various styles with dates related to ancient Egypt, based upon proposed astronomical dates. Although superficially quite simple, it is remarkable that in this volume contributions by several authors propose different synchronisms between Egypt and the Aegean.

And there are further anomalies. Based on the patterns of debris in the ice cores, Claus Hammer is quite confident that he can isolate the eruption which he dates to 1637-1647 (1642 ±5 at 2σ) as be-

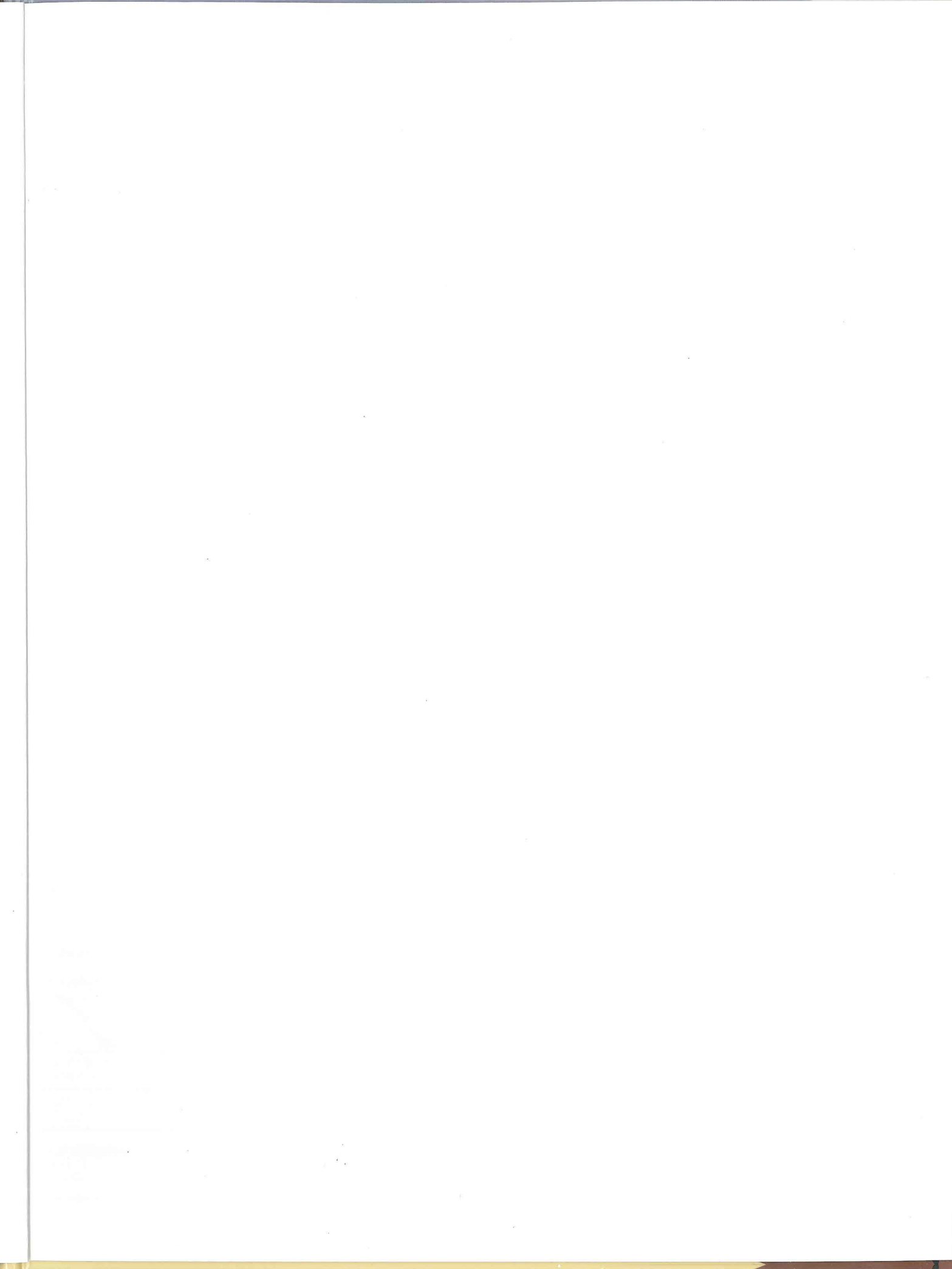
ing one in the northern and western hemispheres, meaning that it would be Santorini. Yet in this volume Muscheler has now demonstrated that there is an unexplained anomaly in the ice cores, nevertheless meaning that in his opinion the ice cores probably monitored the Minoan eruption of Santorini, but that the date is less secure than Vinther *et al.* suggest. However, Muscheler's results suggest that the date is still near the middle of the 17th century – yet more probably closer to 1630. This means a striking convergence of the ¹⁴C, dendrochronological and ice core dates.

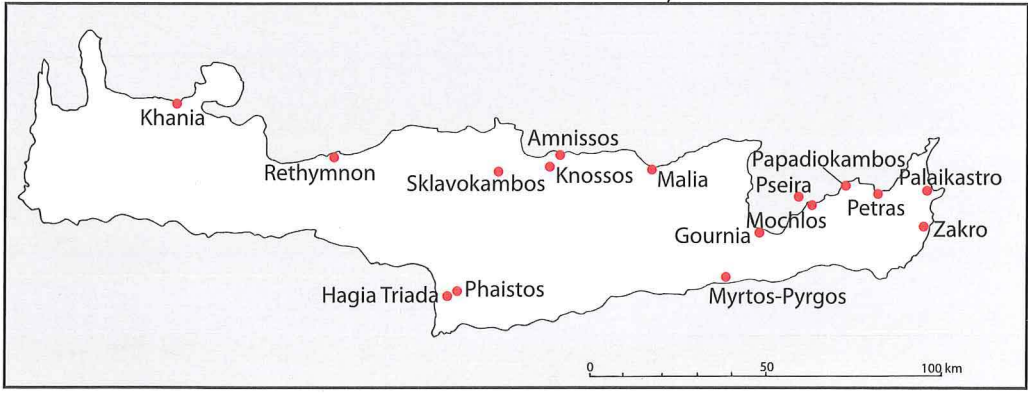
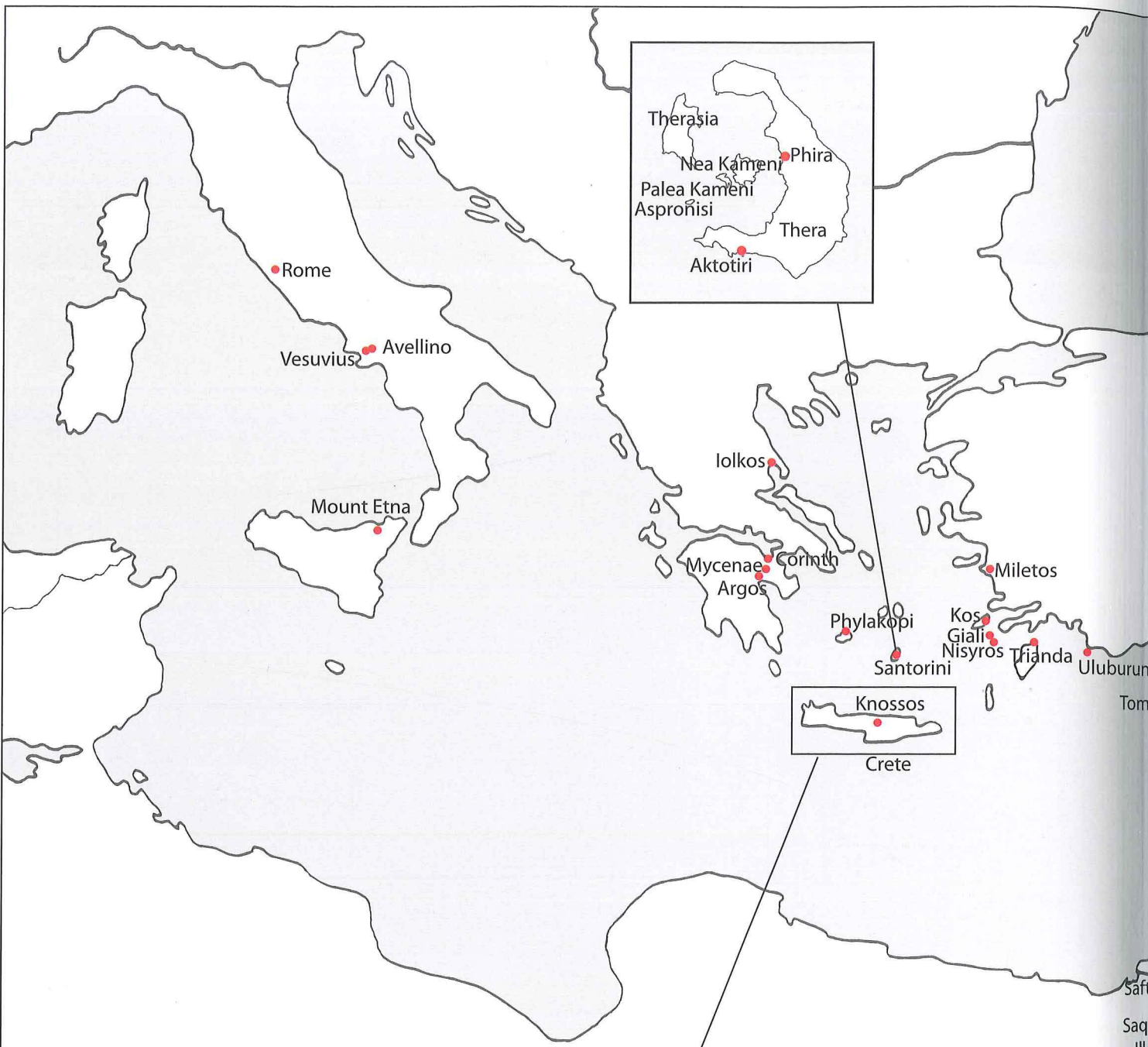
Yet, based on these anomalies, some archaeologists are not prepared to accept the proposed ¹⁴C dates. On the other hand, Heinemeier *et al.* were conscious of the difficulties, and stressed that from their standpoint, the ¹⁴C date threw doubt on the reliability of the Egyptian chronology.¹⁴ Thus, the natural scientists viewed their conclusion as reliable, and concluded that Egyptian chronology or the synchronisms were the weak spot. Thus some archaeologists assumed that the archaeological synchronisms with the Egyptian chronology were reliable (or required at most minor adjustments), and that the ¹⁴C dates were the weak spot, while other archaeologists contend that the archaeological material might just be compatible with the proposed date. For the editor, it is evident that the Egyptian historical chronology cannot be changed significantly and thus that it is either the archaeological material which requires re-analysis, or the ¹⁴C calibration curves.

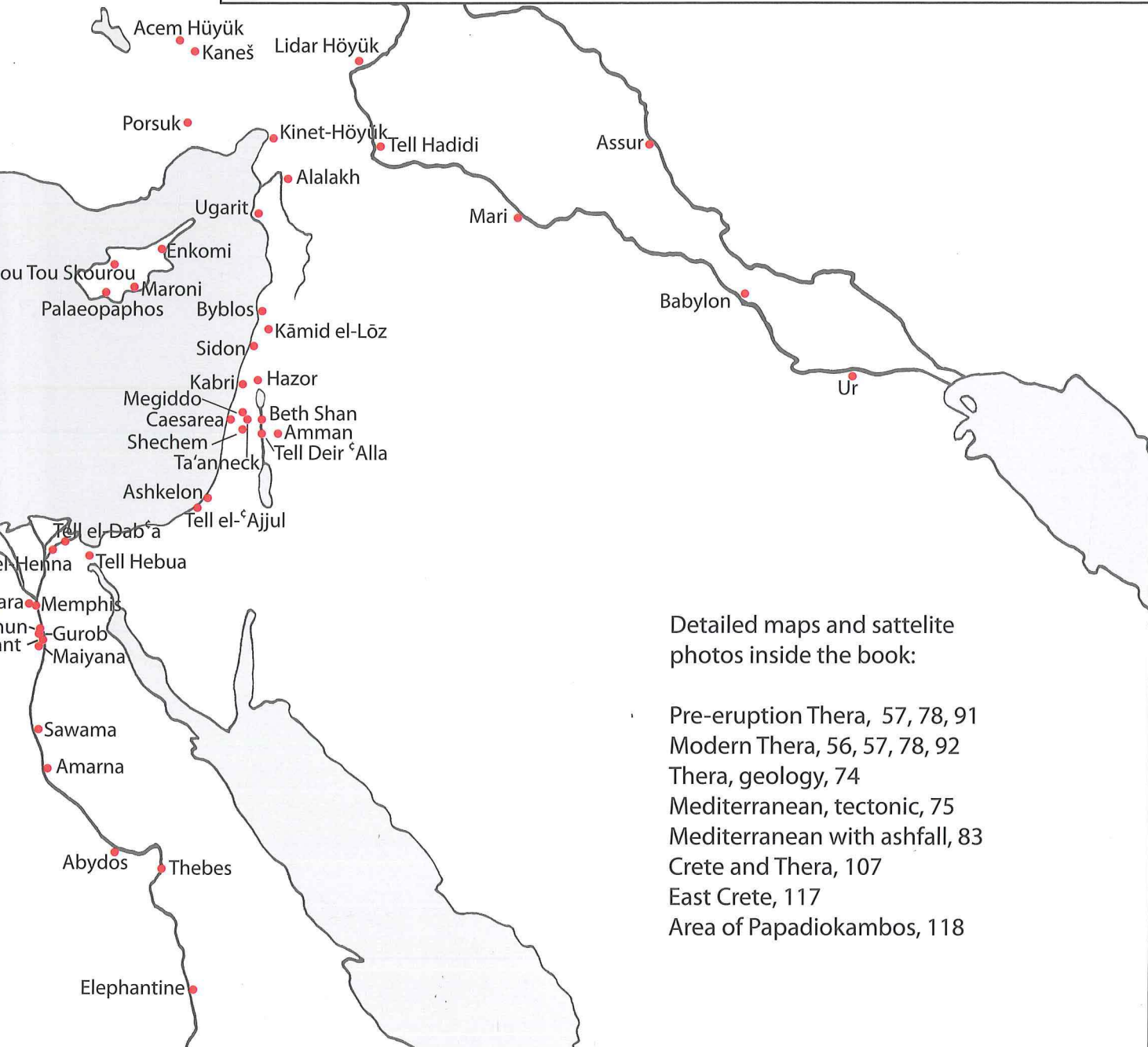
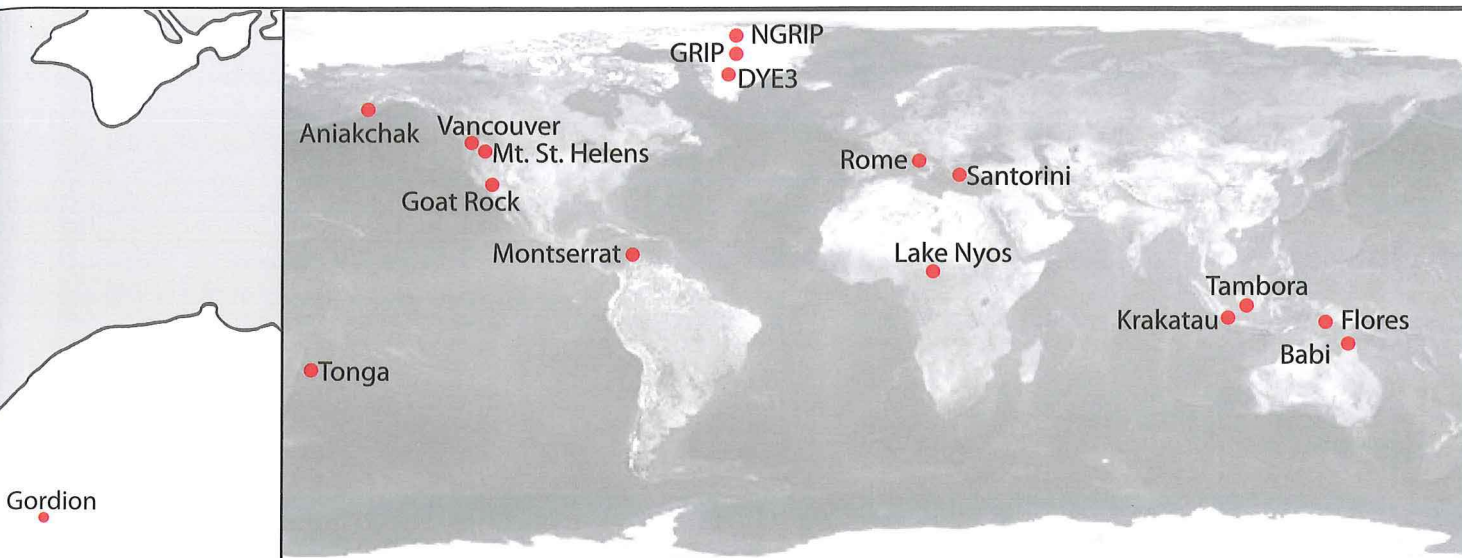
However, neither the Egyptologists nor the natural scientists can resolve the problem of dating the Minoan eruption of Santorini in terms of archaeological units, as this can only be done by archaeologists. And obviously this is part of a much larger project. Let us hope that the present volume offers a useful basis for further discussion.

¹³ The exception to this rule is Gasche *et al.* 1998, where in the criticism it is rarely recognized that the original doubts about the astronomical dates were based on the nature of the typological sequence based on artefacts and stratigraphy.

¹⁴ Friedrich *et al.* 2006.

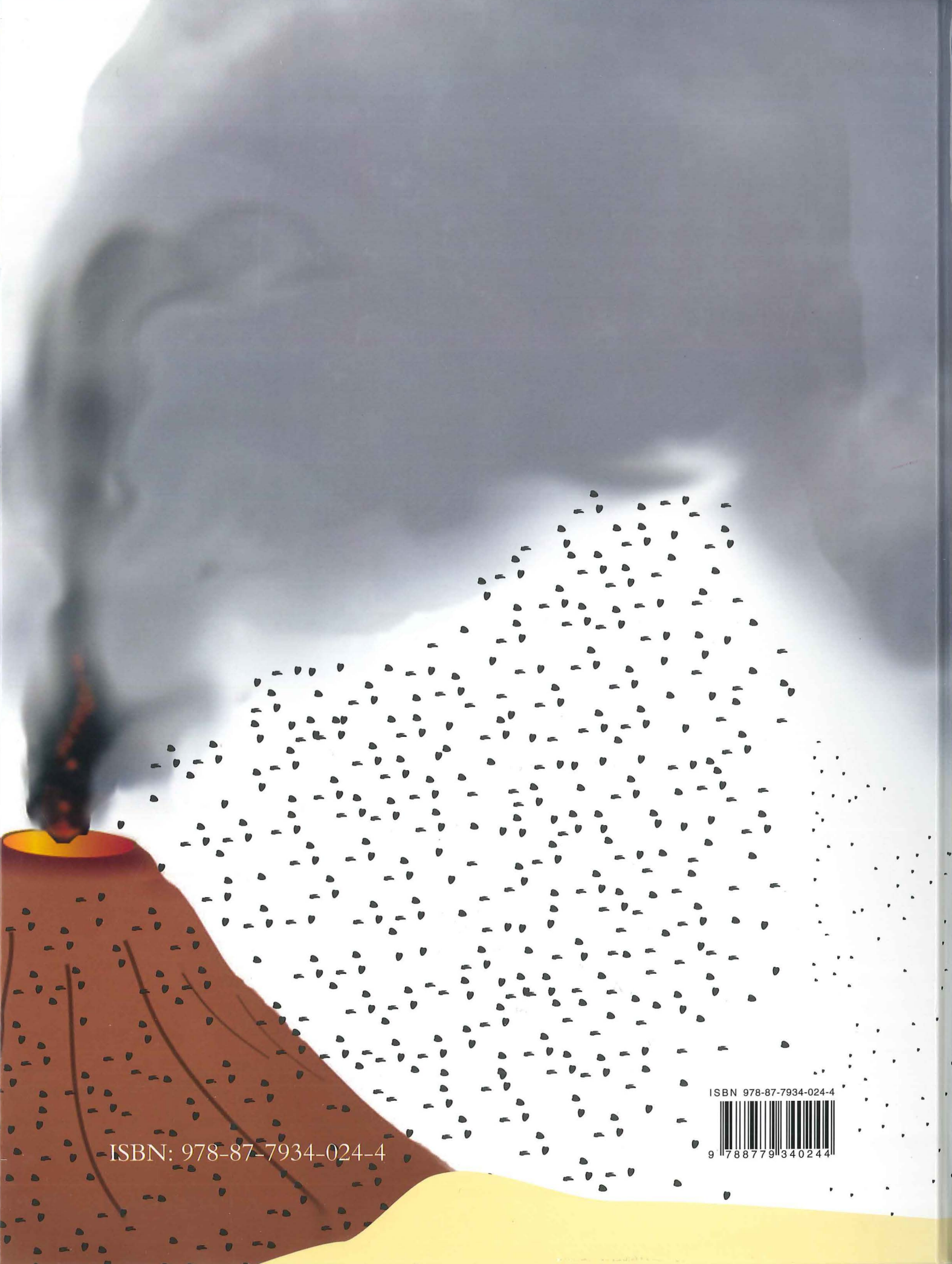






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