matters arising

The Thera eruption and Late Minoan-IB destruction on Crete

PICHLER and Schiering[1] argue that there is no relationship between the paroxysmal volcanic eruption of Santorini in the Bronze Age and the Late Minoan-IB destructions on Crete, as proposed by Marinatos[2]. The arguments for or against such a relationship are not as clear as they contend. There are several suggestions in their paper which may be disputed and they have been selective in their evidence. Contrary to their major point, the resolution of the pottery chronology is not sufficiently precise to infer a 50-yr gap between the destructions on Crete and the main eruption. The complexities of the relationship between IA and IB pottery styles, recently reviewed by Luce[3], have been ignored. There is evidence that the two styles are in part synchronous[3] and there is considerable doubt as to their stratigraphic distinction[3-5].

Acrotiri was originally destroyed by earthquakes and evacuated before the eruption[6,7] and was then apparently revisited by a group reconstructing the town, but was never reinhabited[7]. The gap between the earthquakes and the eruption is often quoted as less than two years[1,3,5], but this is speculation. The evidence on Santorini does not preclude a series of plausible events such as precursory earthquakes and even small eruptions, which may have discouraged reoccupation for an extended period. We agree with Pichler and Schiering that the eruption was probably very short, but challenge their interpretation of the deposits on Santorini. The occurrence of 3m lithic blocks is not evidence of the onset of caldera collapse, or even circular or polygonal fractures. There are several alternative interpretations, including ejection of lithic blocks during phreatomagmatic explosions, blocks eroded from the vent wall, blocks picked up by mud-flows or pyroclastic flows from the volcano's slopes[8]. The largest lithic blocks on Santorini are predominantly found in deposits interpreted by Bond and Sparks[8] as mud-flow not ash-flow deposit. Bond and Sparks[8] also describe late-stage flood deposits and ignimbrites which were emplaced before substantial collapse had begun. A gap of unknown duration between the eruption and caldera collapse cannot be discounted.

The confidence with which Pichler and Schiering assert that the ash layer was of negligible thickness on Crete is unwarranted. Ninkovich and Heezen[9] provided firm evidence of the large scale of the eruption and of a high probability of ash-fall on Crete. Their evidence cannot be discarded, as later papers have confirmed the correlation of the Minoan ash layer[10,11] in RV Vema cores from the Lamont–Doherty Geological Observatory by the presence of the 7,000-yr BP sapropel and chemical analyses. Although the ash layers in cores V10-50 and V10-58 are undoubtedly overthickened by slumping, a reasonable thickness of ash has to accumulate initially to produce a slump. Pichler and Schiering claim to have succeeded in the most difficult of geological tasks, to show that visible remnants of the Minoan ash do not exist on Crete. Their dismissal of the presence of volcanic glass fragments in Cretan soils[12-14] as due to the use of imported pumice lumps in Minoan households and workshops is unconvincing, and we suggest that this evidence supports ash-fall on Crete. Similarly, to dismiss the possibility of catastrophic tsunamis on the basis of an unpublished theory is unacceptable. Finally we note that the 'isoseismic' data in their Fig. 2 concerning the 1926 earthquake, published over 40 yr ago, seems to be a function of the density of population and hence observation points as well as possible tectonic blocks. We believe, therefore, that more evidence is required to test the theory of Marinatos[2] relating the Minoan demise to volcanic activity. There are three time gaps to be considered: that between the earthquake(s) which destroyed Acrotiri and the onset of the eruption, that between the destruction of Acrotiri and devastation of Crete and that between the eruption and caldera collapse, and possible resulting tsunamis. The many uncertainties in the length of these time intervals is such that the volcanic theory cannot be discarded.

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Possible solar eclipse effect 23 October 1976

LILLEY and Woods[1] operated magnetometers at 10 sites in central and eastern Australia during the solar eclipse of 23 October 1976, and reported a possible eclipse effect at two stations (labelled H and J in their Fig. 1) lying in the path of totality. They observed an event at approximately the time of totality (0638 UT) but pointed out that the event had not moved from west to east at the expected rate. As an eclipse affects the ionosphere over a relatively large area one would not expect the few minutes of totality to produce such a pronounced effect as indicated by their records.

In South Africa the eclipse was partial and of limited duration, starting at sunrise ($\sim$ 0420 UT). The records of the magnetic observatories Hermanus (34°S, 19°E) and Grahamstown (33°S, 27°E) should be free of eclipse effects at the time of totality in Australia (0638 UT). The declination variations as recorded at these two observatories over the period illustrated by Lilley and Woods are shown in Fig. 1. It is evident