Archaeomagnetic directions and intensities from New Zealand: evidence for a fifteenth century AD archaeomagnetic “spike” in the SW Pacific?

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The arrival of the great Maori waka and the settlement of New Zealand some seven or eight hundred years ago are described in oral history, but details of exactly when and how colonisation occurred are undocumented. Radiocarbon dating of early archaeological sites is particularly problematic, due to the inbuilt age of datable materials, and non-linearity and ambiguity in the calibration of measurements to calendar dates. Hangi stones, used as heat retainers in traditional Maori earth ovens, hold thermoremanent records of Earth's magnetic field at the time of their last cooling. Matching the directions of these magnetizations to established reference curves provides alternative, archaeomagnetic, estimates of age. Our results cover the past 700 years, with a cluster of dates between 1500 and 1600 AD, from both North and South Islands, but none earlier than 1300 AD, thus supporting a model of rapid coordinated migration around that time. Archaeointensity data have been obtained from sixteen distinct archaeological features, including twelve hangi from eight sites, and from them the first archaeointensity record for New Zealand has been constructed. To this has been added other archaeointensity and palaeointensity data from the SW Pacific region and virtual axial dipole moments (VADMs) have been plotted. This plot outlines steady VADM values of about $8 \times 10^{22}$ Am$^2$ from 1000-1300 AD, and $9.5 \times 10^{22}$ Am$^2$ from 1500 AD to the present, with an intervening sharp peak in the early 15th century when the VADM reached about $13 \times 10^{22}$ Am$^2$. This peak bears many similarities to archaeomagnetic “jerks” and “spikes” in northern hemisphere records from the first millennia BC and AD. However, it is the first such feature to be found in the southern hemisphere at this date, suggesting, in accordance with recent modelling, that it may be a feature of the non-dipole field, associated with rapid growth and decay of an intense flux patch on the core-mantle boundary.