**Table 2** Archaeodirectional data

| Site | Refs | Declination, $D°$ | Inclination, $I°$ |
|---|---|---|---|
| H. Triada | 3, 4 | — | Mean $=58.7\pm0.6$, $n=2$ |
| H. Triada | 1 | 353.8 $\alpha_{95}=2.3$ | 60.1, $n=17$ |
| Phaistos | 3, 4 | $15.6\pm3.3$ | $56.8\pm0.1$, $n=4$ |
| Phaistos | 1 | 356.5 $\alpha_{95}=1.7$ | 61.1, $n=17$ |
| K. Zakro | 3, 4 | — | $56.6\pm3.3$, $n=5$ |
| K. Zakro | 1 | 355.8 $\alpha_{95}=1.9$ | 54.6, $n=49$ |
| Makrygialos | 1 | 354.3 | 57.5 |

**Table 3** Differences between Sun and magnetic compass measurements

| Site | Sun | Magnetic | Difference |
|---|---|---|---|
| Phaistos 3, 1 | 12.1 | 356 | 16.1* |
| Phaistos 3, 3 | 4, 8 | 348 | 16.8 |
| K. Zakros 2, 1 | 256.7 | 194 | 62.7 |

* Compare this with Table 2, Phaistos $D°$ values of refs 3, 4 and ref. 1.

difference is again indistinguishable. The directional differences for central and eastern Crete of $\Delta D = 1.7°$, $\Delta I = 5.2°$, with $\alpha_{95} = 3.5°$ are not changes which support the hypothesis of Downey and Tarling. However, the *in situ* method for measuring inclination and declination should be borne in mind. Downey and Tarling report the appropriate errors for each sample which reduced after averaging to the order of 1-2°. Whenever possible they used a Sun compass or, failing that, a magnetic compass.

We have found that declination results from samples orientated using a magnetic compass should be considered, in certain cases, as extremely dubious[3,4], as they are affected by stray magnetic fields present in a magnetized structure such as a kiln, many pithoi, burnt mud-brick walls, metal fences or an immediate volcanic environment. (The inclination results are not affected by the errors in present magnetic orientations, but could have been affected if the original cooling were in a high magnetic environment.) A comparison of $D°$ values using Sun and magnetic compasses respectively showed differences in the degrees (see Table 3). The Sun compass provides more accurate results.

Other possible effects that might alter the reliability of measurements of $D°$ and $I°$ include earthquake activity in the Aegean seismic arc, which produces tilting with possible local subsidence; thus the tectonic instability of the Knossos region in central Crete with respect to eastern Crete has been well documented[5]. Such land movements[6] must also have an effect on the supposed stable burnt structures and ash materials.

Moreover, the repeated and pronounced volcanic (and seismic) activity of the island in ~197 BC and AD 1950 could have produced discernible shift effects in the original tephra deposits. Furthermore, the possibility of a marked degree of reheating of the base surge and upper tephra deposits in Santorini through these repeated violent explosions[7] should be examined.

Referring to the secular variation of the geomagnetic field for this period, other workers[8-12] suggest that around 1500-1100 BC, a change in the magnetic field of up to 50% of the present value for Crete (44 μT for 1975) took place. As such, the present evidence for the rise of change in direction and intensity (for the same period), with their associated errors of ±2°-5° and ±5% respectively, would give a dating accuracy comparable with the time gap in question.

Another attempt to monitor successive eruptions has been made by applying U-Th series radioisotopic analysis to tephra deposits from Kos, Rhodes, Nisyros, Tilos and Santorini[13]. Differences in the radioisotopes content of the tephra were found which reflect a different magma source. Results indicated that a second eruption could not be ruled out, although not one that was necessarily derived from Santorini itself.

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YIANNIS LIRITZIS
*Ministry of Culture and Science,*
*Department of Underwater Antiquities,*
*58 Omirou St,*
*Athens, Greece*

DOWNEY AND TARLING REPLY—We agree with most of the comments of Liritzis. The palaeointensity observations are subject to a range of errors, therefore we quoted these observations as supporting the directional evidence, rather than using them as primary indicators of age differences. We also concur with his comments concerning the use of a Sun compass, but it is not possible to use it at several key sites, such as Akrotiri, where the structures are protected by a solid roof. In other areas, the Greek authorities were extremely cooperative in removing covers wherever possible. Comparison of Sun and magnetic compass readings on open sites of fired mud bricks showed no differences between the readings, but we are also suspicious of sites with magnetic orientation alone, particularly where large structures are concerned. Luckily, the main difference in direction is in inclination and this tends to be less affected by errors in determining the direction of strike lines. Partially because of such problems in kilns, few of our results were included from these structures (the main exception being the only site we were allowed to sample at Knossos), although the main reason for this omission was that the normal firing of these may not be synchronous with the natural(?) destructions of houses, palaces, villas, and so on. We also accept the possibility of regional tilting, although the coastal evidence for such tilting has a very low angular value. In terms of the volcanics, both tephra sequences would be tilted if significant seismic movements had occurred, while it is difficult to see why subsequent thermal effects should be so confined to specific layers and be so uniform within them that no other components can be isolated. We emphasize that any interpreation would benefit from more intensive and extensive study, including presently unsampled localities, but we were convinced by the difference in direction, supported by palaeointensity differences, which emerged from the results during the final stages of analysis and, on reviewing the problem, the short time gap seemed to offer a possible explanation of other perplexing features, such as differences in the quantities of LMIB pottery retrieved from different sites.

W. S. DOWNEY*
D. H. TARLING
*Department of Geophysics and Planetary Physics,*
*University of Newcastle-upon-Tyne,*
*Newcastle-upon-Tyne NE1 7RU, UK*

* Present address: Department of Physics, University of Papua New Guinea, Port Moresby, Papua New Guinea.

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